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The Power to Grow

July 25, 2011

Filed via Electronic Submittal (E-File)

Honorable Kimberly D Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington DC 20426

SUBJECT: Don Pedro Project
FERC Project No. 2299
Proposed Study Plan

Dear Secretary Bose:

Turlock Irrigation District (TID) and Modesto Irrigation District (MID) (collectively, the Districts), co-licensees of the Don Pedro Project, herewith file their Proposed Study Plan (PSP) in accordance with Federal Energy Regulatory Commission (FERC) regulations at 18 CFR § 5.11. The current license for the Project expires on April 30, 2016.

Relicensing participants filed more than 130 study requests contained within 27 letters filed by the required deadline of June 10, 2011. Study requests were submitted by federal and state resource agencies, local governmental authorities, non-governmental organizations, and members of the public. In addition, several relicensing participants had provided comments on and suggestions for studies at voluntary Resource Work Group meetings held on April 1, April 19-20, and May 18-19, 2011. All study requests have been carefully considered by the Districts in the development of the PSP, resulting in this filing containing 30 proposed studies.

As required by FERC's regulations at 18 CFR § 5.11(e), the Districts will hold Initial Study Plan Meetings on the PSP on Tuesday, August 23, 2011, and Wednesday, August 24, 2011. These meetings will be held at Modesto Irrigation District offices in Modesto, California. Additional details about the meetings are included in the enclosed document and are posted on the Project's relicensing web-site www.donpedro-relicensing.com. The purpose of these meetings is to discuss the PSP with relicensing participants in order to attempt to resolve any outstanding issues on studies to be included in the Districts' Revised Study Plan.

The Districts look forward to continuing its work with the federal and state resource agencies, Indian tribes, FERC staff, local governmental authorities, non-governmental organizations, and members of the public in finalizing the study plan for the Project's relicensing. In accordance with 18 CFR § 5.12, comments on the PSP must be filed with FERC by October 24, 2011.

If you have any questions about this filing, please contact the undersigned at the address or telephone number listed below.

Sincerely,

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cc: Relicensing Participants List

Enclosure: Don Pedro Project Proposed Study Plan

DON PEDRO PROJECT
FERC NO. 2299

PROPOSED STUDY PLAN



Prepared by:
Turlock Irrigation District
Turlock, California
and
Modesto Irrigation District
Modesto, California

July 2011

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APPENDICES

ACRONYM LIST

ACEC.........................Area of Critical Environmental Concern
ac-ft ....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
BA ....Biological Assessment
Basin Plan ....Water Quality Control Plan for the Sacramento and San Joaquin Rivers
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
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
CMARP......................Comprehensive Monitoring, Assessment, and Research 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
DPRA.........................Don Pedro Recreation Agency
DPS ....Distinct Population Segment
DTA ....Devine Tarbell & Associates, Inc.
EA ....Environmental Assessment

EC ....Electrical Conductivity
EES ....EES Consulting, Inc.
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
FC...............................Candidate for listing under ESA
FE ....Federally-listed Endangered Species under ESA
FERC..........................Federal Energy Regulatory Commission
FFS ....Foothills Fault System
FL ....Fork length
FLA ....Final License Application
FMU ....Fire Management Unit
FOT ....Friends of the Tuolumne
FPC ....Federal Power Commission
FPD ....Species Proposed for Delisting under ESA
FPE.............................Proposed for listing as Endangered under ESA
FPT.............................Species Proposed to be listed as Threatened under ESA
FT ....Federally-listed Threatened Species under ESA
ft/mi............................feet per mile
FWCA ....Fish and Wildlife Coordination Act
FYLF..........................Foothill Yellow-Legged Frog
GIS ....Geographic Information System
GLO ....General Land Office
GORP.........................Great Outdoor Recreation Pages
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
MID...........................Modesto Irrigation District
MOU ....Memorandum of Understanding
MSCS.........................Multi-Species Conservation Strategy
msl.............................mean sea level
MVA ....Megavolt Ampere
MVZ..........................Museum of Vertebrate Zoology
MW ....megawatt
MWh ....megawatt hour
mya............................million years ago
NAE ....National Academy of Engineering
NAHC ....Native American Heritage Commission
NAS............................National Academy of Sciences
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
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 Accelerations
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
PTL ....Project Tracking List
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 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
SNTEMP...................stream network temperature
SR...............................California Rare Species
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
STORET ....Storage and Retrieval
SWAMP.....................Surface Water Ambient Monitoring Program
SWE ....Snow-Water Equivalent
SWRCB......................State Water Resources Control Board
TAC............................Technical Advisory Committee
TCP ....Traditional Cultural Properties
TDS ....Total Dissolved Solids
TID.............................Turlock Irrigation District
TMDL ....Total Maximum Daily Load
TOC............................Total Organic Carbon

TRT............................Tuolumne River Trust
TRTAC ....Tuolumne River Technical Advisory Committee
UC..............................University of California
µS/cm ....microSeimens per centimeter
USDA.........................U.S. Department of Agriculture
USDOC......................U.S. Department of Commerce
USDOI .......................U.S. Department of the Interior
USFS..........................U.S. Forest Service
USFWS ......................U.S. Department of the Interior, Fish and Wildlife Service
USGS .........................U.S. Geological Survey
USR............................Updated Study Report
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

1.0 INTRODUCTION

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 the Central Valley region of California. The Districts received their initial license for the Project from the Federal Power Commission, Federal Energy Regulatory Commission's (FERC) predecessor, with an effective date of May 1, 1966. The current license expires on April 30, 2016, and the Districts are in the process of obtaining a new license from FERC to continue to operate the Don Pedro powerhouse. The Districts plan to apply for a new license no later than April 30, 2014.

The Districts began the relicensing process by filing a Notice of Intent (NOI) and Pre-Application Document (PAD) with FERC on February 10, 2011. The filing of these documents formally initiated the relicensing process under Title 18 of the Code of Federal Regulations (CFR) Part 5, FERC's regulations governing the Integrated Licensing Process (ILP). The Districts' PAD included descriptions of the Project facilities, operations, license requirements, and Project lands. It also contained a summary of the extensive baseline information available on water resources; fish and aquatic resources; terrestrial and wildlife resources; rare, threatened, and endangered species; recreation and land use; cultural resources; and socioeconomic resources. A preliminary assessment of the effects of Project operations on resources was provided in the PAD along with ten (10) draft study plans.

The development and issuance of this Proposed Study Plan (PSP) document is a major milestone in the multi-year ILP. The PSP contains the following elements:

- summary of study requests submitted by Relicensing Participants (RPs),
- Districts' proposed studies and study plans,
- list of RPs' study requests the Districts have not adopted and the rationale for not adopting, and
- schedule of related meetings and publishing of study reports.

In accordance with ILP regulations, and as described in the FERC-approved *Process Plan and Schedule* for the Project, the PSP is being filed with FERC and simultaneously distributed to federal and state resource agencies, local governments, affected Indian tribes, non-governmental organizations, and members of the public. This PSP is also being made available on the Districts' relicensing website www.donpedro-relicensing.com.

1.1 General Project Description

The Don Pedro Project, with its 580-foot-high dam located at River Mile (RM) 54.8 on the Tuolumne River, was completed in 1971. The Project includes a reservoir covering approximately 13,000 acres in southwest Tuolumne County and extending to approximately RM 80 at the upstream Project Boundary. A four-unit powerhouse with an authorized capacity of 168 MW sits at the base of the dam. The dam and reservoir replaced the former, and much smaller, old Don Pedro Dam located about 1.5 miles upstream of the Project dam.

The Don Pedro Reservoir, at its normal maximum elevation of 830 feet, contains 2.03 million acre-feet (ac-ft) of storage, approximately 1.7 million ac-ft of which is usable storage. The long-term average annual natural runoff of the Tuolumne River at Don Pedro Dam is approximately 1.9 million ac-ft. The actual mean annual runoff, or flow into the reservoir for the period 1975 to 2009, was 1.6 million ac-ft with the bulk of the difference being the out-of-basin diversions by the City and County of San Francisco (CCSF) for its municipal and industrial (M&I) water customers in the Bay Area. The annual runoff of the Tuolumne River is subject to considerable variability. For example, during that same 1975 to 2009 time period, the annual unimpaired runoff of the Tuolumne River has varied from 0.47 million ac-ft (1977) to 4.8 million ac-ft (1983). The current demand for Tuolumne River water during normal years is roughly 1.5 million ac-ft, divided among the Districts' needs for irrigation and M&I water (0.9 million ac-ft), CCSF's needs for M&I water (0.25 million ac-ft), and flows for anadromous fish in the lower Tuolumne River (0.3 million ac-ft). Don Pedro storage provides protection against water shortages in individual and successive dry years such as occurred during the drought periods of 1976-1977 and 1987-1992. The Don Pedro Reservoir also plays an important role in flood management on the Tuolumne and San Joaquin rivers.

CCSF, which operates hydro and water supply projects further upstream in the Tuolumne River watershed, contributed financially to the construction of the Project in order to obtain a water banking privilege in the new reservoir. The banking arrangement allows CCSF to pre-release flows from its upstream facilities into the Don Pedro Reservoir so that at other times it can hold back an equivalent amount of water that otherwise would have had to be released to satisfy the Districts' senior water rights. The creation of the water storage privilege provides CCSF with greater flexibility in its upstream water and power operations. The U.S. Army Corps of Engineers (ACOE) also contributed to the construction of the Project in order to create 340,000 ac-ft of seasonal flood control space.

1.2 Relicensing Activities to Date

The Districts have selected the ILP, as defined by FERC regulations at 18 CFR Part 5, for the relicensing of the Project. On February 10, 2011, pursuant to 18 CFR § 5.6 and 18 CFR § 5.5, the Districts filed with FERC the NOI and PAD.

On April 8, 2011, FERC provided formal notice of the Districts' NOI and PAD; issued Scoping Document 1 (SD1); and solicited comments on the PAD and SD1, as well as study requests. At the same time, FERC set a date of May 11, 2011, for scoping meetings in Modesto and Turlock, California, and a date of May 10, 2011, for a Project site visit. SD1 contained a *Process Plan and Schedule* which called for parties to provide comments on the SD1 and PAD by June 10, 2011, and established the same date for the filing of study requests.

A total of 27 parties filed 138 study requests of one kind or another, all of which have been considered by the Districts. This PSP provides the Districts' responses to these study requests. Numerous parties also filed comments on the PAD and SD1. The Districts have not yet responded to comments on the PAD and, to the extent they feel appropriate, will do so concurrent with the filing of the Revised Study Plan (RSP) under the ILP schedule.

1.2.1 Voluntary Resource Work Group Meetings

In early 2011, the Districts held meetings with federal and State of California agencies, local governments, Indian tribes, non-governmental organizations (NGOs), businesses, and members of the public who were interested in actively participating in the Project relicensing. These meetings included a relicensing organizational meeting on February 28, 2011. At the February 28 meeting, the Districts and RPs took the opportunity to schedule meetings through the filing of the RSP in November 2011. After conducting a poll and other email communications, the meeting schedule for the year was finalized on March 2, 2011.

The next RP meeting was conducted on April 1, 2011. This meeting was followed by two sets of resource-specific work group (RWG) meetings on April 19-20, 2011, and May 18-19, 2011. The goal of these meetings was to develop a common understanding of the Project facilities and operations, discuss proposed study plans, and identify additional studies needed. As there is a large amount of information already published about the Project and the Tuolumne River, existing information was also discussed.

Between the time the PAD was filed with FERC on February 10, 2011, and the June 10, 2011, deadline for filing study requests, all 10 of the Districts' draft study proposals were discussed and eight new study plans were formulated through the RWG meetings. A summary of the meetings, meeting discussions, and meeting participants is provided in Table 1.2-1.

Table 1.2-1 Resource Working Group meetings held between filing of the PAD and June 10, 2011.

Meeting Date	Resource Area	Study Proposals Discussed	Meeting Participants	
4/1/11	Cultural Recreation Terrestrial Water and Aquatic Resources	• General discussion • Project facility and operations • CCSF operations	• Alliance • ARTA • BAWSCA • BLM • Reclamation • CCSF • CDFG • Chicken Ranch • CSERC • CSPA • CT • ESRCD • FERC • GWWF • HHWP • Jackman • Mapes Ranch • Marston	• Merced FFC • MF • Modesto, City of • NHI, WP&LG • NPS • Ott Farms • RHH • Roseman • SCFB • SFPUC • SWRCB • TMTC • TNC • TRC • TRT • USFWS • Wheeler
4/19/11	Cultural	• Historic Properties • Native American Traditional Cultural Properties	• BLM • CCSF	• TMTC

Meeting Date	Resource Area	Study Proposals Discussed	Meeting Participants	
4/19/11	Recreation	• General discussion	• ARTA • BLM • CCSF • NPS	• RHH • TRC • TRT
4/20/11	Terrestrial Resources	• ESA- and CESA-Listed Plants • ESA-Listed Amphibians - California Red-Legged Frog • ESA-Listed Amphibians - California Tiger Salamander • ESA-Listed Wildlife–VELB • Special-Status Plants • Special-Status Amphibians and Aquatic Reptiles	• BLM • CCSF • CDFG • CSERC • CT • BAWSCA • MF	• NHI • SFPUC • SWRCB • TNC • TRC • TRT • USFWS
4/20/11	Water and Aquatic Resources	• Water Quality • General fishery study needs	• BLM • CCSF • CDFG • CSERC • CT • BAWSCA • MF	• NHI, WP&LG • SFPUC • SWRCB • TNC • TRC • TRT • USFWS
5/18/11	Cultural	• Historic Properties • Native American Traditional Cultural Properties	• BLM • Chukchansi	• NPS • FERC
5/18/11	Recreation	• Recreation Facility Condition and Public Accessibility Assessment (New Study) • Lower Tuolumne Boatable Flow (New Study) • Visual Quality (New Study) • Whitewater Boating Take Out Improvement Feasibility (New Study)	• ARTA • CCSF • NPS	• RHH • TRC • TRT
5/19/11	Terrestrial Resources	• Special-Status Plants • Special-Status Amphibians and Aquatic Reptiles • Wetland Habits Associated with Don Pedro Reservoir (New Study)	• BLM • CSERC • NPS	• TNC • TRC
5/19/11	Water and Aquatic Resources	• Bathymetry Study Plan [1] • Reservoir Temperature Model (New Study) • Project Operations/Water Balance Model (New Study) • Socioeconomics (New Study)	• Alliance • BAWSCA • CCSF • CDFG • City of Modesto • CSERC • CSPA • FERC	• Mapes Ranch • Ott Farms • SFB • SFPUC • SWRCB • TRT • USFWS

[1] Now an attachment to the Reservoir Temperature Model Study Plan.

Alliance	Stanislaus Economic Development and Workforce Alliance
ARTA	ARTA River Trips
BAWSCA	Bay Area Water Supply & Conservation Agency
BLM	Bureau of Land Management
CESA	California Endangered Species Act
CCSF	City and County of San Francisco
CDFG	California Department of Fish and Game
Chicken Ranch	Chicken Ranch Rancheria of Me-Wuk Indians
Chukchansi	Picayune Rancheria of the Chukchansi Indians
CSERC	Central Sierra Environmental Resource Center
CSPA	California Sportsfishing Protection Alliance
CT	CalTrout
ESA	Endangered Species Act
ESRCD	East Stanislaus Resource Conservation District
FERC	Federal Energy Regulatory Commission
GWWF	Golden West Women's Flyfishers/Northern California Federation of Fly Fishers
HHWP	Hetch Hetchy Water & Power
Merced FFC	Merced Fly Fishing Club
MF	Morrison & Foerster
NHI, WP&LG	National Heritage Institute, Water Power & Law Group
NPS	National Park Service
Reclamation	Bureau of Reclamation
RHH	Restore Hetch Hetchy
SCFB	Stanislaus County Farm Bureau
SFB	San Francisco Board of Supervisors
SFPUC	San Francisco Public Utilities Commission
SWRCB	State Water Resources Control Board
TMTC	Tuolumne Mi Wuk Tribal Council
TNC	The Nature Conservancy
TRC	Tuolumne River Conservancy
TRT	Tuolumne River Trust
USFWS	U.S. Fish and Wildlife Service

1.2.2 FERC's Issuance of Scoping Document 1

On April 8, 2011, FERC issued SD1 for the Project in accordance with 18 CFR § 5.8. SD1 provided the Districts and RPs with FERC's preliminary list of issues and alternatives to be addressed in an environmental assessment to accompany FERC's consideration of a new Project license. FERC requested that comments on SD1 and the PAD be provided to FERC no later than June 10, 2011.

1.2.3 FERC's Site Visit and National Environmental Policy Act Scoping Meetings

FERC conducted a Project site visit on May 10, 2011, and held two public scoping meetings for the Project on May 11, 2011, one in Modesto and the other in Turlock, California. The scoping meetings were recorded and transcripts are available through FERC.

1.2.4 Relicensing Participants Filing of Comments and Study Requests

Fifty-one letters commenting on FERC's SD1 and the Districts' PAD were filed with FERC by June 10, 2011. Table 1.2-2 provides a summary of the filings. Note that some commenters filed separate letters on SD1 and the PAD while other commenters included comments on SD1 and the PAD in one letter. Not all of these comment letters contained study requests.

Table 1.2-2 Comment letters filed with FERC on Scoping Document 1 and/or the Districts' PAD.

Commenter	Date of Comment Letter
A & L Pirrone Vineyards, Inc.	June 9, 2011
Acterra: Action for a Healthy Planet	June 10, 2011
Allen, Charlotte	June 10, 2011
Bay Area Water Supply and Conservation Agency	June 10, 2011
Beam, Rose	June 10, 2011
Beard, Lawrence	June 10, 2011
Blake, Martin	June 10, 2011
Board of Supervisors, City and County of San Francisco	June 10, 2011
Britton Konynenburg Partners	June 10, 2011
Bureau of Reclamation	June 9, 2011
Cadagan, Jerry	June 10, 2011
California Department of Fish and Game	June 6, 2011 and June 9, 2011
City and County of San Francisco, Public Utilities Commission	June 10, 2011
City of Ceres	June 20, 2011
City of Modesto	June 8, 2011
City of Portola Valley	June 10, 2011
City of Turlock	June 6, 2011
Clean Water Action--Clary, Jennifer	June 10, 2011
Conservation Groups[1]	June 10, 2011
Denham, Jeff	May 12, 2011
Derryberry, Griffin	June 10, 2011
Doocey, Mrs.	May 24, 2011
Foster Farms	June 1, 2011
Friends of the Tuolumne	June 7, 2011
Gardner, Karen	June 10, 2011
Gorman, Elaine	June 9, 2011
Hackamack, Bob	June 6, 2011
Landowners, Farmers and Interested Parties	June 13, 2011

Commenter	Date of Comment Letter
Lower Tuolumne Farmers	June 9, 2011
Mape's Ranch & Lyons' Investments	June 8, 2011
National Park Service	June 5, 2011
NOAA-Fisheries	June 10, 2011
Ratto Bros	June 8, 2011
Restore Hetch Hetchy	June 10, 2011
Rosapepe, John	June 10, 2011
Sill, Todd	June 3, 2011
Squab Producers	June 1, 2011
Stanislaus County	May 24, 2011
Stanislaus County Farm Bureau	June 9, 2011
State Water Resource Control Board- Division of Water Rights	June 9, 2011
Town of La Grange	June 2, 2011
Tuolumne River Trust	June 7, 2011 and June 10, 2011
Turlock Chamber of Commerce	June 2, 2011
United States Department of Interior, Bureau of Land Management	June 10, 2011
United States Fish and Wildlife Service	June 9, 2011
Western Strategic Solutions	June 7, 2011
Wulff, Deanna Lynn	June 6, 2011 and June 8, 2011
Yosemite Farm Credit	June 9, 2011

[1] American Rivers, American Whitewater, California Sportsfishing Protection Alliance, California Trout Inc., Central Sierra Environmental Resource Center, Environmental Defense Fund, Friends of the River, Golden West Women Flyfishers, Northern California Council Federation of Fly Fishers, Merced Fly Fishing Club, Pacific Coast Federation of Fishermen's Association, Pro-Troll Fishing Products, Trout Unlimited, and Tuolumne River Trust – collectively the "Conservation Groups".

In accordance with the ILP schedule, 27 parties filed study requests of one form or another. A total of 138 study requests were counted by the Districts. Many of these requests did not attempt to address the required ILP study request criteria provided in § 5.9(b) of the FERC regulations. The manner in which the Districts treated the various study requests is discussed in Section 2.0-Relicensing Participants' Study Requests.

1.3 Districts Ongoing Studies and Data Collection Activities

The Districts are continuing to collect, evaluate, and file with FERC resource monitoring information at the Project in accordance with the terms of its current license. These studies include:

- continuation of Annual Reports due April 1 in each year, summarizing annual fall-run Chinook salmon escapement estimates, which are a combination of annual CDFG spawner surveys and the Districts' ongoing counting weir operations,
- *Oncorhynchus mykiss (O. mykiss)* population estimates, which will end in 2011, and
- *O. mykiss* tracking, also ending in 2011.

In accordance with FERC's order dated April 3, 2008, the Districts plan to continue the existing monitoring summarized in the 2005 Ten Year Report, which consists of:

- annual seining surveys (January-June),
- annual screw trapping (January-June),
- annual counting weir operation (September-March),

- annual river temperature monitoring, and
- annual “reference” count snorkel surveys.

In addition, in accordance with FERC’s July 16, 2009 Order on Rehearing, the Districts have completed or are undertaking two additional studies. These are:

- *Lower Tuolumne River Water Temperature Modeling Study*; filed with FERC on March 10, 2011.
- *Lower Tuolumne River Instream Flow Study*; draft report to be available by October 27, 2011, and to be finalized by January 25, 2012.

The Districts have also initiated water quality data collection just downstream of the powerhouse, including dissolved oxygen and temperature data at 15-minute intervals. To support development of a reservoir temperature model, the Districts have established two meteorological stations, one adjacent to the reservoir and one adjacent to the Tuolumne River in the general vicinity of Turlock Lake. The Districts are also in the process of collecting reservoir bathymetry data and temperature profiles.

1.4 Studies Agreed to by the Districts at RWG Meetings

As mentioned in Section 1.2 above, the Districts and RPs have conducted RWG meetings since filing the PAD. At these meetings, additional study and information needs have been discussed. As a result of these meetings, the Districts have agreed to conduct a number of studies in addition to the 10 studies with draft study plans provided in the PAD. The additional studies are:

- Recreation Facility Condition and Public Accessibility Assessment
- Lower Tuolumne River Boatable Flow Study
- Whitewater Boating Takeout Improvement Feasibility Study
- Visual Quality Assessment
- Wetland Habitats Associated with Don Pedro Reservoir Study
- Reservoir Temperature Model, including bathymetry
- Project Operations/Water Balance Model
- Socioeconomics Study

Draft study plans for these studies are provided in this PSP.

2.0 RELICENSING PARTICIPANTS' STUDY REQUESTS

The RPs submitted 27 letters that requested new studies or study modifications to the Districts' draft study plans in the PAD. All in all, there were 114 requests for new studies and 24 requests for study modifications to either a study plan provided in the PAD or a study required by the 2009 FERC Order. The Districts reviewed all letters filed with FERC, searching for references to requests for new studies or information; consolidated similar study requests; and then determined whether or not the study request addressed the ILP's seven criteria.

Table 2.0-1 provides a summary of all study requests, the identity of the party making the request, the date of the letter filed with FERC, and the titles of the studies requested. The study request number assigned by the Districts is provided next to each study's title. A cross-reference between the Districts' assigned study number and the page number within the RP's letter where the study request was made is provided as Appendix A-Cross-Reference Table of Studies and Study Requests.

Table 2.0-1 Study requests filed with FERC.

Relicensing Participant	Date of Comment Letter	Study Description	
		Requested Modification to Study Proposed in the PAD or Modification to Study Required by 2009 FERC Order	Requested New Study
Acterra	June 10, 2011	• None	• Salmonid Populations Limiting Factors Analysis (Acterra-1)
Conservation Groups[1]	June 10, 2011	• Lower Tuolumne River Temperature Model (AR-04) • On-going Rotary Screw Trap Monitoring (AR-06)	• Water Balance/Operations Model (AR-01, AR-02) • Reservoir Temperature Model (AR-03) • Socioeconomics Study (AR-05) • Upper Tuolumne River Anadromous Fish Habitat Recovery (AR-07) • Upper Tuolumne River Steelhead/Rainbow Trout Genetics (AR-08) • Economic Value and Activity of Restored Fishery (AR-09) • Economic Value and Activity of Improved Recreation (AR-10) • Economic Value and Activity of Improved Ecosystem Services (AR-11) • Economic Value and Activity Associated with Modified Water Supply Allocations (AR-12) • Lower Tuolumne Large Woody Debris (AR-13) • Lower Tuolumne River Coarse Substrate for Anadromous Fish Study (AR-14) • Lower Tuolumne River Cottonwood Recruitment (AR-15) • Don Pedro Reservoir Dead Storage Management Feasibility (AR-16) • Lower Tuolumne Recreation Flow (AR-17) • Whitewater Boating Take-Out Adequacy and Feasibility (AR-18)
Bay Area Water Supply and Conservation Agency	June 10, 2011	• None	• Socioeconomics Study (BAWSCA-01)

Relicensing Participant	Date of Comment Letter	Study Description: Requested Modification to Study Proposed in the PAD or Modification to Study Required by 2009 FERC Order	Study Description: Requested New Study
Beam, Rose	June 10, 2011	• None	• Dam's impacts, upper watershed to San Francisco Bay (Beam-01) • Dam's economic impacts on fly fishing and recreation (Beam-02) • Dam's impacts on biodiversity and health of anadromous fish (Beam-03) • Ways MID, TID, and agricultural groups can conserve water. (Beam-04)
Beard, Lawrence	June 10, 2011	• None	• Dam effects on downstream wildlife, recreation, and aesthetics (Beard-01)
Britton Konyenburg Partners	June 10, 2011	• None	• Long-term economic effects of water and hydroelectricity delivery reduction on MID and TID ratepayers: residents, farmers, and ranchers (BKP-01)
Bureau of Land Management	June 10, 2011	• Historic Properties Study Plan (BLM-01, BLM-02, BLM-12, BLM-13) • Traditional Cultural Properties Study Plan (BLM-11, BLM-14, BLM-15)	• Recreation Use and Visitor Survey (BLM-03) • Lower Tuolumne Recreation Flow (BLM-04) • Whitewater Boating Take-Out Adequacy and Feasibility Study (BLM-05) • Visual Resources Assessment (BLM-06) • Recreation Facility Condition and Public Accessibility Assessment (BLM-07) • Noxious Weeds (BLM-08) • Riparian and Wetland Habitat (BLM-09) • CESA-listed Wildlife Bald Eagle (BLM-10)
Bureau of Reclamation	June 9, 2011	• Lower Tuolumne River Water Temperature Model (Reclamation-03)	• Unimpaired flow required to meet salmon doubling goal (Reclamation-01) • Reservoir storage and purpose trade-offs (Reclamation-02) • Reservoir impacts to drought planning (Reclamation-04) • Operations impact on Delta salinity (Reclamation-05)
Cadagan, Jerry	June 10, 2011	• None	• Whitewater Boating Take-out (Cadagan-01)
California Department of Fish and Game	June 9, 2011 and June 6, 2011	• Lower Tuolumne River Water Temperature Model (CDFG-02) • Instream Flow Study (CDFG-04)	• Water Balance and Operations Model (CDFG-01) • Reservoir Water Temperature Management Feasibility (CDFG-03) • Bioenergetics Study (CDFG-05) • Chinook Health Study (CDFG-06) • Reservoir Fish Population Study (CDFG-07)
City and County of San Francisco, Public Utilities Commission	June 10, 2011	• None	• Water Supply and Socioeconomics Impacts (CCSF-01) • Synthesis of existing and new information for Tuolumne River Salmonids (CCSF-02) • Otolith Studies on Lower Tuolumne Salmonids (CCSF-03) • Lower Tuolumne Sand-Bedded Reach Productivity (CCSF-04)
Clean Water Action—Clary, Jennifer	June 10, 2011	• None	• Impacts of diversion (CWA-01) • Impact of current rate of diversion on downstream uses on water quality (CWA-02) • Cumulative impact of climate change (CWA-03)

Relicensing Participant	Date of Comment Letter	Study Description: Requested Modification to Study Proposed in the PAD or Modification to Study Required by 2009 FERC Order	Study Description: Requested New Study
Friends of the Tuolumne	June 7, 2011	• Impact of Old Don Pedro dam on water temperatures (FOT-03) • Operation impacts on Western Pond Turtles (FOT-08)	• Desktop analysis of natural hydrology and water availability on a weekly basis over all year types so that mitigation and enhancement measures can be better developed (FOT-01) • Study of smoltification of anadromous fish and pulse flows (FOT-02) • Costs and benefits of rebuilding the drinking water intake downstream (FOT-04) • Analyze repair of Turlock Lake Dam to enable more storage (FOT-05) • Multi-tower for water releases out of Don Pedro Reservoir Feasibility Study (FOT-06) • Costs and benefits of fish passage tower (FOT-07) • Operation impacts on mussel populations of the Lower Tuolumne River (FOT-09) • Lower Tuolumne River recreation/boating study (FOT-10) • Lower Tuolumne River trout fishing study (FOT-11) • Native and non-native bee competition (FOT-12)
Gardner, Karen	June 10, 2011	• Impacts downstream of dam on water quality (Gardner-01)	• Dam impacts on downstream salmonids (Gardner-02)
Hackamack, Bob	June 8, 2011	• None	• Whitewater recreation needs on the Tuolumne River inlet arm of Don Pedro Reservoir (Hackamack-01)
Lower Tuolumne Farmers	June 9, 2011	• None	• Updated Operations Model (LTF-01)
Mape's Ranch and Lyons Investments	June 8, 2011	• None	• Economic effects of new license on communities that paid for project (MR&LI-01)
Martin, Blake	June 10, 2011	• None	• Water saving technology MID and TID use (Martin-01)
Modesto, City of	June 8, 2011	• None	• Effect of the Project on urban water supply (Modesto-01)
National Oceanic and Atmospheric Administration, Marine Fisheries	June 10, 2011	• Lower Tuolumne River Water Temperature Model [2] (NMFS-06)	• Inter-relationship of the Effects of the Project with those of the La Grange Complex on Tuolumne River Anadromous fishes (NMFS-01) • Develop Operations Model (NMFS-02) • Fish Passage for Anadromous Fish (NMFS-03) • Effects of the Project and Related Facilities on Hydrology for Anadromous Fish (NMFS-04) • Effects of the Project and Related Facilities and Operations on Fluvial Processes and Channel Morphology for Anadromous Fish (NMFS-05) • Reservoir Temperature Model[2] (NMFS-06) • Upper Tuolumne River Habitats for Anadromous Fish (NMFS-07) • Salmon and steelhead Full Life-Cycle Population Models (NMFS-08) • Losses of marine-derived nutrients in the Tuolumne River (NMFS-09)
National Park Service	June 5, 2011	• None	• Recreation Use and Visitor Survey (NPS-01) • Lower Tuolumne Recreation Flow Study (NPS-02) • Whitewater Boating Take-Out Adequacy and Feasibility Study (NPS-03)

Relicensing Participant	Date of Comment Letter	Study Description: Requested Modification to Study Proposed in the PAD or Modification to Study Required by 2009 FERC Order	Study Description: Requested New Study
Restore Hetch Hetchy	June 10, 2011	• None	• Environmental impacts associated with the Fourth Agreement's substitution for storage over natural flows (RHH-01) • Environmental impact of CCSF's upstream operations enabled by Don Pedro (RHH-02) • Upstream operational criteria impacts on downstream resources (RHH-03) • Study removal of Hetch Hetchy Reservoir on downstream resources (RHH-04) • Study of Enlargement of Don Pedro Reservoir or Altering of Banking and Storage Arrangements (RHH-05) • Study of the Integration of Don Pedro Reservoir Operations with New Melones Reservoir Operations (RHH-06) • Conjunctive Use Opportunities (RHH-07) • Identify other points of diversion for CCSF (RHH-08)
Rosapepe, John	June 13, 2011	• Water quality of the Lower Tuolumne River (Rosapepe-04)	• Effects of dams on anadromous fish populations (Chinook salmon and steelhead) (Rosapepe-01) • Effects of dams on recreational opportunities (Rosapepe-02) • Effects of dams on salmon commercial fisheries (Rosapepe-03) • Flow study for attraction of returning and outmigrating anadromous fish (Rosapepe-05) • Fish passage (Rosapepe-06) • Water conservation and efficiency done by TID and MID (Rosapepe-07)
State Water Resource Control Board-Division of Water Rights	June 9, 2011	• None	• Fish Assemblages and Population Study between Don Pedro Dam and La Grange Dam (SWRCB-01) • Lower Tuolumne River Bioenergetics (SWRCB-02) • Lower Tuolumne River Riparian Study (SWRCB-03) • Lower Tuolumne River Freshwater Mussel Survey (SWRCB-04) • Lower Tuolumne River Predation Study (SWRCB-05) • Sediment Transport (SWRCB-06) • Spawning Gravel Study (SWRCB-07) • Large Woody Debris Study (SWRCB-08) • Effect of Water Temperatures and Turbidity on Predation of Juvenile Anadromous Fish in the Lower Tuolumne River (SWRCB-09) • Impact of Water Levels on Recreation Uses in Don Pedro Reservoir (SWRCB-10) • Sturgeon Study (SWRCB-11) • Pacific Lamprey Study (SWRCB-12) • Operations Model (SWRCB-13) • Lower Tuolumne River Flood Capacity (SWRCB-14) • Socioeconomic Model (SWRCB-15)
Turlock, City of	June 6, 2011	• None	• Project's effect on municipal water quality (Turlock-1)

Relicensing Participant	Date of Comment Letter	Study Description	
		Requested Modification to Study Proposed in the PAD or Modification to Study Required by 2009 FERC Order	Requested New Study
United States Fish and Wildlife Service	June 9, 2011	• Special Status Plants Study Plan (USFWS-01) • California Tiger Salamander Study Plan (USFWS-02) • California Red-Legged Frog Study Plan (USFWS-03) • Valley Elderberry Longhorn Beetle Study Plan (USFWS-04, USFWS-05) • ESA- and CESA-Listed Plants Study Plan (USFWS-06, USFWS-07, USFWS-08) • Instream Flow Study (USFWS-09)	• Age and Growth Study of *O. mykiss* in the Tuolumne River (USFWS-10) • Chinook Salmon Egg Viability Study (USFWS-11) • Juvenile Chinook Salmon Survival Study (USFWS-12) • Genetics of Chinook Salmon in the Upper Tuolumne River (USFWS-13)
Western Strategic Solutions	June 9, 2011	• None	• Impacts of inconsistent and increased water flows on the restoration and management efforts of the endangered Riparian Brush Rabbit and Aleutian Cackling Goose. (WSS-01)
TOTALS			
--	Subtotal	24	114
--	Total	--	138

[1] American Rivers, American Whitewater, California Sportsfishing Protection Alliance, California Trout Inc., Central Sierra Environmental Resource Center, Environmental Defense Fund, Friends of the River, Golden West Women Flyfishers, Northern California Council Federation of Fly Fishers, Merced Fly Fishing Club, Pacific Coast Federation of Fishermen's Association, Pro-Troll Fishing Products, Trout Unlimited, and Tuolumne River Trust – collectively the "Conservation Groups".
[2] Same study request.

2.1 General Approach to Evaluating Study Requests

The Districts reviewed each letter that requested a new study or new information. A study request designation was applied to any comment that could reasonably be viewed as a study request (see Appendix A). The Districts' response to a study request falls into one of four categories:

(1) Existing information is deemed to be adequate to address the goals of the study.
(2) The Districts believe the request met the requirements of FERC's ILP regulations, adopted the study request, and prepared a draft study plan.
(3) The Districts believe that a portion of the study request met ILP regulations, adopted that portion, and included it in a study plan.
(4) The Districts believe that the study request did not meet the requirements of the ILP regulations and did not adopt the study request.

Many of the individual study requests actually consisted of multiple studies within a single study request. Where the Districts deemed that a majority of an individual study request met the ILP criteria, the study request was accepted and incorporated into a draft study plan. Where the Districts deemed that the overwhelming majority of the study request did not meet the ILP criteria, the request was not adopted and an explanation of the rationale for not adopting is provided (see Section 4.0-Districts' Response to Study Requests Not Adopted by the Districts). Where no attempt was made to address the ILP criteria, the study request was not adopted; however, the Districts have actually been able to incorporate at least portions of many of these requests within similar study requests made by others that did address the ILP criteria (see Section 3.0-Districts' Proposed Studies).

2.2 ILP Study Request Criteria

In accordance with § 5.9(b)(1)-(7) of 18 CFR, all study requests must be accompanied by a showing that all of the ILP study plan criteria are met. These study request criteria are:

(1) Describe the goals and objectives of each study proposal and the information to be obtained;
(2) If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied;
(3) If the requester is not a resource agency, explain any relevant public interest considerations in regards to the proposed study;
(4) Describe existing information concerning the subject of the study proposal, and the need for additional information;
(5) Explain any nexus between project operations and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements;
(6) Explain how any proposed study methodology (including any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate filed season(s) and duration) is consistent with generally accepted practice in the scientific community or, as appropriate, considers relevant tribal values and knowledge; and
(7) Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.

Each individual study request was evaluated in light of the ILP criteria. A study request must meet all of the criteria. Section 3.0 summarizes the study requests adopted and Section 4.0 summarizes the study requests not adopted. Study requests that were adopted are likely to require further discussion after reviews of draft study plans by RPs.

2.3 Geographic Scope of Studies to Determine Project Effects

The Districts received a number of study requests which called for either resource studies or water use studies that the Districts believe to be outside the proper geographic scope of this relicensing. These generally fall into three categories:

- studies of resources in the San Joaquin River, Delta, Bay, and ocean,
- studies of the agricultural practices of irrigators served by the Districts and/or studies of the management of the Districts' irrigation delivery systems, or
- studies of aquatic habitat conditions upstream of the Don Pedro Project.

The Districts also received a number of study requests unrelated to the Districts and the Don Pedro Project.

Each category is discussed below.

2.3.1 Studies of Resources in the San Joaquin River, Delta, Bay, and Ocean

Several study requests called for studies of fishery resources in the San Joaquin River, the Bay-Delta, and beyond.[1] The Districts have not adopted these study requests. There is considerable existing information accumulated over many years concerning the natural resources of these vast resource areas and no additional studies by the Districts would materially improve the understanding of what affects these resources in these habitats. Further, any study conducted as part of relicensing should be related to Project operations and their resultant impacts to specific resources, all in the context of identifying license requirements. None of these study requests identified a specific resource affected by Project operations. Studies of specific fish or wildlife resources in the San Joaquin River, the Delta, or San Francisco Bay would be time consuming and costly, and would not yield information about specific Project impacts that would inform the development of license requirements. Therefore, studies of these areas would not be useful in establishing a record from which appropriate license requirements may be derived.

2.3.2 Studies of the Districts Customers' Agricultural Practices and/or Studies of the Management of the Districts' Irrigation Delivery Systems

Several parties requested that the Districts undertake studies of the Districts' irrigation delivery systems and/or their customers' on-farm practices.[2] The goals of these study requests appear to be intended to allow FERC to modify the irrigation practices of the Districts' irrigators. The Districts consider these study requests to be outside the scope of relicensing. While FERC can consider information provided by parties to the relicensing related to the Districts' irrigation delivery systems or their customers' on-farm practices, the Districts believe it is beyond FERC's authority to impose conditions directly or indirectly on irrigators and M&I water users, or impose conditions that would interfere with the Districts' obligations to serve their irrigation and M&I customers.

2.3.3 Studies of Aquatic Habitat Conditions Upstream of the Don Pedro Project

Several study requests called upon the Districts to undertake studies of aquatic habitat conditions upstream of the Project on the mainstem Tuolumne River and its tributaries.[3] Project operations do not, and cannot, affect the physical habitat upstream of the Project. There is no change in Project operations or Project facilities that FERC might impose which would affect the physical habitat in the Tuolumne River or its tributaries upstream of the Don Pedro Project. Therefore, studies of these upstream resources would not be consistent with FERC's goal of developing a record necessary to support license requirements that specifically address Project-related impacts.

[1] These include BEAM-01, RHH-03, RHH-06, Rosapepe-03
[2] These include AR-05, AR-12, BEAM-04, FOT-5, MARTIN-01, RHH-07, and Rosapepe-07
[3] These include AR-07, AR-08, NMFS-07, NMFS-09, RHH-01, and RHH-02

2.3.4 Studies Unrelated to the Don Pedro Project

A number of study requests were unrelated to the Don Pedro Project.[4] Studies of issues unrelated to the Project would not serve to inform the development of license requirements.

[4] These include CWA-3, RHH-2, RHH-3, RHH-4, and RHH-8

3.0 DISTRICTS' PROPOSED STUDIES

This section presents the Districts' proposed studies to support the license application and the National Environmental Policy Act (NEPA) document preparation. Draft study plans have been prepared for review and comment based on study requests submitted by RPs and the Districts' assessment of information needs. The Districts believe the information developed by these studies, when combined with existing information as summarized in the Districts' PAD and other ongoing data gathering efforts (see Section 1.3), will provide the information needed to evaluate the effects of Project operations and management activities on resources and inform the development of license requirements.

Table 3.0-1 provides a list of the Districts' draft study plans. For reference purposes, each draft study plan listed in Table 3.0-1 is placed into one of three categories:

- draft study plan was previously included in the PAD,
- study was agreed to at RWG meetings, or
- study was adopted by the Districts in response to a study request.

Table 3.0-1 Studies proposed by Districts.

Study Designation	Study Title	RPs' Study Request Adopted or Adopted in Part[1]	Proposed Study Plan		
			Included in PAD and Revised Herein	Agreed to at RWG Meetings	Newly Proposed
CULTURAL RESOURCES					
CR-1	Historic Properties Study	BLM-01, BLM-02, BLM-11, BLM-12 BLM-13, BLM-14	X		
CR-2	Native American Traditional Cultural Properties Study	BLM-01, BLM-02, BLM-11, BLM-14, BLM-15	X		
RECREATION RESOURCES					
RR-1	Recreation Facility Condition and Public Accessibility Assessment	BLM-03, BLM-07, NPS-01		X	
RR-2	Whitewater Boating Take Out Improvement Feasibility Study	AR-18, BLM-05, Cadagan-01, Hackamack-01, NPS-03		X	
RR-3	Lower Tuolumne Boatable Flow Study	AR-17, BLM-04 Beard-01, FOT-10, FOT-11, NPS-02		X	
RR-4	Visual Quality Study	BLM-06		X	
TERRESTRIAL RESOURCES					
TR-1	Special-Status Plants Study	USFWS-01	X		
TR-2	ESA- and CESA-Listed Plants Study	USFWS-06, USFWS-07, USFWS-08	X		
TR-3	Wetland Habitats Associated with Don Pedro Reservoir Study	AR-15, BLM-09, SWRCB-3, SWRCB-14 WSS-01		X	
TR-4	Noxious Weed Survey	BLM-08			X
TR-5	ESA-Listed Wildlife – Valley Elderberry Longhorn Beetle Study	USFWS-04, USFWS-05	X		
TR-6	Special-Status Amphibians and Aquatic Reptiles Study	FOT-08	X		
TR-7	ESA-Listed Amphibians – California Red-Legged Frog Study	USFWS-03	X		

Study Designation	Study Title	RPs' Study Request Adopted or Adopted in Part[1]	Proposed Study Plan		
			Included in PAD and Revised Herein	Agreed to at RWG Meetings	Newly Proposed
TR-8	ESA-Listed Amphibians – California Tiger Salamander Study	USFWS-02	X		
TR-9	Special-Status Wildlife – Bats Study	--	X		
WATER AND AQUATIC RESOURCES					
W&AR-1	Water Quality Assessment	Gardner-01, CWA-01 CWA-02, Rosapepe-01	X		
W&AR-2	Project Operations/Water Balance Model	AR-02, Reclamation-02 CDFG-01, LTF-01, NMFS-02, NMFS-04, Reclamation-04, SWRCB-13		X	
W&AR-3	Reservoir Temperature Model	AR-03, AR-16, CDFG-03, FOT-03 NMFS-06, Reclamation-03		X	
W&AR-4	Spawning Gravel Study	AR-14, NMFS-05, SWRCB-07			X
W&AR-5	Salmonid Populations Information Integration and Synthesis Study	Acterra-1, Beam-03, CCSF-02, FOT-02 Gardner-02, Rosapepe-01, USFWS-12			X
W&AR-6	Tuolumne River Chinook Salmon Population Model	NMFS-08			X
W&AR-7	Predation Study	AR-13, AR-14, USFWS-11			X
W&AR-8	Salmonid Redd Mapping Study	CCSF-05, CDFG-05, SWRCB-02			X
W&AR-9	Chinook Salmon Fry Study	NMFS-08			X
W&AR-10	*Oncorhynchus mykiss* Population Study	SWRCB-05, SWRCB-06			X
W&AR-11	Chinook Salmon Otolith Study	CCSF-03			X
W&AR-12	*Oncorhynchus mykiss* Habitat Assessment	AR-13, SWRCB-08			X
W&AR-13	Fish Assemblage and Population Between Don Pedro Dam and La Grange Dam Study	SWRCB-01			X
W&AR-14	Temperature Criteria Assessment	NMFS-06			X
W&AR-15	Socioeconomics Study	AR-12, BAWSCA-01, BKP-01, CCSF-01, MOD-01, MR&LI-01, SWRCB-15, TUR-01		X	
TOTALS					
	Subtotal		10	8	12
	Total		--	--	30

[1] Study numbering utilized herein is provided in Table 2.0-1.

Draft study plans that were included in the PAD have been the subject of discussion and modification at RWG meetings. The draft study plans included in the PSP represent the latest revision to those specific plans. The Districts agreed to prepare study plans for several additional studies discussed at RWG meetings. These draft study plans are also included in this PSP.

Studies adopted by the Districts based on study requests made by RPs and on additional information needs identified by the Districts as a result of RWG meetings are included in this PSP. These proposed studies may incorporate all or portions of the study requests. Study requests not adopted by the Districts are discussed in Section 4.0. Many study requests were not accompanied by the necessary showing of conformance with the ILP's seven criteria. However, the Districts were able to incorporate many of these same requests into draft study plans because another party requested a similar study that did suitably address the ILP criteria. Table 3.0-1 identifies which of the Districts' draft study plans incorporate specific requests made by an RP.

An overview of each proposed study is provided below. Detailed plans for each proposed study are provided in the appendices to this PSP. Appendix B-Clean Versions of the Districts' 30 Proposed Study Plans, includes "clean" versions (i.e., no redlines) of the Districts' proposed studies. Appendix C-Redlined Versions of Districts' 10 Proposed Study Plans, consists of redlined versions of the 10 study proposals that were in the Districts' PAD. The redline versions in Appendix C show the changes between the February 10, 2011, filing with FERC and those included in Appendix B. Changes to the study plans were based on discussions with the RPs and written comments filed in response to the PAD. Minor modifications (e.g., updating footers and study numbers and correcting typographical errors) are not shown in redline.

3.1 Cultural Resources

3.1.1 Historic Properties Study (Study Plan CR-1)

Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, requires federal agencies to consider the effects of their undertakings on historic properties listed in or eligible for inclusion in the National Register of Historic Places (NRHP). FERC's issuance of a license for the Project is considered a federal undertaking, and is therefore subject to the provisions and regulations of Section 106.

The primary study goal is to assist FERC in meeting its compliance requirements under Section 106 of the NHPA by determining if licensing of the Project will have an adverse effect on historic properties. The objective of this study is to identify cultural resources within the Project's Area of Potential Effects (APE); formulate a plan to evaluate their eligibility to the NRHP, if needed; and identify Project-related effects on those resources. The results of the study will then be used to develop a Historic Properties Management Plan (HPMP), which will ensure that all cultural resources identified within the APE will be appropriately considered and managed during the term of a new FERC license.

The Districts will develop a technical report prepared to current professional standards consistent with the Archaeological Resource Management Report (ARMR) Guidelines (OHP 1995). The report will include: (1) Study Goals and Objectives, (2) Environmental and Cultural Setting, (3) Methods and Analysis, (4) Results, and (5) Conclusions. The report will meet all of the reporting requirements of the BLM-issued Cultural Resource Use Permit. Upon completion of the field studies, maps provided with the Districts' report will clearly depict on U.S. Geological Survey (USGS) 1:24,000 topographic maps the study areas examined; inventory coverage, including intensity of coverage; and locations of cultural resources identified within the study area. Copies of this report will be provided to the affected Indian tribes; the U.S. Department of Interior, Bureau of Land Management (BLM); the State Historic Preservation Officer (SHPO); California State University, Stanislaus; Central California Information Center; and FERC.

Copies of the final report and detailed locations of identified properties will be withheld from public disclosure in accordance with Section 304 (16 U.S.C. 4702-3) of the NHPA, as amended. Concurrence on report recommendations will be sought from SHPO. BLM and other interested parties will review the cultural report, evaluation plan, and other documents, before the report is issued to SHPO for concurrence.

3.1.2 Native American Traditional Cultural Properties Study (Study Plan CR-2)

This study focuses on the potential for Project-related activities to affect Traditional Cultural Properties (TCP). The primary study goal is to assist FERC in meeting its compliance requirements under Section 106 of the NHPA, as amended, by determining if licensing of the Project will have an adverse effect on TCPs. The objective of this particular study is to identify TCPs that may potentially be affected by Project O&M activities, evaluate their eligibility to the NRHP, and identify Project-related activities that may affect TCPs, including locations of ethnographic use. At a later date, the results of the study will then be used to develop the HPMP, which will ensure that all cultural resources identified within the APE will be appropriately considered and managed during the term of the new FERC license.

The Districts will develop a technical report prepared to current professional standards consistent with the ARMR Guidelines (OHP 1995). The report will include (1) Study Goals and Objectives, (2) Environmental and Cultural Setting, (3) Methods and Analysis, (4) Results, and (5) Conclusions. The report will meet all of the reporting requirements of the BLM-issued Cultural Resource Use Permit. Copies of this report will be provided to the affected Indian tribes; the U.S. Department of Interior, Bureau of Land Management (BLM); the State Historic Preservation Officer (SHPO); California State University, Stanislaus; Central California Information Center; and FERC. Copies of the final report and detailed locations of identified properties will be withheld from public disclosure in accordance with Section 304 (16 U.S.C. 4702-3) of the NHPA (as amended). Concurrence on report recommendations will be sought from SHPO. BLM and other interested parties will review the cultural report, evaluation plan, and other documents, before the report is issued to SHPO for concurrence.

3.2 Recreation Resources

3.2.1 Recreation Facility Condition and Public Accessibility Assessment (Study Plan RR-1)

The goal of the recreation facility condition assessment and public accessibility evaluation is to provide information about the need for maintenance or enhancement of existing recreation facilities to support current and near-term future demand for public recreation in the Project area. The objectives of the study are to:

- assess the condition of existing developed recreation facilities at the Project,
- estimate present capacity of recreation facilities at the Project to support present and future demand for public recreation at the Project (i.e., facility carrying capacity), and
- provide information useful for determining present and future public recreation facility needs for the Project.

This study will assess the condition of existing developed recreation facilities within the Project managed by Don Pedro Recreation Agency (DPRA). The Districts will prepare a report on recreation facility condition and the adequacy of public accessibility.

3.2.2 Whitewater Boating Take Out Improvement Feasibility Study (Study Plan RR-2)

Commercial and private boaters that float the Tuolumne River Wild and Scenic Corridor use the existing take out facility (known as the Ward's Ferry Bridge Take Out) within the Project Boundary. DPRA maintains a restroom at this location on the shoulder of Ward's Ferry Road above the reservoir to avoid improper waste disposal near this portion of the reservoir.

The current whitewater boating take out procedures are time consuming, laborious, and may pose road safety issues. The primary goal of the study is to assess the feasibility of providing improved take out for use by whitewater boaters at the upstream end of the Project. This study, to be conducted in consultation with resource managers and boaters, will evaluate the feasibility of improved facilities at the Ward's Ferry Bridge location and also assess the feasibility of alternative take out locations.

3.2.3 Lower Tuolumne River Boatable Flow Study Plan (Study Plan RR-3)

The goal of the lower Tuolumne River boatable flow study is to determine the lowest flow that can provide non-motorized, recreational river boating opportunities in the lower Tuolumne River. The objectives of the study are to:

- determine whether the currently required minimum flows provide for river boating opportunity in the lower Tuolumne River,
- use existing recreation information, where possible, to assess river boating,
- determine the number of flow days by month at or above the minimum boatable flow for non-motorized river boating opportunities (e.g., rafting, kayaking, and canoeing) under Project operations,
- determine operational constraints, if any, of providing boatable flows for boating opportunities in the study reach,
- identify current put-in and take-out locations for river boating between La Grange Dam and the confluence with the San Joaquin River, and
- evaluate the adequacy of flow information (i.e., availability, reliability, and real-time access).

3.2.4 Visual Quality Study (Study Plan RR-4)

The BLM's Sierra Resource Management Plan assigns inventory classes to visual resource areas within the Sierra Resource Management Area. Management activities consider the adopted Visual Resource Management (VRM) class. The VRM classes within and adjacent to the Project are Class I, Class II, and Class III. Table 3.2-1 describes the three classes and the BLM land areas where they are assigned.

Table 3.2-1 BLM Visual Resource Management classes in and adjacent to the Project Boundary.

	Description	Where Assigned
Class I	To preserve the existing character of the landscape. Any change to the characteristic landscape should be very low and must not attract attention.	Tuolumne Wild and Scenic River Corridor
Class II	To retain the existing character of the landscape. Any change to the characteristic landscape should be low.	Red Hills Area of Critical Environmental Concern
Class III	To partially retain the existing character of the landscape. Any change to the characteristic landscape may be moderate.	Lake Don Pedro/Highway 49 viewshed and all other BLM areas not specifically identified as having a particular VRM rating

The goal of this study is to document current visual conditions of the Project as viewed from BLM lands during various times of the year and identify any adverse visual resource effects due to continued operation of the Project. The objectives of the study are to identify, map, and describe BLM inventories associated with Project facilities and features on public land administered by BLM and document the existing visual condition of all Project facilities and features from associated viewsheds on public land administered by BLM.

3.3 Terrestrial Resources

3.3.1 Special-Status Plants Study (Study Plan TR-1)

Plants listed under the federal ESA or the CESA are addressed in a separate study plan. Only special-status plants otherwise not listed as FT (federally threatened), FE (federally endangered), ST (state threatened), and SE (state endangered) are addressed in the Special-Status Plants Study Plan.

The goal of this study is to provide information to determine the extent to which certain Project O&M activities and/or recreational activities may have the potential to adversely affect special-status plant species. A Project effect may occur if both of the following conditions are met:

- a special-status plant species is found to occur within the study area, and
- a specific Project O&M activity has a reasonable possibility of having an adverse effect on the special-status plant species found.

The goal of this study is to gather the information necessary to perform this analysis and evaluate the Project's potential to adversely affect special-status plants. The Districts will prepare a report that includes the following sections: (1) Study Goals, (2) Methods, (3) Results, (4) Discussion, and (5) Conclusions.

3.3.2 ESA- and CESA-Listed Plants Study (Study Plan TR-2)

The goal of this study is to provide information to determine the extent to which Project O&M and/or recreational activities may have the potential to adversely affect ESA- or CESA-listed plant species. A Project effect may occur if both of the following conditions are met:

- an ESA- or CESA-listed plant species is found to occur within the study area, and
- a specific Project O&M or recreation activity has a reasonable possibility of having an adverse effect on the ESA- or CESA-listed plant species found.

The goal of this study is to gather the information necessary to identify whether Project-related activities have the potential to impact ESA- or CESA-listed plant species. The Districts will prepare a report that includes the following sections: (1) Study Goals, (2) Methods, (3) Results, (4) Discussion, and (5) Conclusions.

3.3.3 Wetland Habitats Associated with Don Pedro Reservoir Study (Study Plan TR-3)

This study addresses the following resource issue identified in Section 4.2.3 of SD1:

- Effects of project operation, including water level fluctuations, ground-disturbing activities, and maintenance activities on wetland, riparian and littoral vegetation communities.

The goal of this study is to map and describe wetland habitats within the study area and to characterize their functional condition. The study objective for individual study sites is to describe specific wetland habitats and collect data sufficient to complete a California Rapid Assessment Method (CRAM) evaluation and scoring for each wetland.

A report will be prepared that includes the following sections: (1) Study Goals, (2) Methods and Analysis, (3) Results, (4) Discussion, and (5) Conclusions. The report will include Geographic Information System (GIS) maps, site data, and photo documentation.

3.3.4 Noxious Weed Survey (Study Plan TR-4)

The goal of this study is to provide information to determine whether continued Project O&M activities or recreational use of certain facilities may contribute to the spread of noxious weeds. The criteria to determine a Project effect resulting from the spread of an existing noxious weed population already within or adjacent to the FERC Project Boundary includes both of the following:

- a noxious weed is found to occur within the study area, and
- a specific Project O&M activity has a reasonable possibility of having an adverse effect on the ecosystem by fostering the increase or spread of the noxious weed found.

The objective of this study is to gather the information necessary to perform this analysis and evaluate the Project's potential to spread noxious weeds. The Districts will prepare a report that includes the following sections: (1) Study Goals and Objectives; (2) Methods; (3) Results; (4) Discussion; and (5) Conclusions. In addition to the study report, results will include GIS maps that show noxious weed population locations. The GIS layer of noxious weeds will be made available to the appropriate resource agencies.

3.3.5 ESA-Listed Wildlife – Valley Elderberry Longhorn Beetle Study (Study Plan TR-5)

The valley elderberry longhorn beetle (VELB; *Desmocerus californicus dimorphus*) is a terrestrial wildlife species that is listed as threatened under the federal ESA. VELB has a reasonable potential to occur in the Project Boundary and may be affected by certain Project O&M or recreation activities.

The goal of this study is to provide information concerning VELB presence and distribution within the Project Boundary. The specific objective of this study is to gather information, including:

- identify and map the location of appropriate elderberry shrubs,
- classify habitat where shrubs are found into riparian or non-riparian, and whether shrubs are isolated or clumped, and
- document the presence or absence of VELB or evidence of VELB when surveys are performed.

The Districts will prepare a report that includes the following sections: (1) Study Goals; (2) Methods; (3) Results; (4) Discussion; and (5) Conclusions. Confidential information will not be included in the report, but will be provided to appropriate resource agencies.

3.3.6 Special-Status Amphibians and Aquatic Reptiles Study Plan (Study TR-6)

Foothill yellow-legged frog (FYLF; *Rana boylii*) is a stream-associated species affected by seasonal flow regimes that influence water stage, velocity, and temperature. Project effects on water levels at the mouths of reservoir tributaries could affect habitat availability and suitability for all life stages. Project operations that may result in changes in water levels and velocity may affect the suitability of instream habitat and if water levels decline, has the potential to strand egg masses and tadpoles. FYLF may occur in the Tuolumne River in the upper most reaches of Don Pedro Reservoir or in tributaries that flow into the reservoir.

Project O&M activities may affect western pond turtle (WPT; *Actinemys* [formerly *Emys* or *Clemmys*] *marmorata*) if this species is present in the Project reservoirs, slow-moving stream reaches, or other water bodies within the Project Boundary tributary to the Project. The Project is well within the elevation range of this species. More specifically, Project water level changes could result in inundation of potential nesting habitat.

The Districts will prepare a report that includes the following sections: (1) Study Goals, (2) Methods and Analysis, (3) Results, (4) Discussion, and (5) Conclusions. The following summaries/data presentations will be provided in the report with the supporting data (in Excel spreadsheet and GIS layers, as appropriate):

- presence/absence of each special-status species by survey period (e.g., spring, summer), sample reach tributary and river,
- abundance of FYLF egg masses by survey period and location,
- abundance of FYLF tadpoles/tadpole groups by survey period and location,

- abundance of FYLF young-of-the-year (metamorphs), subadults, and adults by survey period and location,
- descriptive summaries of FYLF egg mass and tadpole habitat characteristics (at least mean, minimum, maximum, and standard error values) overall and by site,
- number of WPT detections by life stage (e.g., juvenile or adult) in the Project reservoir, Project-affected streams, or other study locations, and
- maps of and descriptive information on the occurrence of potential WPT nesting habitat and its relationship to the study area.

3.3.7 ESA-Listed Amphibians - California Red-Legged Frog Study (Study Plan TR-7)

The goal of this study is to provide current information concerning California red-legged frog (CRLF; *Rana draytonii*), a federally threatened species listed under the federal ESA, and its relationship to the Project facilities. The specific objectives of this study are as follows:

- identify, compile, and map known occurrences of CRLF and the distribution of suitable habitats for CRLF,
- evaluate the likelihood that CRLF currently exist in the Project Boundary using site assessments of habitat suitability and information from historical records,
- compile incidental observation of CRLF observations from other aquatic studies,
- through incidental observations, document the presence and provide estimates of number of exotic species (e.g., bullfrogs, non-native crayfish, bass, catfish, or mosquito fish), which may limit the occurrence of CRLF in otherwise suitable habitats,
- provide information on Project-affected tributary streams to the Don Pedro Reservoir for evaluation of potential Project-related effects on CRLF populations, and
- provide information that can be used to develop a draft Biological Assessment.

The Districts will prepare a report that includes the following sections: (1) Study Goals, (2) Methods, (3) Results, (4) Discussion, and (5) Conclusions. Confidential information will not be included in the report, but will be provided to appropriate resource agencies. This report will be submitted to USFWS, with submittals to BLM for any site assessments that take place on BLM lands. The report will include the following:

- copies of data sheets,
- copies of field notes,
- GPS data for all field reconnaissance sites,
- list of known occurrences of CRLF locations within the study area,
- photographs of the reconnaissance sites including a map of photo locations,
- GIS map of potential CRLF habitat,
- summaries of site habitat assessments, and
- supporting data in Excel spreadsheet and GIS layers, as appropriate.

The Districts will consult with USFWS to determine if additional data gathering is needed and to discuss the potential for Project activities to affect CRLF.

3.3.8 ESA-Listed Amphibians – California Tiger Salamander Study (Study Plan TR-8)

California tiger salamander (CTS; *Ambystoma californiense)* (Central Valley population) is listed as threatened under the federal ESA and as threatened under the CESA. The specific objectives of this study are to:

- identify and map known occurrences of CTS and determine, if appropriate, the closest known breeding locality,
- evaluate the likelihood that CTS currently exist in the study area using habitat assessments and historical records,
- compile incidental observations of CTS from other relicensing studies, and
- provide information that can be used to develop a draft Biological Assessment and support a Biological Opinion.

The Districts will prepare a report that includes: (1) Study Goals, (2) Methods, (3) Results, (4) Discussion, and (5) Conclusions. Confidential information will not be included in the report, but will be provided to appropriate resource agencies. The report will be submitted to USFWS, with separate submittals to BLM for any site assessments that take place on BLM lands. The report will include the following:

- copies of data sheets,
- copies of field notes,
- GPS data for all visited sites,
- list of known occurrences of CTS locations within the study area,
- photographs of the visited sites including a map of photo locations,
- GIS map of potential CTS habitat and locations of visited sites,
- summaries of site habitat assessments, and
- supporting data in Excel spreadsheet and GIS layers, as appropriate.

The Districts will consult with USFWS to determine if additional data gathering is needed and to discuss the potential Project effects on CTS.

In addition to the reports described above, the study results will be displayed in GIS maps and files that show locations of field site visits, habitat potentially suitable for CTS, and known CTS locations. Incidental observations of amphibians, turtles, and reptiles will also be described.

3.3.9 Special-Status Wildlife – Bats Study (TR-9)

The goal of this study is to identify Project O&M and/or recreation activities that may adversely affect special-status bat species. The criteria to determine a Project effect includes both of the following:

- a special-status bat species is found to occur (more than incidentally) within the Project Boundary, and

- a specific Project O&M or recreation activity has a reasonable possibility of having an adverse effect on the special-status bat species found.

The Districts will prepare a report that includes: (1) Study Goals, (2) Study Methods, (3) Results, (4) Discussion, and (5) Conclusions.

3.4 Water and Aquatic Resources

3.4.1 Water Quality Assessment (Study Plan W&AR-1)

This study investigates the potential Project effects to water quality. The goal of this study is to characterize existing water quality conditions in Don Pedro Reservoir and the lower Tuolumne River as measured at the Project discharge points.

During the low flow season, water quality samples will be collected upstream, downstream and within the Project and analyzed for general water quality, nutrients, metals, chlorpyrifos, diazinon, and the Group A Pesticides—aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor epoxide, hexachlorocyclohexanes (including lindane), endosulfan, and toxaphene. Samples collected adjacent to recreation areas will be analyzed for bacteria and total petroleum hydrocarbons.

Analytical results will then be used to address the following:

- 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 Water Quality Control Plan for the Sacramento River and San Joaquin River Basins, fourth edition,
- effects of the Project on compliance with the SWRCB's Clean Water Act (CWA) Section 303(d) List of Total Maximum Daily Load (TMDL) Priority Schedule, and
- water temperatures downstream of the Don Pedro Project.

Water temperatures in the lower Tuolumne River are the subject of a study required by FERC in its July 2009 Order. The Districts' study plan for the conduct of this study was approved by FERC in May 2010 and the study was completed and filed with FERC in March 2011. The study concluded that the existing HEC-5Q model for the lower Tuolumne River should be recalibrated using all available water temperature data. The Districts are planning to perform this recalibration. To improve this model, the Districts are also planning to collect water temperature data just above La Grange Dam.

The Districts plan to prepare an Excel table that will include results for each parameter for each of the seasons collected, along with sample-specific uncertainty, and sorted by sampling location. The table will be provided on a compact disc (CD) and appended to reports.

3.4.2 Project Operations/Water Balance Model (Study Plan W&AR-2)

This study does not directly address any specific resource issues, but provides a tool for examining water quantity, allocation, and distribution under various potential operational scenarios that may inform development of license requirements. The study goal is to develop a Project operations and water balance model that can be used by all RPs during the relicensing to simulate current and potential future operations of the Project. The objective of the study is to develop a model that is reasonably reliable for the purposes of relicensing. The geographic scope of the model will extend from CCSF's operations at their upstream Hetch Hetchy system (represented in aggregate) to the Tuolumne River at Modesto gage at RM 10.

Study objectives include developing a model that simulates current Project water management for a period of analysis that covers an adequate range of historical hydrologic conditions. The Project operations model will also simulate Project flood control operations, seasonal water supply management, reservoir levels for recreation, reservoir releases, and hydropower generation. Objectives also include:

- reproducing observed reservoir levels, reservoir releases, and hydropower generation over a range of hydrologic conditions for the purpose of model calibration,
- providing streamflow, reservoir levels, and diversion flow output to inform other studies, analyses, and models, and
- allowing simulation of changes in Project operations to identify effects on reservoir levels, reservoir releases, water supply, hydropower generation, and downstream flows.

RPs will be given a CD/DVD with an executable version of the model, a Model Development Report that describes all model input and logic including water priorities, and the Districts' Model Validation Report. The Districts will hold a series of workshops with interested RPs to review the model.

3.4.3 Reservoir Temperature Model (Study Plan W&AR-3)

Water temperatures in Don Pedro Reservoir affect water temperatures in reaches of the Tuolumne River downstream of Don Pedro Dam. The reservoir temperature model will simulate the dynamics of the water temperature regime in the Don Pedro reservoir and characterize the seasonal cold water storage volume that exists there. The Districts have chosen a three-dimensional (3-D) model for simulating Don Pedro Reservoir temperatures because of the complexity of the reservoir, the existence of the old Don Pedro Dam, and the importance of this issue. The 3-D model will:

- accurately reproduce observed reservoir temperatures, within acceptable calibration standards over a range of hydrologic conditions,
- simulate reservoir temperatures under alternative Project operating regimes,
- incorporate varying flow and meteorological conditions, and
- provide output that can inform other studies, analyses, and models.

In addition to the model itself, the Districts will prepare a report which will document the mathematical modeling, model calibration/verification, and model predictions. The Districts will hold a series of workshops to review the model development. The Districts will also provide training for RPs interested in using the model.

3.4.4 Spawning Gravel Study (Study Plan W&AR-4)

The spawning gravel study will examine gravel availability and spawning utilization as a means of determining the current spawning capacity for Chinook salmon and *O. mykiss* in the Tuolumne River. Specific information obtained by this study will update information from prior studies in order to:

- characterize the current area, distribution, and use of spawning riffles in the lower Tuolumne River, and
- provide estimates of maximum spawning run sizes that can be supported by the spawning habitat available.

In addition to GIS-based maps of spawning gravel areas, the Districts will prepare a report, which will document the methodology and results of the study.

3.4.5 Salmonid Population Information Integration and Synthesis Study (Study Plan W&AR-5)

The goal of this study is to summarize relevant available information regarding in-river and out-of-basin factors affecting Chinook salmon and *O. mykiss* production in the Tuolumne River. Study approach includes:

- collect and summarize available existing data on Chinook salmon and *O. mykiss* to characterize the Project operations and issues affecting salmonid populations, and
- develop hypotheses to understand potential impacts of one or more contributing factors affecting salmonid populations.

Specific information from this study will also be used in the development of conceptual and quantitative population models as part of interrelated relicensing studies, including the *Tuolumne River Chinook Salmon Population Model* (Study Plan W&AR-6) and the *Oncorhynchus mykiss Population Study* (Study Plan W&AR-10). The Districts will prepare a report which will document the methodology and results of the study.

3.4.6 Tuolumne River Chinook Salmon Population Model (Study Plan W&AR-6)

The Chinook salmon population model will examine the relative influences of various factors on the life-stage specific production of Chinook salmon in the Tuolumne River to identify critical life-stages that may represent a life-history "bottleneck" and to compare relative changes in population size between alternative management scenarios. Specific information obtained by this study will be used to assess the extent to which the abundance of the Chinook salmon populations in the Tuolumne River may be affected by in-river factors.

The Tuolumne River Chinook salmon population modeling study will rely upon existing literature and information, including previously conducted Tuolumne River studies, as well as interrelated relicensing studies in the development of both conceptual and quantitative population models to examine the relative importance of in-river factors affecting Chinook salmon production. In addition to the completed model, the Districts will prepare a report which will document the methodology and results of the study.

3.4.7 Predation Study (Study Plan W&AR-7)

The predation study will provide information to increase understanding of the current effects of predation on rearing and outmigrating juvenile Chinook salmon and *O. mykiss* in the lower Tuolumne River. Specific information obtained by this study will update and supplement information from prior studies in order to:

- estimate relative predator abundance of in-channel habitats used by predator species,
- estimate predation rate from previous studies, and
- determine relative habitat use by juvenile Chinook salmon and predator species at typical flows encountered during the juvenile salmonid outmigration period.

The predation study will update previous studies by examining habitat-specific predator density, predator distribution in response to river flow, and predation rate to estimate the effects of predation on survival of juvenile Chinook salmon and *O. mykiss* in the lower Tuolumne River.

3.4.8 Salmonid Redd Mapping Study (Study Plan W&AR-8)

The salmonid redd mapping study will document the spatial distribution of Chinook salmon and *O. mykiss* redds and redd superimposition as a means of quantifying the current spawning capacity and redd/recruit relationships of the Tuolumne River. Specific information obtained by this study will:

- identify locations of Chinook salmon and *O. mykiss* spawning redds,
- document whether salmon production is limited by redd superimposition at current spawning population levels, and
- document locations and characteristics of *O. mykiss* redds.

The salmonid redd mapping study will examine existing redd count data to determine Chinook salmon and *O. mykiss* redd distribution patterns and document the occurrence of redd superimposition.

3.4.9 Chinook Salmon Fry Study (Study Plan W&AR-9)

The Chinook salmon fry study will examine the influence of flow modifications during the early stages of fry rearing on emigration from the Tuolumne River. Indications that fry survival to emigration in the Tuolumne River is low are based on abundance of fry estimated from rotary screw trap recoveries during most water year types. Specific information obtained by this study will update information from prior studies in order to evaluate:

- opportunity to induce fry emigration by altering flows,
- potential benefits and costs of inducing fry to emigrate early in the rearing period, and
- condition of Chinook salmon fry relative to emigration timing and rearing location within the Tuolumne River.

3.4.10 *Oncorhynchus mykiss* Population Study (Study Plan W&AR-10)

The *O. mykiss* population study will examine the relative influences of various factors on the production of in-river life stages of *O. mykiss* in the Tuolumne River to identify critical life-stages that may represent a life-history "bottleneck" and to compare relative changes in the population between alternative management scenarios. Specific information obtained by this study will be used to assess the extent to which the abundance of the *O. mykiss* population in the Tuolumne River is related to in-river conditions.

The *O. mykiss* population study will rely upon existing literature and information, including previously conducted Tuolumne River studies, as well as interrelated relicensing studies in the development of both conceptual and possibly quantitative population models to examine the relative importance of factors affecting *O. mykiss* production and over-summering population levels.

Information from previously conducted studies, as well as the concurrent *Salmonid Population Information Integration and Synthesis Study* (Study Plan W&AR-5), will provide input to this study. Using this information, conceptual models will be developed as narrative and graphical descriptions of the potential density-dependent and density-independent factors affecting each in-river life-stage of *O. mykiss* in the Tuolumne River. In addition to the completed model, the Districts will prepare a report, which will document the methodology and results of the study.

3.4.11 Chinook Salmon Otolith Study Plan (Study Plan W&AR-11)

This study will examine evidence of the geographic origin and early life-history of Tuolumne River Chinook salmon spawners as a means of comparing the relative contribution of fry and smolt life-stages to subsequent escapement and any associations with flow or antecedent hydrology. Study objectives include:

- determining whether otolith micro-structural growth patterns or micro-chemistry allow the discrimination of growth and residence of juvenile salmon in the Sacramento-San Joaquin River Delta (Delta) and Estuary from growth in the Tuolumne River and floodplain environments, and
- determining whether otolith micro-structural growth patterns or micro-chemistry allow the discrimination of growth and residence of juvenile salmon originating from hatcheries and from riverine environments of the Central Valley drainage upstream of the Delta separate from growth in the Tuolumne River.

The study will rely upon the existing inventory of fall-run Chinook salmon otoliths routinely collected by CDFG, as well as other available sources, to conduct a laboratory study of otolith micro-structure and micro-chemistry to examine salmon origin (i.e., wild vs. hatchery) as well as rearing habitat use (e.g., riverine, floodplain, Delta) and to determine whether fry and smolt contributions to adult escapement vary with winter and spring flow magnitude and timing.

3.4.12 *Oncorhynchus mykiss* Habitat Assessment Study (Study Plan W&AR-12)

The primary goal of this study is to provide information on habitat use, quality, and availability in the lower Tuolumne River to inform the evaluation of potential Project effects on the use, quantity, and quality of habitat available for juvenile *O. mykiss*.

The Districts will prepare a report that includes the following sections: (1) Study Goals and Objectives, (2) Methods, (3) Results, (4) Discussion, and (5) Conclusions. The report will also contain GIS maps of sampled areas, organized and labeled photos of select habitat, and relevant summary tables and graphs. The reported data will be organized by reach site to allow for a spatial presentation of the findings.

3.4.13 Fish Assemblage and Population Between Don Pedro Dam and La Grange Dam Study (Study Plan W&AR-13)

The goal of the study is to characterize the fish assemblage and populations between Don Pedro Dam and La Grange Diversion Dam. The objective of the study is to characterize fish species composition, relative abundance (e.g., catch per unit effort [CPUE]), and fish size and condition factor between Don Pedro Dam and La Grange Diversion Dam.

3.4.14 Temperature Criteria Assessment (Chinook and *Oncorhynchus mykiss*) Study (Study Plan W&AR-14)

The investigation of water temperature-related influences on Chinook salmon and *O. mykiss* will identify and summarize the available methods, literature, and site-specific data available to examine water temperatures and their potential effects on various stages of Chinook salmon and *O. mykiss* life history and ecology including:

- adult upstream migration,
- adult pre-spawn mortality and egg retention,
- adult spawning and embryo incubation,
- juvenile rearing and growth,
- juvenile outmigration, and
- smoltification and smolt outmigration.

Specific study objectives include the following:

- compile available information on life stage-specific water temperature parameters (i.e., water temperatures at which specific effects on a fish population may occur),
- compile and summarize life stage-specific fisheries population parameters (i.e., specific water temperature-related effects),

- evaluate the potential for water temperatures to affect predation risk by identifying water temperature parameters that affect predatory behavior identifying water temperature parameters that affect predator avoidance behavior, and
- evaluate the historical exceedance of specific water temperature parameters.

To account for seasonal and geographical differences and to address such effects in a comprehensive fashion, the relationship between water temperature and fisheries population will be investigated for Chinook salmon and *O. Mykiss* in the Tuolumne River by species and by life stage. Tasks in this study plan will address life stage-specific parameters for both anadromous and resident *O. mykiss* since both anadromous and resident *O. mykiss* have similar freshwater ecological requirements and utilize similar habitat types, with the possible exception of the adult life stage of resident *O. Mykiss* and smolt life stage of anadromous *O. mykiss*.

The Districts will prepare a report documenting the results of the literature reviewed, the methodology utilized to identify the relationship between water temperature and targeted populations, the methodology utilized to determine species and life stage-specific water temperature parameters, species and life stage-specific fisheries population parameters, and results of the baseline water temperature evaluation including calculation of temperature exceedance probability distributions.

3.4.15 Socioeconomics Study (Study Plan W&AR-15)

The primary goals of the proposed socioeconomics study plan are:

- to quantify the baseline economic values and socioeconomic benefits supported by the Project, and
- develop methodologies that can be used to evaluate potential socioeconomic effects with proposed changes in Project operations.

The objectives include, broadly, an evaluation of the economic and social effects of potential changes in agricultural and urban water supplies associated with changes in Project operations.

More specifically, the objectives include:

- characterizing the economy in the regions that benefit from the Project,
- determining the primary factors affecting economic activity in each of the regions that benefit from the Project,
- quantifying the economic value generated by Project water supplies,
- identifying the role of the Project in the performance of the regional economies that benefit from the Project, and
- estimating the socioeconomic impacts likely to result from changes in Project operations.

CCSF and its Bay Area wholesale water customers benefit from CCSF's water storage privilege in Don Pedro Reservoir. CCSF and its Bay Area customers may be significantly impacted by potential reductions in water supply that could result from relicensing of the Project. CCSF has indicated to the Districts that it will be conducting an independent assessment of socioeconomic impacts to the City and County of San Francisco and its Bay Area wholesale water customers and will provide this assessment to the Districts and FERC.

3.5 List of Appendices

The following appendices are located at the end of this PSP:

- Appendix A – Cross-Reference Table of Studies and Study Requests
- Appendix B – Clean Versions of Districts' 30 Proposed Study Plans
- Appendix C – Redlined Versions of Districts' 10 Proposed Study Plans that were in the PAD and which the Districts revised for inclusion in this PSP, excluding changes to footers and study numbers, as well as minor typographic corrections.

4.0 DISTRICTS' REPLY TO STUDY REQUESTS THAT WERE NOT ADOPTED

This section provides the Districts' reply to study requests the Districts believe do not meet the seven study plan criteria under § 5.9(b) of FERC's ILP regulations or are inconsistent with FERC policy and court precedents related to the FPA.

A total of 138 individual studies were requested by 27 RPs (Table 2.0-1). Many of these study requests were similar in purpose and scope. Under the governing regulations for the ILP, a study request must meet each of seven criteria provided in § 5.9(b) of FERC's regulations. While many study requests made considerable effort to address the ILP's seven criteria, there were also many study requests which made little or no effort to show that the request met each of the study criteria.

The Districts undertook considerable effort to identify and review each study request regardless of whether the request made a reasonable attempt to demonstrate consistency with FERC's criteria. While the Districts did not adopt study requests that made no effort to address the ILP's seven study criteria, the Districts did attempt to incorporate many of these same requests into study plans if a similar request was submitted by a party that did address the criteria (see Table 3.0-1).

In general, reasons for not adopting a specific study request fell into one or more of the following areas:

Studies of pre-project conditions. FERC and the reviewing courts have held that existing conditions are the proper baseline in the context of relicensing. Trying to establish what resource conditions were, or might have been, 50 or more years ago is unlikely to be accurate or defensible. Additionally, attempting to predict what conditions would be today if the Project had not been built provides equally uncertain results. Hence, existing conditions are the baseline for comparison under the FPA.

Study goals and/or objectives not described or resource agency management goals not provided (5.9(b)(1)(2)). FERC's regulations require that study requestors provide a description of the goals of the study and, if the study is requested by a state or federal agency, the relevant resource agency management goals.

Lack of connection between Project operations and an effect on a resource (5.9(b)(5)). Under FERC policy and regulations, a study request must demonstrate a reasonable connection between Project operations and an actual effect on the resource to be studied. This "nexus" between the Project's operation and a resource impact must not amount to mere speculation, but have a basis in fact and/or be informed by professional judgment.

There is no evidence of a problem and/or the study request is an attempt to search for the existence of a problem or nexus. Similar to the rationale described above, the study request should not be for a study to determine if a Project effect, or nexus, might exist. If the study request is an attempt to search for a Project effect, then the Districts believe it does not meet the ILP criteria for a study request. In the City of Centralia, Washington vs. FERC (D.C. Circuit Court of Appeals, June 2000), the Court found that a license applicant could be required by FERC "to conduct a study when there is some evidence of a problem and a study is necessary to determine the extent of the harm." The Court also held that an applicant does not have "a duty to determine if a problem exists," and that it is not enough to speculate that a problem may exist or that the "evidence" of a problem is based on a "prediction based on opinions."

Study request constitutes basic research and/or is not likely to inform the development of license requirements (5.9(b)(5)). FERC regulations indicate that a study request must specify how the study will inform the development of license requirements. It is not the purpose of relicensing to begin or support programs of multi-year research at an applicant's expense, and studies should recognize the timeframe available under the ILP. A study request must show how the results of the study will provide information relevant to evaluating Project impacts and not just contribute to general knowledge of a resource.

Study request does not propose a specific methodology, proposes a methodology that is untried or uncertain, proposes a methodology that will not meet the stated objective, or proposes a methodology that will not yield the intended results (5.9(b)(6)). A study request should identify a specific methodology for performing the requested work. If such methodology is untried, or is unlikely to obtain the information needed, then the study request may not be adopted.

4.1 Study Requests Where Minor Differences Remain

Studies requested by RPs are summarized in Table 2.0-1 and draft study plans provided in the PSP are listed in Table 3.0-1. The Districts acknowledge that the draft study plans prepared to address the study requests made by RPs may not contain every aspect of the study request. For example, several requests for a Project operations model specified use of HEC-ResSim. The Districts have agreed to prepare a Project operations model, but have not adopted use of HEC-ResSim. However, the Districts' model will accomplish the same goal and be user-friendly. Study requests where the majority of the study request has been adopted, but minor differences remain, are considered study requests adopted, with differences to be discussed over the next 90 days, as provided in the ILP.

4.2 Study Requests Not Adopted by the Districts Because Study Criteria Were Not Addressed

As mentioned previously, numerous requests for studies were received by the Districts which made no attempt to address the seven study criteria required by the ILP. All study requests that did not attempt to address the ILP study criteria were not adopted by the Districts because they were deemed to not address the FERC criteria. However, the Districts reviewed all of these requests and many of them have been incorporated into studies being proposed by the Districts.

Table 3.0-1 provides a cross-referenced list of study requests and study requests adopted by the Districts.

4.3 Study Requests Not Adopted by the Districts Which Did Attempt to Address the ILP Study Criteria

A number of RPs submitted study requests that made a good faith effort to address the seven ILP criteria, but which the Districts believe are not appropriate for purposes of relicensing for one or more of the reasons identified in Section 4.0 above. Each of the requests not adopted are discussed in the following sections.

4.3.1 Federal Agencies

4.3.1.1 National Marine Fisheries Service (NMFS)

- *NMFS-01: Inter-relationship of the Effects of the Project with those of the La Grange Complex on Tuolumne River Anadromous Fishes*

This study request was not adopted by the Districts because La Grange Dam is not a part of the Don Pedro Project license. Evaluating the effects of the non-jurisdictional La Grange Dam on resources does not meet ILP Criteria #5 in that the study request does not propose a study to investigate the effects of the Project's operations on resources, nor does it demonstrate a nexus between the Don Pedro Project and the specific resource to be studied (anadromous fish). Therefore, this study would not inform the development of license requirements.

La Grange Dam and its related facilities existed and were completely functional long before the Don Pedro Project was built. The fact that the storage of water in Don Pedro Reservoir benefits the Districts' irrigators and municipal and industrial water users does not make La Grange Dam or any other part of the Districts' water delivery systems subject to FERC's jurisdiction.

The Districts will provide relevant information on La Grange Dam to promote efficient Endangered Species Act Section 7 consultation to the extent this information is needed for such purposes. While Section 7 consultation may require FERC to consider the effects of non-Project facilities or activities on listed species, La Grange Dam is a private facility and is not the subject of the formal action being undertaken by FERC. The "resource" to be examined relative to the action being reviewed by FERC is anadromous fish, not La Grange Dam.

- *NMFS-03: Effects of the Project and Related Activities on Fish Passage for Anadromous Fishes*

The Districts have not adopted this study request because NMFS has not provided any evidence that anadromous fish occur upstream of La Grange Dam and below Don Pedro Dam. Therefore, the Project is not preventing the upstream migration of anadromous fish. No anadromous fish are able to migrate beyond the tailwater of La Grange Dam. Anadromous fish have not occurred above La Grange Dam for more than 110 years. While CDFG has planted salmon in Don Pedro Reservoir for recreation purposes, CDFG had no intent that these fish would be anadromous.

Therefore, the Don Pedro Project has no effect on the anadromous fish resource because no anadromous fish are reaching the Don Pedro Dam. This study also would not inform license requirements because lack of fish passage at Don Pedro is not affecting the anadromous fish resource.

To the extent that NMFS-03 requests studies of the effects of releases occurring at various facilities located at La Grange Dam (powerhouse, tailrace, canal overflows, spillway), the Districts have not adopted these study requests because these do not constitute an effect of Don Pedro Project operations on the resource to be studied.

Request Element No. 4 and No. 5 of this study request involve proposed studies of fish barriers on the Tuolumne River upstream of the Project, including the conduct of studies to determine potential fish migration impediments on the upper Tuolumne River. The Don Pedro Project does not affect anadromous fish habitat conditions upstream of the Project. Determining if suitable spawning, rearing, juvenile, and adult habitat conditions occur in the watershed upstream of the Project would appropriately be the responsibility of the fish resource managers.

- *NMFS-04: Effects of Project and Related Facilities on Hydrology for Anadromous Fish: Magnitude, Timing, Duration, and Rate of Change*

While much of the information requested by NMFS-04 will be available as outputs from the Project Operations Model, Request Element No. 5 having to do with river accretions and depletions is adopted only in part by the Districts. The Districts will estimate accretion/depletion flows occurring between La Grange Dam to Roberts Ferry Bridge as necessary to improve the calibration of the Project Operations Model. The Districts will undertake three measurements of these accretion/depletion flows to represent annual accretion/depletions (May-September, October-December, January-April).

Regarding Request Element No. 6 (evaluation of the potential to increase lower Tuolumne River flood capacity), NMFS is requesting that the Districts consider increasing the magnitude of peak flows above the current flood control protection flow established by the ACOE. As part of the 1996 Settlement Agreement, the Districts had previously discussed possible changes in the Project flood control manual with the ACOE. The ACOE was not receptive to this request and there is no reason to believe that ACOE has changed its thinking on this matter. Therefore, this request is inconsistent with agency management goals established for flood protection on the river. Neither the Districts nor FERC would be able to unilaterally adjust this flood protection flow; therefore, this study would not inform future license conditions.

- *NMFS-05: Effects of Project and Related Facilities and Operations on Fluvial Processes and Channel Morphology for Anadromous Fishes*

The Districts are not adopting this study request because much of the information being requested (Element Nos. 1, 3, 5, 6, and 7) has previously been developed and is available in the Tuolumne River Restoration Plan (McBain & Trush 2000), the subsequent McBain & Trush 2004 Coarse Sediment Management Plan, and through the CALFED-funded Fine Sediment Management Project and related investigations of sediment sources from Gasburg and Dominici creeks. NMFS provides no explanation of why the existing information is not adequate, nor why specific additional information is needed (ILP Criteria #4).

The Districts are proposing to conduct a study related to quantifying in-channel structural complexity for *O. mykiss* in the lower Tuolumne River (NMFS Element No. 2), a study of spawning gravels in the lower Tuolumne River (NMFS Element No. 4), and a synthesis of available data to assess Project effects on anadromous fish and their habitats (see Study Plan Nos. W&AR-4, W&AR-5, and W&AR-12).

- *NMFS-06: Effects of Project and Related Facilities and Operations on Water Temperature for Anadromous Fish*

The Districts are not adopting this study request in full, but are in part. The Districts are not adopting NMFS' request to institute new minimum flows because this is not a study request. However, the Districts have adopted the NMFS request for additional water temperature monitoring and modeling below Don Pedro Dam (see Study Plan No. W&AR-3).

- *NMFS-07: Effects of the Project and Related Facilities and Operations on Upper Tuolumne River Habitats for Anadromous Fishes*

The Districts have not adopted any of the requested elements of this study as they all relate to obtaining information about anadromous fish habitats not affected by the Don Pedro Project. This request does not meet ILP Criteria #5 because NMFS provides no evidence that the Project affects habitat above the Project Boundary. NMFS requests stream surveys of North Fork, Middle Fork, South Fork, Cherry Creek, and the Clavey River, none of which are affected by Project operations. Although the Project can not physically affect habitat upstream of Don Pedro reservoir, NMFS claims that the relationship to Project effects is that the Don Pedro Dam forms a barrier to anadromous fish migration. However, since there are no anadromous fish below Don Pedro Dam, the Project is not acting as a barrier to anadromous fish.

- *NMFS-09: Effects of the Project and Related Activities on the Losses of Marine-Derived Nutrients in the Tuolumne River*

This study request is intended to establish pre-project conditions related to the delivery of marine-derived nutrients to the upper Tuolumne River. NMFS states that Project effect on the resource is that passage of salmon to habitats upstream is impeded by the Project. This is not a Project effect in that blockage to upriver habitats first occurred with the Wheaton Dam in 1873 and La Grange Dam in 1893, well over 100 years ago. Since there are no anadromous fish below Don Pedro Dam, the Project is not acting as a barrier to anadromous fish.

4.3.1.2 U.S. Fish and Wildlife Service

- *USFWS-09 (FWS-1): Instream Flow Study*

This study requests that the Districts undertake an instream flow study which examines the duration and frequency of floodplain inundation and related fry and juvenile Chinook salmon and *O. mykiss* habitat. USFWS recommends that current flow regimes be compared to pre-project conditions. The Districts have not adopted this study. As noted by the USFWS, the Districts are currently conducting an instream flow study on the lower Tuolumne River that includes an assessment of floodplain habitat. USFWS is raising issues that it previously raised during the current IFIM study plan review process. These comments were fully considered and FERC issued its approved study plan in May 2010. The Districts believe the information that will be provided by the ongoing IFIM study will address the information needs raised by the USFWS. The ongoing IFIM study will be completed in early 2012. The USFWS study also requests that current river conditions be compared to pre-project conditions. The Districts believe that this will not serve to inform the development of license requirements because there is no reliable data available to describe salmon or *O. mykiss* use of the Tuolumne River floodplain 50, 75, or 100 years ago. FERC has consistently held that use of pre-project conditions as some sort of preferred benchmark is inconsistent with its regulatory requirements.

■ *USFWS-10 (FWS-2): Age and Growth Study of O. mykiss in the Tuolumne River*

This study requests that the Districts collect *O. mykiss* from the Tuolumne River above and below La Grange Dam by intensive capture methods, estimate age structure and growth, and then compare these "populations" to evaluate any differences "that may be caused by direct, indirect, and cumulative effects from the Don Pedro Dam" and to provide "necessary information to evaluate Project direct effects on growth and population dynamics." The Districts are not adopting this study request. It is unclear how this information will be used to inform license requirements. It is also unclear how all factors affecting population dynamics (flow, habitat, food abundance, temperature, competition, predator/prey relationships, and disease) will be parsed out and what percent of each of these factors might be assigned to a Project effect. Furthermore, there is no evidence to suggest that *O. mykiss* populations in the lower Tuolumne River are experiencing growth problems or food abundance issues. This study is more aptly described as a research program or a study to determine if there is a nexus or a problem. Studies that are no more than a search for a possible nexus do not meet the requirements that a nexus be demonstrated to exist.

■ USFWS-11 (FWS-3): Chinook Salmon Egg Viability Study

This study request is intended to determine if Chinook salmon egg survival varies longitudinally along the lower Tuolumne River, as well as evaluating hyporheic temperature, dissolved oxygen, and gravel permeability differences from site to site. The Districts have not adopted this specific study request, although much of the information requested will be developed by the instream water temperature model that will be recalibrated by the Districts. Egg survival to emergence has been extensively studied (TID/MID 1992; Stillwater Sciences 2007) and incubation temperature criteria are well established in the literature. There is no explanation by USFWS why existing information is not adequate to address this request (ILP Criteria #4).

■ *USFWS-13 (FWS-5): Genetics of Chinook Salmon in the Upper Tuolumne River*

This study request is intended to determine the genetic composition of Chinook salmon (and apparently *O. mykiss*, although this is not clear[5]) in the upper Tuolumne River watershed upstream of the Project. This study was not adopted by the Districts. The genetics of Chinook salmon planted in the Don Pedro Reservoir are a function of CDFG hatchery operations from which the source population of any continued plantings is derived. This is unrelated to any Project operations. This study would not inform the development of license requirements as FERC has no authority to control the activities of CDFG's genetic management program at its hatchery.

4.3.1.3 U.S. Bureau of Land Management

■ *BLM-10: CESA-Listed Wildlife – Bald Eagle*

This study requests that the Districts provide general information concerning bald eagles associated with Project facilities. The Districts have not adopted this study. BLM provides no data, nor makes any inference, to an actual Project effect on the bald eagle resource. It simply requests information. This does not meet ILP Criteria #5 because there is no evidence or no showing that the Project is harming bald eagles.

4.3.2 State Resource Agencies

4.3.2.1 California Department of Fish and Game

■ *CDFG-03: Reservoir Water Temperature Management Feasibility*

CDFG's goal for this study is to "evaluate the feasibility of engineering alternatives for water temperature management and the selective withdrawal of cold water from Don Pedro Reservoir." This study has not been adopted by the Districts. The existing Don Pedro system of outlet works delivers water from the coldwater pool over a wide range of flows and water levels. There is no evidence to suggest that the existing facilities are not completely capable of meeting temperature goals of fishery managers in the lower Tuolumne River. Therefore, the existing facilities should be capable of addressing issues that may arise related to downstream flows and temperatures. CDFG's study is a request to evaluate a protection, mitigation and enhancement (PM&E) measure, the need for which has not been shown.

■ *CDFG-04: Instream Flow Study; Modification of Ongoing Study*

CDFG requests modifications to the ongoing Instream Flow Incremental Methodology (IFIM) study ordered by FERC in its July 2009 order. The Districts have not adopted these modifications. All parties had an opportunity to comment on the IFIM draft study plan when it was issued September 3, 2009. Comments were considered and incorporated where deemed consistent with the FERC order and appropriate study methods. FERC considered all comments

[5] For example, under Section 7.4, Study Methods, Task 1 is labeled "Adult *O. mykiss* migrant monitoring….", but the task describes adult and sub-adult Chinook salmon sampling.

and approved the study plan, with modifications. The Districts see no need to reinitiate this process at this time. The ongoing IFIM study is due to be completed in April 2012, subject to available study flows. The Districts propose to include the IFIM study in its Initial Study Report (ISR) to be filed with FERC in January 2013. IF CDFG believes that additional information is needed at that time, a study modification can be requested within the parameters of the ILP. CDFG offers no explanation why the ongoing IFIM study will not meet the goals of the CDFG-requested study.

- *CDFG-05: Bioenergetics Study*

CDFG states that the goal of this study is to analyze the effects of the Don Pedro Project on water temperature and food in the lower Tuolumne River, and, relatedly, to assess impacts on salmonid growth and habitat. The Districts have not adopted the specific study methodology – a bioenergetics model – proposed by CDFG. The Districts are proposing detailed studies to develop and calibrate both reservoir and river temperature models. The Districts are also proposing to conduct a synthesis study concerning existing information on Tuolumne River salmon, such as prior multi-year evaluations on juvenile salmon growth (Study Plan No. W&AR-9). The Districts' proposed studies will address the overall goals of the CDFG study request at considerably less cost. CDFG requests that the proposed bioenergetics model predict growth of salmonids for unimpaired flows and temperature regimes. The Districts believe that trying to predict salmonid growth rates under such conditions is an attempt to recreate pre-project conditions, would be highly speculative, and would not inform license requirements. CDFG cites an abundance of existing data sources, but does not indicate that any of these sources support a conclusion that salmonids in the lower Tuolumne River have impaired growth rates, or that macroinvertebrate production in the lower Tuolumne River is otherwise impaired. ILP Criteria #5 requires that there must be some evidence of a Project effect on a resource to justify such a study; otherwise, the Districts would be required to study every conceivable issue, whether or not there is evidence of a Project nexus to a resource effect.

- *CDFG-06: Chinook Health Study*

CDFG proposes that the Districts undertake a study to determine how Project operations influence health and abundance of juvenile fall-run Chinook salmon. This study request is primarily a fishery survey to determine the occurrence of fish pathogens in the Tuolumne River and the "health" of salmon smolts. Results of a similar study by the USFWS in 2001 hypothesizes that water temperature may affect the presence or toxicity of pathogens in the lower Tuolumne River. The same study determined that smolt condition in the lower Tuolumne River was as expected for a healthy Chinook population. The Districts have not adopted this study request. The Project discharges no contaminants. Temperature is not a cause of disease, but is hypothesized to contribute to the susceptibility to disease. There is no agreed-upon quantitative method to relate temperature to disease (e.g., does a temperature reduction of 2 degrees reduce disease susceptibility by 5%, 10%, or 20%?). CDFG specifically states that the role of disease and contaminants on Tuolumne River Chinook salmon are "not well understood." Therefore, the requested study is more aptly considered as a research effort and is not likely to inform license requirements (ILP Criteria #5). Also, existing studies conducted by USFWS adequately address the issue of Chinook salmon health (ILP Criteria #4).

■ *CDFG-07: Reservoir Fish Population Study*

CDFG requests that the Districts provide information concerning the relative abundance and occurrence of fishes in Don Pedro Reservoir. Don Pedro Reservoir is known to support viable populations of both coldwater and warmwater fishes. All the available information indicates that fish populations are in good condition. The reservoir fisheries under active management are stocked fisheries. The Project is a recognized destination for sport-fishing enthusiasts and fishing tournaments are held there each year. CDFG presents no information to suggest that there is any specific problem being experienced by the reservoir fish population. This is a study to search for the possibility that a nexus might exist between Project operations and reservoir fishery, which is excluded as qualifying as an ILP study because there is no known nexus between Project operations and a resource effect. If applicants were required to conduct studies that searched for the possibility of a nexus, then there would be no limit to the studies that an applicant would have to undertake. It is a specific goal of the ILP to focus efforts on narrowly focused and needed studies where there is a basis to assert that the Project is having an effect on the resource. That is not the case here; therefore, the Districts have not adopted this study. In any event, CDFG reports (pers. comm. Brian Beal of CDFG with Dave Jignor DPRA, February 2011) that CDFG plans to conduct a fish population study itself on Don Pedro Reservoir in 2011.

4.3.2.2 California State Water Resources Control Board

■ *SWRCB-02: Lower Tuolumne River Bioenergetics Study*

SWRCB requests the Districts conduct an assessment of the growth of juvenile anadromous fish using a bioenergetics method. This request appears to be very similar to CDFG-05, which was not adopted by the Districts. The Districts will summarize existing information collected over the last 20-30 years as part of its proposed *Salmonid Populations Information Integration and Synthesis Study Plan* (see Study Plan No. W&AR-5). The Districts are not adopting the bioenergetics model approach for the reasons provided in response to CDFG-05.

■ *SWRCB-03: Lower Tuolumne River Riparian Study*

This study request is intended to investigate the potential effects of Project operations on the riparian plant community of the lower Tuolumne River. The study also requests that the Districts reevaluate the current flood management operations of the Project. The Districts have not adopted these study requests. Regarding the condition of the lower Tuolumne River riparian resources, this issue has been extensively studied (McBain & Trush 2000; Stella et al. 2006 Mahoney and Rood 1998). Riparian recruitment has also been studied. Existing information is adequate to describe the resource and potential Project effects. In addition, the goal of the study request appears to be an effort to reevaluate the current flood control practices of Project operations. The Don Pedro Project is operated in accordance with the ACOE Flood Control Manual agreed to with the ACOE. The federal government contributed to the Project construction in exchange for these flood control benefits. The Districts discussed possible changes to the flood control manual with the ACOE previously. ACOE was not receptive. The Districts do not have the authority to unilaterally reconsider flood control operations.

- *SWRCB-04: Lower Tuolumne River Freshwater Mussel Survey*

The study is intended to obtain information on mussel presence in the lower Tuolumne River, as warmwater and coldwater habitat are both listed as beneficial uses of the lower Tuolumne River. The Districts have not adopted this study request. Studies conducted by the Districts in the lower Tuolumne River from 1987 to 2009 have shown that only one mussel species (occurrences of *Corbicula* spp.) is present in the lower Tuolumne River. It appears that SWRCB's concerns on mussel populations may be related to recent experience with algal toxins on the Klamath River; however, there is no similar water quality linkage on the Tuolumne River. SWRCB does not cite any evidence of a problem on the Tuolumne River; therefore, this appears to be a study to search for the possibility of a nexus. The Districts believe that existing data collected over the last 22 years provides adequate information related to mussels in the lower Tuolumne River.

- *SWRCB-06: Sediment Transport*

This study is intended to determine the amount of sediment trapped in Don Pedro Reservoir and the reduced sediment transport to the lower Tuolumne River. The Districts have not adopted this study. Determining the amount of sediment in or entering Don Pedro Reservoir will not inform the development of license requirements (ILP Criteria #5). The Districts are conducting a bathymetry survey of the reservoir to develop up-to-date elevation-capacity information. This can be compared to the original elevation-capacity data, but care must be exercised in any comparison because of the different methods used to develop each data set. In addition, existing information included in the Tuolumne River Restoration Plan (McBain and Trust 2000) provide the data requested by SWRCB; therefore, existing information is adequate to address the request and SWRCB provides no rationale why the existing information is not adequate.

- *SWRCB-08: Large Woody Debris Study*

This study is intended to estimate the amount of large woody debris (LWD) trapped by Don Pedro Reservoir for the purpose of investigating whether the lower Tuolumne River is being impacted by such loss. The Districts have not adopted this study because it would not inform the development of license requirements (ILP Criteria #5) and there is no methodology that can provide reliable estimates of LWD quantities (ILP Criteria #6). However, the Districts are proposing a study of existing habitat conditions for *O. mykiss* that will quantify structural habitat complexity due to LWD (Study Plan No. W&AR-12).

- *SWRCB-11: Sturgeon Study*

This study is intended to determine the presence of green sturgeon and white sturgeon in the lower Tuolumne River and investigate whether Project operations may be affecting these species. The Districts are not adopting this study. This is primarily a presence/absence study and the SWRCB does not offer any evidence that Project operations are affecting this species; therefore, this is a search for the possibility that a nexus might exist. No specific Project effects are identified, nor does SWRCB indicate how this study would inform the development of license requirements.

- *SWRCB-12: Lamprey Study*

This study is intended to obtain information on the presence of Pacific lamprey in the lower Tuolumne River and identify Project effects, if any. The Districts have not adopted this study. Pacific lamprey have been routinely detected since rotary screw trap operations began in 1996 (e.g., 1,952 captured in 2010) and these data will provide adequate resource information to evaluate Pacific lamprey in the Tuolumne River.

- *SWRCB-14: Lower Tuolumne River Flood Capacity*

This study request is very similar to portions of SWRCB-03 and NMFS-04, which the Districts have not adopted for the reasons discussed in those Districts' responses.

4.3.3 Other Governmental and Non-Governmental Organizations

A number of local governmental authorities and NGOs submitted comments on the PAD and requested that the Districts undertake certain investigations. However, the overwhelming majority of these requests made no attempt to address any or all of the ILP's seven study plan criteria. The Districts have not adopted study requests which made no effort to demonstrate compliance with the ILP regulations. However, many of the requests are similar to studies being proposed by the Districts and/or requests made by others which did address the seven criteria. In this way, many of these study requests are actually being addressed (see Table 3.0-1 of this PSP). Study requests of local governmental authorities or NGOs which did discuss the seven criteria, but which are not being adopted by the Districts, are presented below.

- *AR-05[6]: Socioeconomics Study*

This study request is intended to supplement the Districts' proposed socioeconomic study by requesting that specific future potential actions by the Districts and their individual water customers be considered in this study. The Districts are not adopting this request. The Districts' S*ocioeconomics Study* (Study Plan No. W&AR-15) is intended to evaluate Project effects on socioeconomic conditions; specifically, to evaluate the impact of reduced Project water being available to the Districts' customers. Reduced water supply from the Project will result in unmet demand and therefore result in socioeconomic impacts. The Districts believe this is the proper context for the estimation of such effects. There is no other water source equal in reliability and quality available to replace any lost Project water. The Districts believe that FERC's authority does not extend to the Districts' irrigators and their farm practices or crop selection as implied by the AR study request. Therefore, this request would not inform the development of license requirements. Existing information on the Districts' water management practices and the

[6] Acting collectively, this group of NGOs filed study requests. The group includes American Rivers, American Whitewater, California Sportsfishing Protection Alliance, California Trout Inc., Central Sierra Environmental Resource Center, Environmental Defense Fund, Friends of the River, Golden West Women Flyfishers, Northern California Council Federation of Fly Fishers, Merced Fly Fishing Club, Pacific Coast Federation of Fishermen's Association, Pro-Troll Fishing Products, Trout Unlimited, and Tuolumne River Trust.

availability and sustainability of groundwater supplies should be adequate to address this study request in the context of FERC relicensing.

- *AR-07: Upper Tuolumne River Anadromous Fish Habitat Recovery*

This study request is intended to provide information on salmonid habitat above La Grange, Don Pedro, and Early Intake dams and reservoirs. The Districts have not adopted this study request, except as provided in the Districts' study of the fishery between La Grange Dam and Don Pedro Dam (Study Plan No. W&AR-13). Otherwise, this study request is similar to NMFS-03 and NMFS-07, which the Districts did not adopt for the reasons provided in those responses.

- *AR-08: Upper Tuolumne River O. mykiss Genetics Evaluation*

The goal of this study request is to investigate salmonid habitat in the upper Tuolumne River above Don Pedro Reservoir. The Districts have not adopted this study. This study request does not describe a connection between Project operations and habitats upstream of the Project. This study would not inform development of license requirements. The Don Pedro Project is not currently a barrier to anadromous fish because there have not been anadromous fish present above La Grange Dam since at least 1893. In any event, it is the responsibility of the fishery managers to investigate the types of habitats available in reaches unaffected by Project operations. Further, the genetics of *O. mykiss* above and below Central Valley and Tuolumne River dams have been studied by Nielsen et al. 2005, Garza and Pearse 2008, and others.

- *AR-09: Economic Value and Activity Associated with a Restored Fishery*

This study is intended to develop estimates of economic value of increased fish populations above and below Don Pedro Reservoir. The Districts have not adopted this study request. Changes in Project operation to improve in-river salmonid habitat may or may not result in increased recreational or commercial fisheries. There are many factors which would affect region-wide fish populations and whether increased fishing would occur, and how much. Any projected increase would be purely speculative, and the proportion due to the Project would be arbitrarily assigned. In any event, it has been FERC's policy that it does not need economic value information to determine a proper balance between Project and non-Project resources. The information developed by this study request would be highly speculative and would not inform the development of license requirements.

- *AR-10: Economic Value and Activity Associated with Improved Recreation in and along the Lower Tuolumne River*

This study proposes to estimate the economic value associated with recreation on the lower Tuolumne River. The Districts are not adopting this study. The Don Pedro Project may contribute to cumulative effects on flows in the lower Tuolumne River; but effects during lower flow periods are directly related to diversions at the La Grange Dam, a non-Project facility. The Districts have proposed to evaluate the boatability of the lower Tuolumne River at current minimum flow levels for non-motorized recreation boaters to determine the lowest flow which is able to be floated. Recreational use of the lower Tuolumne River is already available for a wide range of craft. There is no evidence presented that suggests there are Project effects on such recreational activity.

- *AR-11: Economic Value and Activity Associated with Improved Ecosystem Services Associated with a Healthier Tuolumne River*

This study is proposed to estimate the economic value/cost of ecosystem services associated with modified flow regimes in the lower Tuolumne River. The Districts have not adopted this study. The information is not needed by FERC to make resource balancing decisions and therefore would not inform the development of license requirements. Attempting to assign incremental economic values to increments of river "health" is highly uncertain and lacks scientific rigor.

- *AR-13: Effects of the Project and Related Activities on Large Wood and Microhabitat Structures for Anadromous Fish*

The study intends to estimate the amount of LWD trapped by Don Pedro Reservoir and evaluate the LWD quantity, location, and microhabitats currently found along the lower Tuolumne River. This study request is similar to SWRCB-08 and NMFS-05. The Districts have not adopted this study request for the reasons indicated in these responses. However, the Districts are proposing to evaluate LWD microhabitat structures in the lower Tuolumne River as suggested by a component of AR-13 (see Study Plan No. W&AR-12).

- *AR-14: Effects of Project and Related Activities on Coarse Substrate for Anadromous Fish: Sediment Distribution, Transport, and Storage*

The study request is very similar to NMFS-05, SWRCB-06, and SWRCB-07. The Districts have not adopted these study requests for the reasons indicated in those responses. There is considerable existing information on this subject, including the McBain & Trush 2004 Coarse Sediment Management Plan. The Districts do not agree that existing information is not adequate. The Districts are also proposing to undertake a related study which will address questions related to gravel availability and spawning use (see Study Plan Nos. W&AR-4 and W&AR-8).

- *AR-15: Effects of Project and Related Activities on Recruitment of Cottonwoods and Other Native Riparian Vegetation*

This study request is intended to evaluate the potential effects of Project flow regimes on recruitment of cottonwoods and other riparian vegetation along the lower Tuolumne River. The Districts have not adopted this study. AR-15 offers no reason why existing information is not adequate for addressing this question. This topic has been thoroughly studied. Cottonwood improvements would need manipulation of the recession rate of the runoff hydrograph. Management of high flow levels at the Project is in accordance with the ACOE Flood Control Manual and ACOE approval. A previous request by the Districts that the ACOE consider modifications to the Flood Control Manual did not meet with success and is unlikely to do so now. Therefore, this study would also not inform the development of license requirements.

■ *AR-16: Don Pedro Reservoir Water Supply (Dead Storage) Management Feasibility Study*

This study request is intended to evaluate the engineering feasibility of accessing and managing the "dead storage" that exists behind the old Don Pedro Dam. The Districts have not adopted this study at this time. Such a study would involve an analysis of the hydraulic aspects of the openings in the old Don Pedro Dam and could be accomplished, if needed, using archived drawings of the old structure. However, this is a study of a PM&E measure and no evidence exists at this time to suggest the dead storage would be needed or useful.

5.0 MEETINGS AND REPORTS

This section describes the Districts' plan to hold study plan meetings during the 90-day review period for the relicensing's PSP (Section 5.1) and for making information available to RPs (Section 5.2).

5.1 Study Proposal Meetings

In accordance with Section 5.11(6)(e) of FERC's ILP regulations, the Districts will hold an Initial Proposed Study Plan (Initial PSP) Meeting. The purpose of this meeting is to clarify the intent and content of the Districts' PSP, explain any initial information gathering that needs to take place, and resolve any outstanding issues with respect to the plans. The meeting dates will be within the required 30-day ILP timeframe subsequent to filing the PSP document as scheduled:

Date:	Tuesday, August 23, 2011
Time:	9:00 am-5:30 pm
Location:	Modesto Irrigation District Offices 1231 11th Street Modesto, CA 95352
Agenda:	Water Resources, Aquatic Resources, Terrestrial Resources

Date:	Wednesday, August 24, 2011
Time:	9:00 am-5:30 pm
Location:	Modesto Irrigation District Offices 1231 11th Street Modesto, CA 95352
Agenda:	Cultural Resources, Recreation Resources

As described in Section 1.2.4, on February 28, 2010, the Districts and the RPs scheduled a series of meetings, continuing through filing of the RSP in November 2011, to develop and discuss study proposals. The meeting dates currently scheduled for the period between the Initial PSP meeting and the filing of the RSP are:

- September 14, 2011 – Cultural Resources, Recreation Resources
- September 15, 2011 – Water Resources, Aquatic Resources, Terrestrial Resources
- October 4, 2011 – Water Resources, Aquatic Resources, Terrestrial Resources
- October 5, 2011 – Cultural Resources, Recreation Resources
- November 3, 2011 – Water Resources, Aquatic Resources, Terrestrial Resources
- November 4, 2011 – Cultural Resources, Recreation Resources

The Districts will post meeting notices including location, start time, and agenda on its Relicensing Website (www.donpedro-relicensing.com) Event Calendar. All meetings will be held in conformance with the Communication Guidelines included in Section 2.3 of the Districts' PAD.

5.2 Initial and Updated Study Reports

As required by 18 CFR § 5.11(c) and (f), the Districts plan to file with FERC and distribute to RPs an Initial Study Report (ISR) within one year of the date of FERC's Study Plan Determination, and an Updated Study Report (USR) within two years of FERC's Study Plan Determination. Each report will describe the Districts' overall progress in implementing the studies, status of schedule, and a summary of data collected to date. Each report will also include a discussion of any variance from the FERC-approved study proposal and modifications to ongoing studies as well as any new studies proposed by the Districts. The Districts intend to follow guidelines provided in 18 CFR § 5.15(c) and (f) regarding holding a meeting with RPs within 15 days of filing the Initial and Updated Study Reports and filing with FERC a meeting summary within 15 days of the meeting. The Districts have proposed specific dates for the filing of its ISR (January 4, 2013) and USR (November 27, 2013).

6.0 REFERENCES

Beal, Brian. 2011. California Department of Fish and Game. Personal communication with Dave Jignor, DPRA. February 2011.

Garza, J. C. & D. E. Pearse, 2008. Population genetic structure of Oncorhynchus mykiss in the California Central Valley, Final report for California Department of Fish and Game Contract #P0485303.

Mahoney, J. M. and S. B. Rood, 1998. Streamflow requirements for cottonwood seedling recruitment-an integrative model. Wetlands 18:634-645.

McBain & Trush, 2000. Habitat Restoration Plan for the Lower Tuolumne River Corridor. Prepared for Tuolumne River Technical Advisory Committee (Don Pedro Project, FERC License No. 2299) by McBain and Trush, Arcata, CA.

McBain & Trush, 2004. Coarse sediment management plan for the lower Tuolumne River. Prepared for the Tuolumne River Technical Advisory Committee, with assistance from Stillwater http://tuolumnerivertac.com/Documents/7-204_Revised_CSMP_Report.pdf.

Nielsen, J. L., S. A. Pavey, T. Wiacck, and I. Williams, 2005. Genetics of Central Valley O. mykiss populations; drainage and watershed scale analyses. San Francisco Estuary and Watershed Science 3: Article 3, 31 pages.

Office of Historic Preservation (OHP). 1995. Archaeological Resource Management Reports (ARMR): Recommended Contents and Format. Sacramento, California. On file, Office of Historic Preservation, Sacramento, California.

Stella, J.C., J. J. Battles, B. K. Orr, and J. R. McBride, 2006. Synchrony of seed dispersal, hydrology and local climate in a semi-arid river reach in California. Ecosystems 9:1200-1214.

Stillwater Sciences. 2007. Tuolumne River Fine Sediment Management Project: Chinook Salmon Survival to Emergence Study. Prepared for California Bay Delta Authority (Agreement 2001-C208) by Stillwater Sciences, Berkeley, CA. March. http://tuolumnerivertac.com/Documents/2001-C208_Survival-to-Emergence.pdf

Stillwater Sciences. 2009. Tuolumne River Instream Flow Studies. Final Study Plan. Prepared by Stillwater Sciences, Davis, California for Turlock Irrigation District and Modesto Irrigation Districts, California.

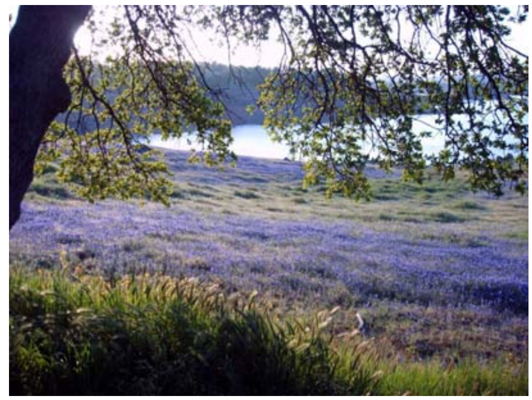
Stillwater Sciences. 2011. Tuolumne River water temperature modeling study. Final Report. Prepared by Stillwater Sciences, Berkeley, California for Turlock Irrigation District and Modesto Irrigation District, California. March 2011.

Turlock Irrigation District and Modesto Irrigation District (TID/MID). 1992. Lower Tuolumne River spawning gravel studies report. Appendix 8 *In* Report of Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 39 of the License for the Don Pedro Project, No. 2299. 8 Volumes. November.

DON PEDRO PROJECT
FERC NO. 2299

PROPOSED STUDY PLAN

APPENDICES



Prepared by:
Turlock Irrigation District
Turlock, California
and
Modesto Irrigation District
Modesto, California

July 2011

Appendix A Cross-Reference Table of Studies and Study Requests

Appendix B Clean Versions of Districts' 30 Proposed Study Plans

CR-1	Historic Properties Study
CR-2	Native American Traditional Cultural Properties Study
RR-1	Recreation Facility Condition and Public Accessibility Assessment
RR-2	Whitewater Boating Take Out Improvement Feasibility Study
RR-3	Lower Tuolumne River Boatable Flow Study
RR-4	Visual Quality Study
TR-1	Special-Status Plants Study
TR-2	ESA- and CESA-Listed Plants Study
TR-3	Wetland Habitats Associated with Don Pedro Reservoir Study
TR-4	Noxious Weed Survey
TR-5	ESA-Listed Wildlife-Valley Elderberry Longhorn Beetle Study
TR-6	Special-Status Amphibians and Aquatic Reptiles Study
TR-7	ESA-Listed Amphibians–California Red-Legged Frog Study
TR-8	ESA-Listed Amphibians-California Tiger Salamander Study
TR-9	Special-Status Wildlife-Bats Study
W&AR-1	Water Quality Assessment
W&AR-2	Project Operations/Water Balance Model
W&AR-3	Reservoir Temperature Model
W&AR-4	Spawning Gravel Study
W&AR-5	Salmonid Populations Information Integration and Synthesis Study
W&AR-6	Tuolumne River Chinook Salmon Population Model
W&AR-7	Predation Study
W&AR-8	Salmonid Redd Mapping Study
W&AR-9	Chinook Salmon Fry Study
W&AR-10	*Oncorhynchus mykiss* Population Study
W&AR-11	Chinook Salmon Otolith Study
W&AR-12	*Oncorhynchus mykiss* Habitat Assessment
W&AR-13	Fish Assemblage and Population Between Don Pedro Dam and LaGrange Dam Study
W&AR-14	Temperature Criteria Assessment (Chinook and *Oncorhynchus mykiss*)
W&AR-15	Socioeconomics Study

Appendix C Redlined Versions of Districts' 10 Proposed Study Plans

CR-1	Historic Properties Study
CR-2	Native American Traditional Cultural Properties Study
TR-1	Special-Status Plants Study
TR-2	ESA- and CESA-Listed Plants Study
TR-5	ESA-Listed Wildlife-Valley Elderberry Longhorn Beetle Study
TR-6	Special-Status Amphibians and Aquatic Reptiles Study
TR-7	ESA-Listed Amphibians–California Red-Legged Frog Study
TR-8	ESA-Listed Amphibians-California Tiger Salamander Study
TR-9	Special-Status Wildlife-Bats Study
W&AR-1	Water Quality Assessment

APPENDIX A

CROSS-REFERENCE TABLE OF STUDIES AND STUDY REQUESTS

Table A-1 Cross-reference between the Districts' assigned study number and the page number of Relicensing Participant's letter where the study request was made.

Relicensing Participants Study Request				TID & MID Assigned Study Number
Relicensing Participant	**Date of Comment Letter**	**Study Topic**	**Where requested in Comment Letter**	
Acterra	10-Jun-11	Salmonid Populations Limiting Factors Analysis	Page 2 Last Paragraph	Acterra-01
American Rivers et al [1]	10-Jun-11	Water Balance/Operations Model--Model Choice	Page 29 Section 5.0	AR-01
		Water Balance/Operations Model--Coordinate with on-going regional efforts	Page 29 Section 5.0	AR-02
		Reservoir Temperature Model	Page 29 Section 5.0	AR-03
		Lower Tuolumne River Temperature Model	Page 30 Section 5.0	AR-04
		Socioeconomics Study	Page 30 Section 5.0	AR-05
		On-going Rotary Screw Trap Monitoring	Pages 30-31 Section 5.0	AR-06
		Upper Tuolumne River Anadromous Fish Habitat Recovery	Pages 42-45	AR-07
		Upper Tuolumne River Steelhead/Rainbow Trout Genetics	Pages 46-48	AR-08
		Economic Value and Activity of Restored Fishery	Pages 49-53	AR-09
		Economic Value and Activity of Improved Recreation	Pages 54-58	AR-10
		Economic Value and Activity of Improved Ecosystem Services	Pages 59-62	AR-11
		Economic Value and Activity Associate with Modified Water Supply Allocations	Pages 63-74	AR-12
		Lower Tuolumne Large Woody Debris	Pages 75-79	AR-13
		Lower Tuolumne River Coarse Substrate for Anadromous Fish Study	Pages 80-84	AR-14
		Lower Tuolumne River Cottonwood Recruitment	Pages 85-87	AR-15
		Don Pedro Reservoir Dead Storage Management Feasibility	Pages 88-90	AR-16
		Lower Tuolumne Recreation Flow	Pages 91-95	AR-17
American Rivers et al*	10-Jun-11	Whitewater Boating Take-Out Adequacy and Feasibility	Pages 96-99	AR-18

Relicensing Participants Study Request				
Relicensing Participant	**Date of Comment Letter**	**Study Topic**	**Where requested in Comment Letter**	**TID & MID Assigned Study Number**
Bay Area Water Users	10-Jun-11	Socioeconomic Study	Page 1 Last Two Paragraphs	BAWSCA-01
Rose Beam	10-Jun-11	Dam's impacts, upper watershed to San Francisco Bay	Page 1 Second Paragraph	Beam-01
		Dam's economic impacts on fly fishing and recreation	Page 1 Third Paragraph	Beam-02
		Dam's impacts on biodiversity and health of anadromous fish	Page 1 Third Paragraph	Beam-03
		Ways MID, TID, and agricultural groups can conserve water.	Page 1 Last Paragraph	Beam-04
Lawrence Beard	10-Jun-11	Dam effects on downstream wildlife, recreation, and aesthetics	Page 1 Last Two Lines of Paragraph	Beard-01
Britton Konynenburg Partners	10-Jun-11	Long-term economic effects of water and hydroelectricity delivery reduction on MID & TID ratepayers: residents, farmers, and ranchers/	Page 2 First Bullet of Last Paragraph	BKP-01
Bureau of Land Management	10-Jun-11	Historic Properties Study Plan & Traditional Cultural Properties & Ethnographic Study Plan	Page 1 Last Paragraph	BLM-01
		Historic Properties Study Plan & Traditional Cultural Properties & Ethnographic Study Plan	Page 2 First Paragraph	BLM-02
		Recreation Use and Visitor Survey	Pages 12-17	BLM-03
		Lower Tuolumne Recreation Flow	Pages 18-22	BLM-04
		White Water Boating Take-Out Adequacy & Feasibility Study	Pages 23-26	BLM-05
		Visual Resources Assessment	Pages 24-25	BLM-06
		Recreation Facility Condition and Public Accessibility Assessment	Pages 26- 33	BLM-07
		Noxious Weeds	Pages 35-36	BLM-08
		Riparian and Wetland Habitat	Pages 39-40	BLM-09
		CESA-listed Wildlife Bald Eagle	Pages 46-47	BLM-10

Relicensing Participants Study Request				TID & MID Assigned Study Number
Relicensing Participant	**Date of Comment Letter**	**Study Topic**	**Where requested in Comment Letter**	
Bureau of Land Management	10-Jun-11	Historic Properties Study Plan & Traditional Cultural Properties & Ethnographic Study Plan	Page 4 Last Paragraph	BLM-11
		Historic Properties Study Plan	Page 6 Last Paragraph	BLM-12
		Historic Properties Study Plan	Page 9 First Paragraph	BLM-13
		Historic Properties Study Plan & Traditional Cultural Properties & Ethnographic Study Plan	Page 11 First Paragraph	BLM-14
		Traditional Cultural Properties Study Plan	Pages 23-24 Last Paragraph	BLM-15
Bureau of Reclamation	10-Jun-11	Unimpaired flow required to meet salmon doubling goal	Page 4 Second Paragraph	Reclamation-01
		Reservoir storage and purpose trade-offs	Page 4 Third and Fourth Paragraph	Reclamation-02
		Lower Tuolumne River Water Temperature Model	Page 8 First Paragraph	Reclamation-03
		Reservoir impacts to drought planning	Page 8 Fourth Paragraph	Reclamation-04
		Operations impact on Delta salinity	Page 10 First Paragraph	Reclamation-05
Jerry Cadagan	10-Jun-11	White Water Boating Take-out	Page 1 Last Three lines of (5)	Cadagan-01
City and County of San Francisco	10-Jun-11	Water Supply and Socioeconomics Impacts	Pages 6-9, Page 12 Part A	CCSF-01
		Synthesis of exigent and new information for Tuolumne River Salmonids	Pages 1-3 Exhibit A	CCSF-02
		Otolith Studies on Lower Tuolumne Salmonids	Pages1-2 Exhibit B	CCSF-03
		Lower Tuolumne Sand-Bedded Reach Productivity	Page 1 Exhibit C	CCSF-04
California Department of Fish and Game	9-Jun-11	Water Balance and Operations Model	Page 2 First Paragraph	CDFG-01
		Lower Tuolumne River Water Temperature Model	Page 11	CDFG-02
	&	Reservoir Water Temperature Management Feasibility	Page 18	CDFG-03
		Instream Flow Study	Page 24	CDFG-04
	6-Jun-11	Bioenergetics Study	Page 28	CDFG-05
		Chinook Health Study	Page 34	CDFG-06
		Reservoir Fish Population Study	Page 42	CDFG-07

Relicensing Participants Study Request				TID & MID Assigned Study Number
Relicensing Participant	**Date of Comment Letter**	**Study Topic**	**Where requested in Comment Letter**	
Clean Water Action	10-Jun-11	Impacts of diversion	Page 1 First Paragraph	CWA-01
		Impact of current rate of diversion on downstream uses on water quality	Page 1 Second Paragraph	CWA-02
		Cumulative impact of climate change	Page 1 Third Paragraph	CWA-03
Friends of the Tuolumne	7-Jun-11	Desktop analysis of natural hydrology and water availability on a weekly basis over all year types so that mitigation and enhancement measures can be better developed	Page 1 Last Sentence of Paragraph 2	FOT-01
		Study of smoltification of anadromous fish and pulse flows	Pages 1-2 First Two Sentences of Paragraph 3	FOT-02
		Impact of Old Don Pedro dam on water temperatures	Page 2 First Paragraph Under Alternatives to Physical Structures	FOT-03
		Costs and benefits of rebuilding the drinking water intake downstream	Page 2 Second Paragraph Under Alternatives to Physical Structures	FOT-04
		Analyze repair of Turlock Lake Dam to enable more storage	Page 2 Third Paragraph Under Alternatives to Physical Structures	FOT-05
		Multi-tower for water releases out of Don Pedro Reservoir Feasibility Study	Page 3 First Sentence	FOT-06
		Costs and benefits of fish passage tower	Page 3 Second Paragraph	FOT-07
		Operation impacts on Western Pond Turtles	Page 4 Second Paragraph	FOT-08
		Operation impacts on mussel populations of the Lower Tuolumne River	Page 4 First Sentence Under Mussels	FOT-09
		Lower Tuolumne River recreation/boating study	Page 6 Second Paragraph	FOT-10
		Lower Tuolumne River trout fishing study	Page 6 Third Paragraph	FOT-11
		Native and non-native bee competition	Page 6 Last Sentence	FOT-12
Karen Gardner	10-Jun-11	Impacts downstream of dam on water quality	Page 1 First Paragraph	Gardner-01
		Dam impacts on downstream salmonids	Page 1 First Paragraph	Gardner-02

Relicensing Participants Study Request				TID & MID Assigned Study Number
Relicensing Participant	**Date of Comment Letter**	**Study Topic**	**Where requested in Comment Letter**	
Bob Hackamack	6-Jun-11	Whitewater recreation needs on the Tuolumne River inlet arm of Don Pedro Reservoir	Page 1	Hackamack-01
Lower Tuolumne Farmers	9-Jun-11	Updated Operations Model	Page 3 Parts (a) and (b)	LTF-01
Blake Martin	10-Jun-11	Water saving technology MID and TID use	Page 1 First Sentence	Martin-01
City of Modesto	8-Jun-11	Effect of the Project on urban water supply	Page 2 Last Paragraph Including Points 1-9	Modesto-01
Mape's Ranch and Lyons' Investments	8-Jun-11	Effect of the Project on urban water supply	Page 2 Second Paragraph	MR&LI-01
National Marine Fisheries Service	10-Jun-11	Inter-relationship of the Effects of the Project with those of the La Grange Complex on Tuolumne River Anadromous fishes	Page 1 Section 1.0, Page 10 Section 5.9 (b):1.0	NMFS-01
		Develop Operations Model	Pages 1-4	NMFS-02
		Fish Passage for Anadromous Fish	Page 1 Paragraphs 2 and 3, Pages10-13	NMFS-03
		Effects of the Project and Related Facilities on Hydrology for Anadromous Fish	Pages 1-6	NMFS-04
		Effects of the Project and Related Facilities and Operations on Fluvial Processes and Channel Morphology for Anadromous Fish	Pages 1-6	NMFS-05
		Reservoir Temperature Model & Lower Tuolumne River Water Temperature Model	Pages 1-4, Page 7 Point 1) Under Goals and Objectives of Request	NMFS-06
		Upper Tuolumne River Habitats for Anadromous Fish	Pages 1-4	NMFS-07
		Salmon and steelhead Full Life-Cycle Population Models	Page 1, Page 4 Last Paragraph, Page 6 First Paragraph, Page 10 First Paragraph	NMFS-08
		Losses of marine derived nutrients in the Tuolumne River	Pages 1-4, Page 7 First Paragraph	NMFS-09

Relicensing Participants Study Request				
Relicensing Participant	**Date of Comment Letter**	**Study Topic**	**Where requested in Comment Letter**	**TID & MID Assigned Study Number**
National Park Service		Recreation Use and Visitor Survey	Page 6	NPS-01
		Lower Tuolumne Recreation Flow Study	Page 13	NPS-02
		White Water Boating Take-Out Adequacy and Feasibility Study	Page 18	NPS-03
Restore Hetch Hetchy	10-Jun-11	Environmental impacts associated with the Fourth Agreement's substitution for storage over natural flows	Page 23 Last Sentence	RHH-01
		Environmental impact of CCSF's upstream operations enabled by Don Pedro	Page 24 Last Sentence of First Paragraph	RHH-02
		Upstream operational criteria impacts on downstream resources	Page 27 Last Sentence of First Paragraph	RHH-03
		Study removal of Hetch Hetchy Reservoir on downstream resources	Page 27 Last Sentence Under Section B	RHH-04
		Study of Enlargement of Don Pedro Reservoir or Altering of Banking and Storage Arrangements	Page 28 Section 2	RHH-05
		Study of the Integration of Don Pedro Reservoir Operations with New Melones Reservoir Operations	Page 28 Section 3	RHH-06
		Conjunctive Use Opportunities	Page 29 Section 4	RHH-07
		Identify other points of diversion for CCSF	Page 29 Section 5	RHH-08
John Rosapepe	13-Jun-11	Effects of dams on anadromous fish populations (Chinook salmon and steelhead)	Page 1 First Paragraph	Rosapepe-01
		Effects of dams on recreational opportunities	Page 1 First Paragraph	Rosapepe-02
		Effects of dams on salmon commercial fisheries	Page 1 Second Paragraph	Rosapepe-03
		Water quality of the Lower Tuolumne River	Page 1 Third Paragraph	Rosapepe-04
		Flow study for attraction of returning and outmigrating anadromous fish	Page 1 Fifth Paragraph	Rosapepe-05
		Fish passage	Page 1 Fifth Paragraph	Rosapepe-06

Relicensing Participants Study Request				TID & MID Assigned Study Number
Relicensing Participant	**Date of Comment Letter**	**Study Topic**	**Where requested in Comment Letter**	
		Water conservation and efficiency done by TID and MID	Page 1 Last Paragraph	Rosapepe-07
State Water Resources Control Board	9-Jun-11	Fish Assemblages and Population Study between Don Pedro Dam and La Grange Dam	Page 1 Attachment A	SWRCB-01
		Lower Tuolumne River Bioenergetics	Page 1 Attachment A	SWRCB-02
		Lower Tuolumne River Riparian Study	Page 2 Attachment A	SWRCB-03
		Lower Tuolumne River Freshwater Mussel Survey	Page 2 Attachment A	SWRCB-04
		Lower Tuolumne River Predation Study	Page 3 Attachment A	SWRCB-05
		Sediment Transport	Pages 3-4 Attachment A	SWRCB-06
		Spawning Gravel Study	Page 4 Attachment A	SWRCB-07
		Large Woody Debris Study	Pages 4-5 Attachment A	SWRCB-08
		Effect of Water Temperatures and Turbidity on Predation of Juvenile Anadromous Fish in the Lower Tuolumne River	Page 5 Attachment A	SWRCB-09
		Impact of Water Levels on Recreation Uses in Don Pedro Reservoir	Pages 5-6 Attachment A	SWRCB-10
		Sturgeon Study	Page 6 Attachment A	SWRCB-11
		Pacific Lamprey Study	Pages 6-7 Attachment A	SWRCB-12
		Operations Model	Page 7 Attachment A	SWRCB-13
		Lower Tuolumne River Flood Capacity	Pages 7-8 Attachment A	SWRCB-14
		Socioeconomic Model	Page 8 Attachment A	SWRCB-15
City of Turlock	6-Jun-11	Project’s effect on municipal water quality	Page 2 Last Three Paragraphs	Turlock-01
U.S. Fish and Wildlife Service	9-Jun-11	Special Status Plants Study Plan	Page 10 Attachment 6-4	USFWS-01
		California Tiger Salamander Study Plan	Page 10 Attachment 6-5	USFWS-02
		California Red-Legged Frog Study Plan	Pages 10-11 Attachment 6-6	USFWS-03
		Valley Elderberry Longhorn Beetle Study Plan	Page 11 Attachment 6-7 Section 5.1	USFWS-04
		Valley Elderberry Longhorn Beetle Study Plan	Page 11 Attachment 6-7 Section 5.3	USFWS-05
		ESA & CESA-Listed Plants Study Plan	Page 11 Attachment 6-8 Section 2.0	USFWS-06
		ESA & CESA-Listed Plants Study Plan	Page 11 Attachment 6-8 Section 5.1	USFWS-07

Relicensing Participants Study Request				TID & MID Assigned Study Number
Relicensing Participant	**Date of Comment Letter**	**Study Topic**	**Where requested in Comment Letter**	
		ESA & CESA-Listed Plants Study Plan	Page 12 Attachment 6-8 Section 5.3	USFWS-08
		Instream Flow Study	Page 12 FWS-1, Also see Enclosure 1 Page 1	USFWS-09
		Age and Growth Study of O. mykiss in the Tuolumne River	Page 13 FWS-2, Also see Enclosure 2 Page 1	USFWS-10
		Chinook Salmon Egg Viability Study	Page 13 FWS-3, Also see Enclosure 3 Page 1	USFWS-11
		Juvenile Chinook Salmon Survival Study	Page 13 FWS-4, Also see Enclosure 4 Page 1	USFWS-12
		Genetics of Chinook Salmon in the Upper Tuolumne River	Page 13 FWS-5, Also see Enclosure 5 Page 2	USFWS-13
Western Strategic Solutions	9-Jun-11	Impacts of inconsistent and increased water flows on the restoration and management efforts of the endangered Riparian Brush Rabbit and Aleutian Cackling Goose.	Pages 1-2, Page 3 Last Sentence, Pages 5-7	WSS-01

[1] American Rivers, American Whitewater, California Sportsfishing Protection Alliance, California Trout Inc, Central Sierra Environmental Resource Center, Environmental Defense Fund, Friends of the River, Golden West Women Flyfishers, Northern California Council Federation of Fly Fishers, Merced Fly Fishing Club, Pacific Coast Federation of Fishermen's Association, Pro-Troll Fishing Products, Trout Unlimited, and Tuolumne River Trust – collectively the "Conservation Groups."

APPENDIX B

CLEAN VERSIONS OF DISTRICTS' 30 PROPOSED STUDY PLANS

STUDY PLAN CR-1

**TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT**

**DON PEDRO PROJECT
FERC NO. 2299**

Historic Properties Study Plan

July 2011

Related Study Requests: BLM-01, 02, 11, 12, 13, and 14

1.0 Project Nexus

Turlock Irrigation District's (TID) and Modesto Irrigation District's (MID) (collectively, the Districts) continued operation and maintenance (O&M) of the Don Pedro Project (Project) may affect historic properties that are listed on or eligible for listing on the National Register of Historic Places (NRHP). The effect may be direct (e.g., result of ground disturbing activities), indirect (e.g., public access to recreation areas), or cumulative (e.g., caused by a Project activity in combination with other non-Project activities). Certain Project O&M activities may affect historic properties within the Project Boundary or outside the Project Boundary if a result of Project-related activities.

Several terms used throughout this Study Plan warrant definition.

- **Historic Properties.** This term is defined under 36 Code of Federal Regulations (CFR) § 800.16(l)(1), as prehistoric or historic sites, buildings, structures, objects, districts, or traditional cultural properties (TCP)[1] included in or eligible for inclusion in the NRHP. Historic properties are identified through a process of evaluation of specific criteria found at 36 CFR § 60.4.
- **Cultural Resources.** For the purpose of this study plan, this term is used to mean any prehistoric or historic district, site, building, structure (to include any industrial/engineering systems), object, or TCP, regardless of its NRHP eligibility. As well, if the results of this study warrant it, a landscape approach may be used to determine if there are any cultural landscapes present.

2.0 Resource Agency Management Goals

A new FERC license for the Project may permit activities that "…cause changes in the character or use of historic properties, if any such historic properties exist…" (36 CFR § 800.16(d)). FERC must therefore comply with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and its implementing regulations at 36 CFR 800. These

1 TCPs are addressed in a separate study proposal (Native American Traditional Cultural Properties Study).

regulations require the head of any federal department or independent agency having authority to license any undertaking to take into account the effects of the undertaking on historic properties.

As provided for in 18 CFR § 5.5(e), the Districts will request that FERC designate them as FERC's non-federal representatives for purposes of initiating consultation under Section 106 of the NHPA and implementing regulations found at 36 CFR § 800.2(c)(4).

Additionally, the State Historic Preservation Officer (SHPO), in accordance with Section 101(b)(3) of NHPA "…advises and assists Federal agencies in carrying out their Section 106 responsibilities…" by ensuring historic properties are taken into account early in the planning and development processes.

The U.S. Department of Interior, Bureau of Land Management (BLM) Mother Lode Field Office has management responsibility within the Project's Area of Potential Effects (APE) on any federal lands administered by BLM. The primary goal of BLM is that FERC comply with Section 106 and that historical properties are appropriately considered and managed. As defined in 36 CFR 800.16(d), the APE is "...the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historical properties, if any such properties exist."

Study results may be used in the development of Project facilities and/or license terms of the new license for the purpose of protecting or treating impacts to historic properties that would result from continued Project O&M, or for the purpose of enhancing historic properties that would be affected by continued Project O&M. These facilities, operations and management activities, which are referred to collectively as protection, mitigation, and enhancement (PM&E) measures, could include development of a Historic Properties Management Plan (HPMP)[2] that would describe and implement PM&E measures for historic properties potentially affected by continued Project O&M. A HPMP is a plan for considering and managing effects on historic properties that may occur from constructing, operating, and maintaining hydropower, transmission, and distribution projects, and establishes a decision-making process for considering those effects. Because it is not possible to determine all of the effects of various activities that may occur over the course of a license, FERC typically requires, as a license requirement, that a licensee develop and implement a HPMP that considers and manages effects on historic properties throughout the term of the license. For hydropower relicensings, FERC typically completes Section 106 by entering into a Programmatic Agreement (PA) or Memorandum of Agreement (MOA) with the Advisory Council on Historic Preservation (ACHP) and the SHPO that typically requires the licensee to develop and implement a HPMP. However, it should be noted that the Section 106 process is still active throughout the life of the new license, particularly regarding new activities by the license holder that have not undergone Section 106 requirements or newly identified cultural resources that also have not undergone Section 106 consideration. As such, while the HPMP and PA or MOA conclude the process needed for obtaining a new FERC license, the Project must continue to comply with Section 106 requirements, the guidelines for which are developed and provided in the HPMP. Additionally, FERC requires that a licensee develop the HPMP in consultation with various other federal, state, tribal, and non-government parties that have interests in the project.

[2] While not a part of this study, the information developed by this and other relicensing studies may be used to develop a HPMP in consultation with interested parties, and include a draft HPMP with the Draft License Application and a final HPMP in the Final License Application.

3.0 Study Goals

The primary study goal is to assist FERC in meeting its compliance requirements under Section 106 of the NHPA, as amended, by determining if licensing of the Project will have an adverse effect on historic properties. The objective of this study is to identify cultural resources within the APE, formulate a plan to evaluate their eligibility to the NRHP, if needed, and identify Project-related effects on those resources. At a later date the results of the study will then be used to develop the HPMP, which will ensure that all cultural resources identified within the APE will be appropriately considered and managed during the life of the new FERC license.

To address effects on historic properties, as required under Section 106, the APE is defined as all lands within the FERC boundary that are (1) below the normal maximum water surface elevation, (2) within designated Project facilities and formal recreation use areas, (3) within informal recreation use areas identified by the Don Pedro Recreation Agency, and (4) within the Red Hills Area of Critical Environmental Concern (ACEC). It is possible that the studies implemented as part of the relicensing process may identify Project-related activities that have the potential to affect historic properties outside this APE. It is also possible that during relicensing, Project improvements may be proposed that are outside the APE. If such areas are identified, the APE will expand in accordance with 36 CFR 800.4(a)(1) in consultation with the SHPO, BLM, Tribes, and other interested parties, as appropriate. Additional cultural resource inventories will be completed as part of this study if the APE is expanded.

The study will also comply with other relevant federal laws including the National Environmental Policy Act (NEPA), the Archaeological Resources Protection Act (ARPA) of 1974 (16 USC 469), the American Indian Religious Freedom Act (AIRFA) of 1978 (42 USC 1996 and 1996a), the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 (25 USC 3001), Executive Order 11593 (Protection and Enhancement of the Cultural Environment) of 1971 (16 USC 470), the American Antiquities Act of 1906, and Executive Order 13007 (Indian Sacred Sites) of 1996 (73 Federal Register 65, pp. 18293-24).

4.0 Existing Information and Need for Additional Information

Section 5.8 of the Pre-Application Document (PAD) describes existing, relevant, and reasonably available information regarding cultural resources. This information is summarized below.

To gather existing, relevant, and reasonably available information regarding cultural resources in the Project APE and vicinity, the Districts performed a records search in July 2010 at the Central California Information Center (CCIC) of the California Historical Resources Information System at California State University (CSU), Stanislaus in Turlock. In addition to identifying cultural resources, this research also served to obtain background information pertinent to understanding the archaeology, history, and ethnohistory of the Project vicinity and APE. The data gathering area included the FERC Project Boundary, which is much larger than the APE, plus an additional 0.25-mile buffer beyond, to identify previously recorded cultural resources and previous cultural studies that may require consideration during the Project.

The records search included reviews of cultural resources records and site location maps, historic General Land Office (GLO) plats, NRHP, California Register of Historic Resources, Office of Historic Preservation Historic Property Directory, *California State Historic Landmarks* (CDPR

1996), *California Inventory of Historic Resources* (CDPR 1976), historic topographic maps, and the Caltrans Bridge Inventory.

The records search indicates that the Project area is highly sensitive for prehistoric and historic-era properties and that some areas within the Project have been subject to previous cultural surveys (see Section 5.8 in the PAD). However, the research also revealed that many areas within the APE have not yet been surveyed for cultural resources and a portion of previously surveyed areas should be reexamined to meet current professional standards for identifying historic properties. To accomplish this, and to meet the study plan objective, additional archival research and field surveys are necessary. This study plan will be used to guide efforts in acquiring the additional information.

The existing information described below is not adequate to meet the goal of the study. Information necessary to address the study goal includes site-specific cultural resources inventory.

4.1 Summary of Record Searches

4.1.1 Previous Cultural Studies

The above-described records search identified 43 previous cultural resource investigations within 0.25-mile of the FERC Project Boundary, of which 18 fall within the FERC Boundary. The investigations date from the 1960s to 2009 and were prompted by a variety of different ground-disturbing developments, to include water control/treatment facilities, utilities, housing developments, mining activities, road/highway construction, recreation facilities, and grazing leases. Two of the previous investigations are articles from *The Quarterly of the Tuolumne Historical Society*, and one is comprised of documentation of monuments and plaques of the E Clampus Vitus organization.

4.1.2 Previously Recorded Archaeological Sites

The records search identified 146 known archaeological sites previously documented within 0.25 mile of the FERC Project Boundary, of which 61 fall within the FERC Boundary. Of the 146 sites within 0.25 mile of the FERC Boundary, one includes both prehistoric and protohistoric components, five sites have both prehistoric and historic-era components, six sites did not have any information on file at the Information Center and therefore are unknown as to their site type, 57 sites are prehistoric in age, and 77 sites are historic in age. Of the 61 sites within the FERC Boundary, 32 are prehistoric, 21 are historic, six are those sites with no site form, and two are multi-component, with both prehistoric and historic-era components. The prehistoric components typically include flaked stone with and without bedrock milling stations, with both short- and long-term occupation sites represented. The historic components are predominantly represented by refuse scatters and/or remains of habitation structures/buildings. According to the Office of Historic Preservation's *Archaeological Determinations of Eligibility* list and the *Directory of Properties in the Historic Property Data File* on file at the CCIC, of the 146 sites recorded in the vicinity of the Project APE, four have been determined eligible for inclusion on the NRHP, all of which are located within the FERC Boundary. The remaining 142 resources remain unevaluated for the NRHP.

4.1.3 Potential Historic-Period Cultural Resources

Historic period U.S. Geological Survey (USGS) topographic maps and GLO plats were reviewed during the records search to identify locations of potential historic-era sites and features within the FERC Project Boundary and within 0.25 mile of the FERC Boundary. This resulted in the identification of well over 50 locations where unrecorded historic period sites or features may be present. These sites and features include potential roads and trails, the town site of Jacksonville, buildings, mines, ditches, the Hetch Hetchy Railroad/Yosemite Short Line Railroad, the Hetch Hetchy Aqueduct, and other features.

Historic period maps often provide a general idea of where sites may be located but are not necessarily accurate. Today's maps and mapping standards are not translatable to the past and plots cannot be taken as exact. Because of the disparity between historic period maps and modern maps, it is not known if physical attributes associated with the potential sites and features still exist, are accessible, or if the remains are within the FERC Boundary. Potential site locations will be plotted on field maps prior to fieldwork and the survey crew will carefully scrutinize such areas for physical remains.

5.0 Study Methods

5.1 Study Area

The study area that will be investigated to accomplish the current study is the APE. As defined in 36 CFR 800.16(d), the APE is "...the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historical properties, if any such properties exist." The APE for the Don Pedro Project relicensing study effort is defined as including all lands within the FERC boundary that are 1) below the normal maximum water surface elevation, 2) within designated Project facilities and formal recreation use areas, 3) within informal recreation use areas identified by the Don Pedro Recreation Agency, and 3) within the Red Hills Area of Critical Environmental Concern (ACEC). If, at a later time, the Districts propose Project activities that are outside of the study area that may affect resources addressed by this study proposal, the study area will be expanded, if necessary, to include these areas. As well, should large resources, such as TCPs, be identified that continue outside of the Project APE, those resources will be recorded in their entirety, if appropriate and accessible (i.e., linear resources such as roads may not be followed out to their terminus), and the APE may be expanded to incorporate them if it is determine that Project O&M could effect these areas. As required under Section 106 [36 CFR § 800.4(a)(1)], maps depicting the APE will be submitted to the SHPO for formal review, comment, and approval.

5.2 General Concepts

The following general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- The Districts will make a good faith effort to obtain permission in advance of performance of the study to access private property where needed. Field crews may make minor modifications in the field to adjust to and accommodate actual field conditions and

unforeseeable events. Any modifications made will be documented and reported in the draft study reports.

5.3 Study Methods

The study approach will consist of the following six steps:

Step 1 - Obtain SHPO Approval of APE. As required under Section 106 [36 CFR § 800.4(a)(1)], the Districts will submit maps depicting the APE to the SHPO for formal review, comment, and concurrence[3]. Once approved, the maps including SHPO's concurrence letter, will be filed with FERC.

The Districts may request that SHPO concur with a modified APE during the study if the Districts determine that the Project affects historic properties outside the previously SHPO-approved APE.

Step 2 - Archival Research. Information has been obtained from the record search that identified previous cultural surveys and recorded archaeological and historic-era properties within or adjacent to the APE. Archival research will also be conducted at the repositories listed below to obtain additional information specific to the prehistory and history of the Project area, the hydroelectric system in whole, and its individual features. The results of the archival research will serve as the basis for preparing the prehistoric and historic contexts against which archaeological and historic-era properties may be evaluated. Historical photographs located during the archival research may be cited in the text as figures, unless they are subject to copyright laws. Previous NRHP evaluations of resources, if they exist, will be used as much as possible. The places to be contacted or visited may include:

- Bancroft Library, University of California, Berkeley
- California State Library, California History Room and Government Publications
- Bureau of Land Management, Mother Lode Field Office Data Files
- Turlock Museum and Archives
- Modesto Museum and Archives
- Sacramento History Center and Archives
- Sierra Miwuk Tribal Archives
- Tuolumne County Assessor's and Recorder's Offices
- Tuolumne County Historical Society
- Southern Tuolumne County Historical Society
- Archives of the Hetch Hetchy Water and Power/San Francisco Public Utilities Commission
- Oral Histories of Project Personnel and/or Local Residents, Historians, or Enthusiasts
- Turlock Irrigation District and Modesto Irrigation District
- Sonora Bypass Project Archaeological Documents Produced by the Far Western Anthropological Group

Step 3 - Field Survey. FERC is required to make a good faith effort to identify historic properties that may be affected by the proposed federal undertaking (i.e. the relicensing) (36

[3] Participating Tribes and agencies will be provided the opportunity to review and comment on all determinations prior to submission to the SHPO.

CFR § 800), which does not include identifying past project related effects, other than noting present resource conditions in order to determine their existing level of integrity. A comprehensive and intensive field survey will be completed in accordance with the Secretary of Interior's Standards and Guidelines for Identification (NPS 1983) and the BLM's Class III/intensive standards, per the BLM's 8100 manual series. All BLM lands within the Project APE will be inventoried at this level, unless it is determined unsafe to do so by the Districts in consultation with the BLM.

Archaeological Field Survey. To assist FERC in meeting its compliance obligations, and to develop appropriate management measures for historic properties identified within the APE, a field survey will be performed to verify locations of previously recorded cultural resources and to examine all accessible lands not previously surveyed or which were surveyed to less than adequate standards. Areas within the APE that cannot be accessed in a safe manner will not be included within the survey or recording of archaeological and historic-era properties; these areas will be identified in the resulting survey report in text and maps with an explanation for survey exclusion.

The field survey will be directly supervised in the field by qualified, professional archaeologists (i.e., individuals who meet the Secretary of the Interior's Standards for professional archaeologists and are listed on a California State BLM permit which require the permit holders to have extensive California archaeological experience). Prior to beginning field work, the field crew will visit a prehistoric archaeological assemblage recovered from a location near the Project vicinity to become familiar with prehistoric materials that might be encountered during the field survey of the Project APE. The purpose of the field survey is to: (1) examine lands which have not been previously surveyed; (2) examine lands previously surveyed but where the field strategy is unknown; and (3) examine lands previously surveyed but for which the field strategy does not meet current professional standards, as defined in the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation* (NPS 1983).

If conditions allow, lands will be examined that are typically inundated by the Project reservoir but which may become accessible during the survey season as a result of normal reservoir draw-downs.

Locations of previously recorded cultural resources will be verified and the sites re-recorded only if their existing site records or other documentation do not meet current standards for recording, or if the condition and/or integrity of the property has changed since its previous recording. Newly discovered cultural resources, including isolated finds, will be fully documented following the recordation procedures outlined in *Instructions for Recording Historical Resources* (OHP 1995), which utilizes state of California Department of Parks and Recreation (CDPR) forms CDPR 523 A-L. Prehistoric isolates will be defined as three or less artifacts (flakes, groundstone, etc.) per 50 square meters. Prehistoric isolated features will not be treated as isolated finds, but will be recorded as a site. Historic isolates will be defined on a case by case basis, depending on the types of historic resources identified within the APE. A sketch map for each site recorded or re-documented will be drawn to scale and the property photographed. The locations of all archaeological sites and isolates documented during the survey will be plotted by the Districts' cultural resources specialist or cultural consultant onto the appropriate USGS 1:24,000-scale topographic map at the time of discovery. Field personnel will use a GPS receiver to document the location of cultural resources (including isolates) recorded during the survey, which will be plotted onto the appropriate USGS topographic quadrangle using the UTM coordinate system. GPS data related to recordation of historic properties will adhere to CDPR specifications for accuracy and site specific procedures. Additionally, the areas examined will be plotted onto the appropriate USGS 7.5-minute topographic quadrangle for comparison with previous survey coverage maps.

Archaeological surveys that occur on BLM lands will require valid permits. The Districts' consultants will possess a valid Cultural Resource Use Permit issued through the BLM California State Office and will obtain a Field Authorization through the BLM Mother Lode Field Office prior to examining BLM lands. The Districts' consultants also will notify BLM when fieldwork is scheduled to begin. All artifacts encountered during the field survey will be left in place; no artifacts will be collected during the field survey.

Historic-Era Inventory of the Built Environment. A field inspection, documentation, and subsequent NRHP evaluation (see below) of any historic-era built environment resources will be undertaken by qualified, professional individuals meeting the Secretary of the Interior Standards for Architectural and Engineering Documentation. Individual components will be recorded or re-recorded to meet current CDPR standards. This will include digital color photography and sketch maps of each built resource and each associated feature.

Discovery and Treatment of Human Remains. If an inadvertent discovery of human remains occurs on federal lands, the person making the discovery shall follow the procedures outlined in 43 CFR § 10(4)(b) of NAGPRA and the guidance provided by the ACHP, requiring that they immediately notify the BLM and affected Tribes, as appropriate, by telephone, and provide written confirmation of the discovery. On BLM-administered land, NAGPRA responsibilities cannot be delegated to FERC or the Districts. All work in the immediate area of the discovery will cease and the area will be secured to protect the remains. The Districts' cultural resources specialist will consult with the affected Tribes to contact the lineal descendent and ascertain the cultural affiliation, as outlined in NAGPRA under 43 CFR § 10(14), in order to otherwise abide by NAGPRA to determine the disposition of the discovered human remains (43 CFR § 10[6]).

On privately owned lands, the California Penal Code (CPC), California Health and Safety Code (CH&SC), and California Public Resources Code (CPRC), also prohibit damage, defacement, or disinterment of human remains without legal authority, and establish civil and criminal penalties for actions associated with private landholdings. Although the CH&SC and CPRC technically apply only to those portions of the APE not under federal jurisdiction, in practice the law is applied throughout the area. Criminal sanctions provided for in the CPC, CH&SC, and CPRC would be above and beyond the penalties authorized by the ARPA. Other state laws and codes may also apply.

<u>Step 4 - National Register of Historic Places Evaluation.</u> During documentation of archaeological sites and features in Step 3, the Districts will also document the condition of each resource to assist in identifying potential and existing Project-related effects and level of integrity to provide recommendations for NRHP eligibility or evaluations. All previously unevaluated cultural resources that are currently being, or would be negatively affected by the Project will be evaluated at this phase if possible, based on the documented remains, background research, and other pertinent information. The NRHP evaluations will be submitted to the SHPO for concurrence. Any NRHP evaluations completed for sites located on federal agency lands

will be submitted to the appropriate agency for review prior to obtaining SHPO concurrence. Resources requiring further cultural resources management consideration beyond the study will be identified and included in the Districts' PM&Es for implementation, likely under a FERC-approved HPMP, unless more immediate action is deemed necessary to address Project-related effects.

The Districts will utilize the National Register criteria for all sites to be evaluated, which are defined in 36 CFR 60.4, and which include the following:

> ***National Register Criteria for Evaluation.*** *The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and*
>
> *(a) that are associated with events that have made a significant contribution to the broad pattern of our history;*
> *(b) that are associated with the lives of persons significant in our past;*
> *(c) that embody the distinctive characteristics of a type, period, or method of construction or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction;*
> *(d) that have yielded, or may be likely to yield, information important to prehistory or history.*

As well, properties not normally considered for listing in the National Register (i.e., cemeteries, birthplaces, or graves of historical figures, properties owned by religious institutions or used for religious purposes, structures that have been moved from their original locations, reconstructed historical buildings, properties primarily commemorative in nature, and properties that have achieved significance within the past 50 years) may qualify if they are integral parts of districts that do meet the criteria for evaluation or can apply the *Criteria Considerations* found at 36 CFR 60.

Evaluation of Historic Project System Features. Previously evaluated historic Project systems or individual features will not be re-evaluated unless substantial changes in their conditions have been observed and documented during the study, or the evaluation is more than 10 years old. If deemed appropriate by a qualified, professional cultural resources specialist, individual historic-era features may be evaluated together as a district.

All previously unevaluated historic-era Project features will be formally evaluated for eligibility to the NRHP. The evaluation will consist of three tasks: (1) development of a historic context for the APE using archival research; (2) examination of each historic feature to document and assess the level of integrity, both individually and as an element of a potential Hydroelectric Historic District; and (3) the historical information and the physical site data obtained during background and field research will be used to evaluate the eligibility of each Project feature individually and as part of a potential historic district for inclusion on the NRHP.

Step 5 - Identify and Assess Potential Project Effects on National Register-Eligible Properties. As required under 36 CFR § 800.5, the Districts will identify and assess, in consultation with the

SHPO, BLM, and potentially affected Indian Tribes, any adverse effects on historic properties or potential historic properties resulting from Project O&M. Adverse effects are defined as follows:

> *An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative (36 CFR § 800.5(a)(1).*

Step 6 - Reporting. See Section 9.0 for a description of the deliverables generated from this study.

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC issues its Study Plan Determination by December 31, 2011 and the study is not disputed by a mandatory conditioning agency:

- Field Work (Steps 1, 2, and 3) ....January 2012 - October 2012[4]
- Office Work (Steps 4 and 5) ....October 2012 - December 2012
- Consultation .... As needed and Quarterly Reports
- Report Preparation (Step 6)... March 2013 - April 2013
- Report Review by Agencies and Tribes (Step 6) ....May 2013 - June 2013
- Report Submittal to SHPO (Step 6) .... July 2013 - September 2013
- Drafting HPMP[5] ....July 2013 - October 2013
- Report Issuance .... January 2014

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

The proposed study methods discussed above are generally consistent with the study methods followed in several recent relicensing projects (i.e., French Meadows Transmission Line Project, FERC No. 2479; Merced River Hydroelectric Project, FERC No. 2179; Yuba-Bear Hydroelectric Project, FERC No. 2266). These methods have been accepted by the participating Indian Tribes, agencies, and other interested parties associated with those projects. The methods presented in this study plan also are consistent with the ACHP's guidelines for compliance with the requirements of Section 106 of the NHPA found at 36 CFR 800.

[4] Fieldwork will include the time of year when the reservoir level is at its lowest to ensure as much surface area is exposed as possible for the study.

[5] Though the HPMP is not the outcome of the proposed study, the results of the study will be used to help draft an HPMP for the Project relicensing efforts. The FERC generally requests a draft HPMP be submitted with the draft license application and a final HPMP be submitted with the final license application. However, the Districts will not request of the participating tribes and agencies, or SHPO, to complete a Section 106 review of the HPMP until the appropriate cultural resources management reports documenting completed studies are provided to tribes, agencies, and the SHPO.

8.0 Deliverables

The Districts will prepare a technical report prepared to current professional standards consistent with the Archaeological Resource Management Report (ARMR) Guidelines (OHP 1995). The report will include the following sections: (1) Study Goals and Objectives, (2) Environmental and Cultural Setting, (3) Methods and Analysis, (4) Results, (5) Discussion; and (6) Conclusions[6]. Upon completion of the field studies, cultural maps provided with the Districts' report will clearly depict the following on USGS 1:24,000 topographic maps: the study areas examined; inventory coverage, including intensity of coverage; and locations of cultural resources identified within the study areas.

Copies of the final report and detailed locations of identified properties may be withheld from public disclosure in accordance with Section 304 (16 U.S.C. 4702-3) of the NHPA (as amended). Concurrence of report recommendations will be sought from the SHPO. Draft versions of the report will be provided to BLM, Tribes, and other parties, as appropriate. If any portion of the documentation is deemed too sensitive for distribution by the affected tribes, the Districts' ethnographer will work with the concerned groups for an appropriate outcome, which could include withholding information from distribution.

The results of the study will also be reported in Exhibit E of the License Application, which will include a summary of the information and findings of the study plan. Figures and other pertinent data supporting the summary in Exhibit E will be appended to the License Application. The cultural records and other sensitive information will be included in a Confidential appendix withheld from public disclosure, in accordance with Section 304 (16 U.S.C. 4702-3) of the NHPA as amended.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

California Department of Parks and Recreation (CDPR). 1976. California Inventory of Historic Resources. On file, Central California Information Center, Turlock, California.

——. 1996. California State Historic Landmarks. On file, Central California Information Center, Turlock, California.

Office of Historic Preservation (OHP). 1995. Archaeological Resource Management Reports (ARMR): Recommended Contents and Format. Sacramento, California. On file, Office of Historic Preservation, Sacramento, California

U.S. Department of Interior, National Park Service (NPS). 1983. Archaeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines in the Federal Register, September 29, 1983 (48FR44716). Department of the Interior, Washington, D.C.

[6] The report will meet all of the reporting requirements of the BLM-issued Cultural Resource Use Permit.

STUDY PLAN CR-2

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Native American
Traditional Cultural Properties Study Plan

July 2011

Related Study Requests: BLM-01, 02, 11, 14, and 15

1.0 Project Nexus

Turlock Irrigation District's (TID) and Modesto Irrigation District's (MID) (collectively, the Districts) continued operation and maintenance (O&M) and/or recreation activities at the Don Pedro Project (Project) may affect Traditional Cultural Properties (TCP). The effect may be direct (e.g., result of ground-disturbing activities), indirect (e.g., public access to Project areas), or cumulative (e.g., caused by a Project activity in combination with other past, present, and reasonably foreseeable future projects). This study focuses on the potential for Project-related activities to affect TCPs.

TCPs are not automatically considered historic properties[1]. As defined under 36 Code of Federal Regulations (CFR) 800.16(l), historic properties are prehistoric or historic sites, buildings, structures, objects, districts, or locations of traditional use or beliefs that are included in, or eligible for inclusion in, the National Register of Historic Places (NRHP). Historic properties are identified through a process of evaluation against specific criteria found at 36 CFR 60.4.

To be considered a historic property, a TCP must have integrity and meet at least one of the NRHP criteria. When a place of traditional practices is evaluated as eligible for listing on the NRHP, it is termed a TCP. A TCP is defined as any property that is "…eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community" [NR Bulletin 38 (Parker and King 1998:1)].

TCPs are further defined in National Register Bulletin 38 (Parker and King 1998:1) as:

1. Locations associated with the traditional beliefs of a Native American group about its origins, its cultural history, or the nature of the world.
2. A rural community, whose organization, buildings and structures, or patterns of land use reflect the cultural traditions valued by its long-term residents.

[1] Historic properties other than TCPs are addressed in a separate study proposal (*Historic Properties Study*) in the relicensing.

3. An urban neighborhood that is the traditional home of a particular cultural group, and that reflects its beliefs and practices.
4. Locations where Native American religious practitioners have historically gone and are known or thought to go to today, to perform ceremonial cultural rules of practice.
5. Locations where a community has traditionally carried out economic, artistic or other cultural practices important in maintaining its historic identity.

The Project nexus with TCPs is the potential effect the Project could have on traditional/Tribal spiritual areas and other traditional uses in the Project Boundary or adjacent locations that are affected by Project activities. These include, but are not limited to: uses of geologic formations (i.e., landmarks); retrieval of fish for both ceremonial and spiritual purposes; gathering of plants for food, medicinal purposes and traditional uses (e.g., basket making); use of signal points including sightlines for fire signals; and access by Tribe members to and transit on trails and banks of the Tuolumne River traditionally used by Tribes.

2.0 Resource Agency Management Goals

FERC licenses may permit activities that may "…cause changes in the character or use of historic properties, if any such historic properties exist…" (36 CFR § 800.16[d]). FERC must therefore comply with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and its implementing regulations at 36 CFR Part 800 that require any federal department or independent agency having authority to license any undertaking to take into account the effects of the undertaking on historic properties.

As provided for in 18 CFR § 5.5(e), the Districts under separate cover will request that FERC designate them as FERC's non-federal representative for purposes of initiating consultation under Section 106 of the NHPA and the implementing regulations found at 36 CFR § 800.2(c)(4).

Additionally, the State Historic Preservation Officer (SHPO), in accordance with Section 101(b)(3) of NHPA "…advises and assists Federal agencies in carrying out their Section 106 responsibilities…" by ensuring historic properties are taken into account early in the planning and development processes.

The Bureau of Land Management (BLM) also has management responsibility for federal lands within the Project's Area of Potential Effects (APE). As defined in 36 CFR 800.16(d), the APE is "...the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historical properties, if any such properties exist."

3.0 Study Goals

The primary study goal is to assist FERC in meeting its compliance requirements under Section 106 of the NHPA, as amended, by determining if licensing of the Project will have an adverse effect on TCPs. The objective of this particular study is to identify TCPs that may potentially be affected by Project O&M, evaluate their eligibility to the NRHP, and identify Project-related activities that may affect TCPs, including locations of ethnographic use. At a later date, the results of the study will then be used to develop the Historic Properties Management Plan

(HPMP), which will ensure that all cultural resources identified within the APE will be appropriately considered and managed during the life of the new FERC license.

The Project is also subject to compliance with other relevant federal laws including the National Environmental Policy Act (NEPA), the Archaeological Resources Protection Act (ARPA) of 1974 (16 USC 469), the American Indian Religious Freedom Act (AIRFA) of 1978 (42 USC 1996 and 1996a), the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 (25 USC 3001), Executive Order 11593 (Protection and Enhancement of the Cultural Environment) of 1971 (16 USC 470), the American Antiquities Act of 1906, and Executive Order 13007 (Indian Sacred Sites) of 1996 (73 Federal Register 65, pp. 18293-24).

The term TCP has been in use only in recent decades, thus many older historic studies, oral traditions, and other background materials identified during this study may not use this term specifically, although in principal the information may address what is now termed TCP. Working with indigenous/aboriginal people and gathering any pertinent studies, information, or reports that are used to identify significant indigenous/aboriginal sites will contribute to the understanding of TCPs, and possibly other locations of tribal importance, taking into account relevant tribal values and knowledge as required in FERC's relicensing guidelines. In addition to the Tribal consultation process described more fully in Section 6.3 of this study proposal, significant, relevant studies conducted by ethnographers, graduate students, cultural journalists, and oral historians that are archived in public and private libraries will be reviewed and the relevant data included in the study results.

4.0 Existing Information and Need for Additional Information

Sections 5.8 and 5.10 of the Pre-Application Document (PAD) describe existing, relevant, and reasonably available information regarding cultural resources. This information is summarized below.

A records search was conducted during July of 2010 at the Central California Information Center (CCIC) of the California Historical Resources Information System at California State University (CSU), Stanislaus in Turlock. The records search included reviews of cultural resources records and site location maps, historic General Land Office (GLO) plats, NRHP, California Register of Historic Resources, Office of Historic Preservation Historic Property Directory, *California State Historic Landmarks* (CDPR 1996), *California Inventory of Historic Resources* (CDPR 1976), historic topographic maps, and the Caltrans Bridge Inventory.

The records search included all lands within the FERC Project Boundary and a 0.25-mile buffer beyond. The purpose of the record search was to identify any previously recorded TCPs that may be in the FERC Boundary or in the vicinity, and to identify characteristic resource types previously identified within the FERC Boundary and vicinity to help in the preparation of an ethnographic context for the area and/or any potential TCP documentation. The records search also included a 0.25-mile buffer beyond the FERC Boundary to allow adequate coverage and flexibility for Project planning.

The records search did not identify any TCPs or Indian Trust Assets (ITA) within the FERC Project Boundary.

ITAs are legal interests in assets held in trust by the federal government for Indian Tribes or individual Indians. Assets can be real property, physical assets, or intangible property rights. A characteristic of an ITA is that it cannot be sold, leased, or otherwise alienated without the United States government's approval. Examples of ITAs are lands, including reservations and public domain allotment; minerals; water rights; hunting and fishing rights; other natural resources; money or claims. ITAs do not include things in which a tribe or individuals have no legal interest. For example, off-reservation sacred lands or archaeological sites in which a Tribe has no interest are not an ITA.

Additionally, the Districts contacted the California Native American Heritage Commission (NAHC) at the beginning of September 2010 to obtain a listing of Tribal groups who should be contacted regarding the Project. The NAHC responded in a letter dated February 3, 2011, with a list of potentially affected Tribes. In addition to the NAHC list of tribes, the Districts have identified a number of other Indian Tribes that may have an interest in the relicensing based on the proximity of these groups' traditional territory to the Project APE. The list compiled by the Districts, including the NAHC list, is provided in Table 4.0-1. Additional groups that might be identified at a later date will be added.

Table 4.0-1 Tribal contact list.

Central Sierra Me-Wuk Cultural & Historic Reba Fuller, Spokesperson PO Box 699 Tuolumne, CA 95379	North Fork Mono Tribe Ron Goode, Chairperson 13396 Tollhouse Road Clovis, CA. 93611
Buena Vista Rancheria Roselynn Lwenya, Ph.D Environmental Resources Director P.O. Box 162283 Sacramento, CA 95816	Buena Vista Rancheria Rhonda Morningstar Pope Chairperson P.O. Box 162283 Sacramento, CA 95816
Picayune Rancheria of the Chukchansi Indians Mary Motola, Cultural Specialist 46575 Road 417 #A Coarsegold, CA 93614	Picayune Rancheria of the Chukchansi Indians Reggie Lewis, Chairperson 46575 Road 417 #A Coarsegold, CA 93614
Southern Sierra Miwuk Nation Sandy Vasquez, Chairperson P.O. Box 1200 Mariposa, CA 95338	Southern Sierra Miwuk Nation Jay Johnson, Spiritual Leader 5235 Allred Road Mariposa, CA 956338-9357
Southern Sierra Miwuk Nation Anthony Brochini, Cultural Resources Representative P.O. Box 1200 Mariposa, CA 95338	Southern Sierra Miwuk Nation Les James, Spiritual Leader P.O. Box 1200 Mariposa, CA 95338
Tuolumne Band of Me-Wuk Indians Stanley Rob Cox, Cultural Resources Department P.O. Box 699 Tuolumne, CA 95379	Tuolumne Band of Me-Wuk Indians Kevin Day, Chairperson P.O. Box 699 Tuolumne, CA 95379
Tuolumne Band of Me-Wuk Indians Reba Fuller, Spokesperson P.O. Box 699 Tuolumne, CA 95379	Mono Nation (non-profit organization associated with the North Fork Mono Rancheria) James Bethel, President 58288 Road 225 North Fork, CA 93643

Chicken Ranch Rancheria of Me-Wuk Melissa Powell, Cultural Resources Coordinator P.O. Box 1159 Jamestown, CA 95327	Chicken Ranch Rancheria of Me-Wuk Lloyd Mathiesen, Chairperson P.O. Box 1159 Jamestown, CA 95327
California Valley Miwok Tribe Silvia Burley, Chairperson 10601 N. Escondido Place Stockton, CA 95212-9231	

Prior to the mid-September 2010 public meetings for the Project relicensing, the Districts sent letters to the Tribal contacts inviting them to the meetings for an initial public introduction to the Project relicensing. Included in these letters was a request for relevant information related to the relicensing. The Tribal contacts were also referred to the public relicensing website and given the names and contact information for the Districts.

To date, no concerns or potential TCPs or ITAs have yet been identified by the Tribes within the FERC Project Boundary or 0.25 mile beyond.

5.0 Study Methods

5.1 Study Area

The study area that will be investigated to accomplish the current study is the APE. As defined in 36 CFR 800.16(d), the APE is "...the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historical properties, if any such properties exist." The APE for the Don Pedro Project relicensing study effort is defined as including all lands within the FERC boundary that are 1) below the normal maximum water surface elevation, 2) within designated Project facilities and formal recreation use areas, 3) within informal recreation use areas identified by the Don Pedro Recreation Agency, and 3) within the Red Hills Area of Critical Environmental Concern (ACEC). If, at a later time, the Districts propose Project activities that are outside of the study area that may affect resources addressed by this study proposal, the study area will be expanded, if necessary, to include these areas. As well, should large resources, such as TCPs, be identified that continue outside of the Project APE, those resources will be recorded in their entirety, if appropriate and accessible (i.e., linear resources such as roads may not be followed out to their terminus), and the APE may be expanded to incorporate them if it is determined that Project O&M could affect these areas. As required under Section 106 [36 CFR § 800.4(a)(1)], maps depicting the APE will be submitted to the SHPO for formal review, comment, and approval.

5.2 General Concepts

The following general concepts apply to the study:

- Personal safety is the most important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study reports.

5.3 Study Methods

The study approach will consist of the following seven steps:

Step 1 - Obtain SHPO Concurrence on the APE. As required under Section 106 [36 CFR § 800.4(a)(1)], the Districts will submit maps depicting the APE to the SHPO for formal review, comment, and concurrence[2]. Once approved, the maps including SHPO's concurrence letter will be filed with FERC.

The Districts may request that SHPO concur with a modified APE during the study if the Districts determine that the Project affects historic properties outside the previously SHPO-approved APE.

Step 2 - Archival Research. The Districts performed initial archival research in preparation of the PAD. In this step, the Districts will, at a minimum, conduct additional archival research at the following places, as appropriate:

- Bancroft Library, University of California, Berkeley
- California State Library, California History Room and Government Publications
- Bureau of Land Management, Motherload Field Office Data Files
- Turlock Museum and Archives
- Modesto Museum and Archives
- Sierra Miwuk Tribal Archives
- Tuolumne County Assessor's and Recorder's Offices
- Tuolumne County Historical Society
- Southern Tuolumne County Historical Society
- Archives of the Hetch Hetchy Water and Power/San Francisco Public Utility Commission
- Oral Histories of Project Personnel and/or Local Residents, Historians, or Enthusiasts
- Turlock Irrigation District and Modesto Irrigation District
- Other appropriate Tribal, private, state, or federal repositories identified during the research

Step 3 - Tribal Consultation and Identification of Resources. Following the ethnographic literature review in Step 1, the next step in identifying potential TCPs will involve extensive Tribal consultation. Consultation and any fieldwork and potential TCP documentation shall be undertaken in accordance with Section 106 of the NHPA, as amended, and shall be consistent with National Register Bulletin No. 38, *Guidelines for Evaluating and Documenting Identification of Traditional Cultural Properties*. Prior to conducting any fieldwork or field visits on BLM lands, the Districts' ethnographer will obtain a Field Authorization through the BLM Mother Lode Field Office.

In order to facilitate Tribal consultation, the Districts intend to retain a qualified, professional ethnographer who meets the standards for ethnography as defined in Appendix II of National Register Bulletin No. 38. The Districts will coordinate its selection of the ethnographer with the assistance of affected Tribes and other interested cultural/Tribal stakeholders.

[2] Participating tribes and agencies will be provided the opportunity to review and comment on all determinations prior to submission to the SHPO.

The ethnographer, in consultation with designated Tribal representatives (e.g., Tribal Chair), will determine the scope and breadth of interviews. The ethnographer will then contact the appropriate Tribe(s) and interested Tribal and cultural stakeholders to arrange for interviews at a time and location acceptable to those Tribal interviewees. Tribal interviewees and the ethnographer may need to visit the APE together to accurately define potential TCPs. If necessary, the Districts will arrange for an initial introductory meeting between the Districts, Tribal representatives, and the ethnographer.

Interviews may be conducted on a one-on-one basis with the ethnographer. The oral traditions and information collected during the interviews will be used to help define potential TCPs in the APE and to assist in making sound judgments and management decisions in Project planning. All information gathered will be kept confidential and respectfully documented by the ethnographer.

If participating Indian Tribes do not wish to disclose the locations of any potential TCPs, the Districts will instead work with the Tribes to identify the general issues and concerns that the Tribe(s) may have regarding potential impacts of the Project upon resources known to the Tribe(s) and work and with the Tribes and appropriate land management agencies to develop agreeable measures to address these concerns.

<u>Step 4 - Archaeological Site Visit.</u> Tribal interviewees or a physically capable Tribal representative and the ethnographer may want to visit archaeological sites identified during the study or during the Historic Properties Study. The purpose of the visit would be to provide Tribal representatives the opportunity to examine prehistoric archaeological sites encountered during the Historic Properties Study field work, and for the ethnographer to obtain additional information on potential TCPs. After the site visit(s), Tribal representatives may choose to share additional TCP information. BLM will be involved with any site visits on BLM-administered land. BLM will request to meet in advance with those Tribal representatives who wish to visit prehistoric sites on BLM-administered land. This is prudent and reasonable as BLM has ongoing management obligations for resources on lands under its management, regardless of whether these resources are within the FERC Project Boundary. BLM keeps information about archaeological sites and all Native American-related cultural resources confidential. Prior to conducting fieldwork on BLM lands, the ethnographer and other Districts' consultants will possess a valid Cultural Resource Use Permit issued through the BLM California State Office and will obtain a Field Authorization through the BLM Mother Lode Field Office.

<u>Step 5 - National Register of Historic Places Evaluation.</u> Following completion of Step 4, the Districts' ethnographer will evaluate the eligibility of identified TCPs for listing on the NRHP using data collected from the field studies described above. The NRHP codifies the criteria used to evaluate most cultural resources at 36 CFR 60.4, as follows:

> ***<u>National Register Criteria for Evaluation</u>****. The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and*

(a) that are associated with events that have made a significant contribution to the broad pattern of our history;
(b) that are associated with the lives of persons significant in our past;
(c) that embody the distinctive characteristics of a type, period, or method of construction or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction;
(d) that have yielded, or may be likely to yield, information important to prehistory or history.

However, amendments to the NHPA in 1992 [§101(d)(6)(A)] specify that properties of traditional religious and cultural importance to an Indian Tribe may be determined eligible for inclusion in the NRHP because of their "association with cultural practices or beliefs of a living community that are: (1) rooted in that community's history; and (2) are important in maintaining the continuing cultural identity of the community." Therefore, a TCP can only be significant if it meets these two criteria. However, if sacred areas or religious locations are identified that do not meet these criteria, they will still be evaluated following the Section 106 process. Formal evaluations will be submitted to the SHPO for concurrence.

As well, properties not normally considered for listing in the NRHP (i.e., cemeteries, birthplaces, or graves of historical figures; properties owned by religious institutions or used for religious purposes; structures that have been moved from their original locations; reconstructed historical buildings; properties primarily commemorative in nature; and properties that have achieved significance within the past 50 years) may qualify if they are integral parts of districts that do meet the criteria for evaluation or can apply the *Criteria Considerations* found at 36 CFR 60.

<u>Step 6 - Identify and Assess Potential Project Effects on National Register-Eligible Properties.</u> As required under 36 CFR § 800.5, the Districts will identify and assess, in consultation with the SHPO, BLM, and potentially affected Indian Tribes, any adverse effects on TCPs resulting from Project O&M. Adverse Effects are defined as follows:

> *An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative* (36 CFR § 800.5(a)(1)).

<u>Step 7 - Reporting.</u> See Section 9.0 for a description of the deliverables generated from this study.

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC issues its Study Plan Determination by December 31, 2011 and the study is not disputed by a mandatory conditioning agency:

- Planning/Pre-field Arrangements .... January 2012 - February 2012
- Field Work (Steps 1, 2, and 3) .... March 2012 - December 2012
- Office Work (Steps 4 ,5, and 6) .... January 2013 - July 2013
- Study Proposal Consultation .... As needed and Quarterly Reports
- Report Preparation (Step 7)...August 2013 - September 2013
- Report Review by Agencies and Tribes[3] (Step 7)............... September 2013 - October 2013
- Report Submittal to SHPO[4] (Step 7).................................... October 2013 - November 2013
- Drafting HPMP[5] ....July 2013 - October 2013
- Report Issuance .... January 2014

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

The proposed study methods discussed above are generally consistent with the study methods followed in several recent relicensing projects (i.e., French Meadows Transmission Line Project, FERC No. 2479; Merced River Hydroelectric Project, FERC No. 2179; Yuba-Bear Hydroelectric Project, FERC No. 2266). These methods have been accepted by the participating Indian Tribes, agencies, and other interested parties associated with those projects. The methods presented in this study plan also are consistent with the ACHP's guidelines for compliance with the requirements of Section 106 of the NHPA found at 36 CFR 800 and with the related guidance set forth in National Register Bulletin 38.

8.0 Deliverables

The Districts will prepare a technical report prepared to current professional standards consistent with the Archaeological Resource Management Report (ARMR) Guidelines (OHP 1995). The report will include the following sections: (1) Study Goals and Objectives; (2) Environmental and Cultural Setting; (3) Methods and Analysis; (4) Results; (5) Discussion; and (6) Conclusions[6]. The report will include the evaluation plan with a detailed assessment of Project effects. Copies of this report will be provided to the affected Indian Tribes, BLM, SHPO, CSU, Stanislaus, CCIC, and FERC. Copies of the final report and detailed locations of identified properties will be withheld from public disclosure in accordance with Section 304 (16 U.S.C. 4702-3) of the NHPA (as amended). Concurrence on report recommendations will be sought from SHPO. BLM and other interested parties will review the cultural report, evaluation

[3] Non-confidential portions only.
[4] Non-confidential portions only.
[5] Though the HPMP is not the outcome of the proposed study, the results of the study will be used to help draft an HPMP for the Project relicensing efforts. The FERC generally requests a draft HPMP be submitted with the draft license application and a final HPMP be submitted with the final license application. However, the Districts will not request of the participating tribes and agencies, or SHPO, to complete a Section 106 review of the HPMP until the appropriate cultural resources management reports documenting completed studies are provided to tribes, agencies, and the SHPO.
[6] The report will meet all of the reporting requirements of the BLM-issued Cultural Resource Use Permit.

plan, and other documents, before they are sent to SHPO for concurrence. If any portion of the documentation for a traditional property is deemed to sensitive for distribution by the affected tribes, the Districts' ethnographer will work with the concerned groups.

The results of the study will be reported in Exhibit E of the License Application, which will include a summary of the information and findings of the Study Plan. Figures and other pertinent data supporting the summary in Exhibit E will be appended to the License Application. The cultural records and other sensitive information will be included in a confidential appendix withheld from public disclosure, in accordance with Section 304 (16 U.S.C. 4702-3) of the NHPA as amended.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

California Department of Parks and Recreation (CDPR). 1976. California Inventory of Historic Resources. On file, Central California Information Center, Turlock, California.

——. 1996. California State Historic Landmarks. On file, Central California Information Center, Turlock, California.

Parker, Patricia L., and Thomas F. King. 1998. Guidelines for Evaluating and Documenting Traditional Cultural Properties. Revised. National Register Bulletin 38. U.S. Department of the Interior, National Park Service, National Register, History, and Education Division, Washington, D.C.

STUDY PLAN RR-1

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Recreation Facility Condition and Public Accessibility Assessment Study Plan

July 2011

Related Study Requests: BLM-03, 07; NPS-01

1.0 Project Nexus

The Federal Energy Regulatory Commission (FERC) regulations require that the license application include a description of the existing recreation measures or facilities to be continued and maintained, during the term of the new license, new measures or facilities proposed by the applicant for the purpose of enhancing recreational opportunities at the project, and measures to ensure the safety of the public in its use of project lands and waters. In addition, recreation is a recognized project purpose at FERC-licensed projects under Section 10(a) of the Federal Power Act.

2.0 Resource Agency Management Goals

Turlock Irrigation District (TID) and Modesto Irrigation District (MID) (or collectively, the Districts) believe the U.S. Department of Interior, Bureau of Land Management (BLM) has interests in public access and use of lands managed by BLM on and near Don Pedro Reservoir. The BLM Sierra Resource Management Plan (SRMP) was implemented in February 2008 and is nearly identical to the Proposed SRMP and Final Environmental Impact Statement published June 8, 2007. Detailed management resolutions (i.e., management activities, mitigations, and project design features) for public lands are outlined in the SRMP, and some goals are specific to recreation. Two recreation goals outlined in the SRMP are: (1) ensure the continued availability of outdoor recreational opportunities while protecting other resources and uses; and (2) ensure adequate river flows for boating, fishing, swimming, etc. Additionally, five recreation objectives are also detailed: (1) develop recreation management strategies for large blocks of BLM land in wild and scenic river corridors; (2) develop recreation sites that meet public health and safety standards; (3) mitigate conflicts between competing uses; (4) maintain existing visitor center, campground, trail, and day-use facilities to accepted BLM standards; and (5) manage recreation for a remote experience on the wild segments of the North Fork American, Tuolumne, and Merced rivers pursuant to the Wild and Scenic Rivers Act (BLM 2008).

3.0 Study Goals

The goal of the recreation facility condition assessment and public accessibility evaluation is to provide information about the need for maintenance or enhancement of existing recreation facilities to support current and future demand for public recreation at the Project. The objectives of the study are to:

- assess the condition of existing developed recreation facilities at the Don Pedro Project,
- estimate present capacity of recreation facilities at the Project to support present and future demand for public recreation (i.e., facility carrying capacity),
- describe the preferences, attitudes, and characteristics of the Project's recreation users, and
- collect information about current Project recreation activities and future demand for activities.

4.0 Existing Information and Need for Additional Information

All recreation activities at the Project are managed by the Don Pedro Recreation Agency (DPRA). Operationally, the DPRA is a department within TID. It is an agency sponsored by the Districts and City and County of San Francisco (CCSF). DPRA is managed by a Board of Control. Funding for routine operation and maintenance is provided by the recreation fees it charges. Capital funding is provided by the Districts and CCSF.

Project recreation predominantly occurs at the three developed recreation sites on the reservoir:

- Fleming Meadows Recreation Area
- Blue Oaks Recreation Area
- Moccasin Point Recreation Area

Developed toilet facilities are operated and maintained at 11 remote locations where recreation use is known to be concentrated. All developed facilities at these 14 locations will be included in this assessment (Figure 5.1-1).

DPRA operates and maintains all these developed recreation facilities and routinely assesses the need for maintenance, repair, and replacement. This study will supplement information on existing Project recreation facility condition and accessibility already available from DPRA.

Regarding an assessment of visitor use of the Project, there is sufficient information to estimate overall use of the Project in Visitor Days. DPRA counts visitors entering the developed recreation facilities at gated and staffed entry kiosks. DPRA also estimates the number of people who access the reservoir from roadside pullouts and other informal access points. The spatial distribution of boating activity on the reservoir is available from data collected in 2002 and 2003, and from DPRA routine patrols. Additional information is needed on use levels for individual activities, user satisfaction, latent demand, and current and future recreation needs. This information can be obtained by conducting a Recreation Use Assessment.

5.0 Study Methods

This study will assess the condition of existing developed recreation facilities within the Don Pedro Project operated by DPRA (Figure 5.1-1). Participation rates in various recreation activities, user satisfaction, latent demand, and current and future recreation needs will also be assessed.

5.1 Study Area

This study will take place at Don Pedro Reservoir in Tuolumne County, California. The study area consists of developed recreation sites and facilities at three locations: Fleming Meadows, Blue Oaks, and Moccasin Point recreation areas on Don Pedro Reservoir, as well as 12 remote facilities where toilets are maintained (Table 5.1-1 and Figure 5.1-1).

Table 5.1-1 Summary of recreation facilities and other on-site amenities at Don Pedro Project-developed recreation areas.

Amenities	Moccasin Point RA	Blue Oaks RA	Fleming Meadows RA
Project Recreation Facilities			
Camping Units - Total	96	195	267
With water and electric hookups	18	34	90
Picnic Areas -Total	2	1	2
Group Picnic Sites	1	1	1
Boat Launch Ramp	1	1	1
Fish Cleaning Stations	1	1	1
Comfort Stations - Total	8	11	14
With hot showers	2	5	5
Additional On-Site Recreation Amenities			
Concession Store	Yes	No	Yes
Swimming Lagoon	No	No	Yes
Volleyball / Softball Area	No	No	Yes
Marina	Yes	No	Yes
Amphitheatre	No	No	Yes
Houseboat Mooring	Yes	No	Yes
Boat Rentals	Yes	No	Yes
Houseboat Rentals	Yes	No	Yes
Boat Repair Yard	No	Yes	No
Gas and Oil	Yes	No	Yes
Sewage Dump Station	Yes	Yes	Yes

Fleming Meadows Recreation Area consists of 267 campsites (90 with water, sewer and electric hookups), 1 group picnic area, 2 picnic areas (includes one group picnic area, 1 boat launch ramp, 1 fish cleaning station, and 14 comfort stations (5 with showers). Additional on-site amenities include a concession store, swimming lagoon, volleyball and softball areas, marina, amphitheater, houseboat mooring, boat rentals, houseboat rentals, boat repair yard, gas and oil, and a sewage dump station.

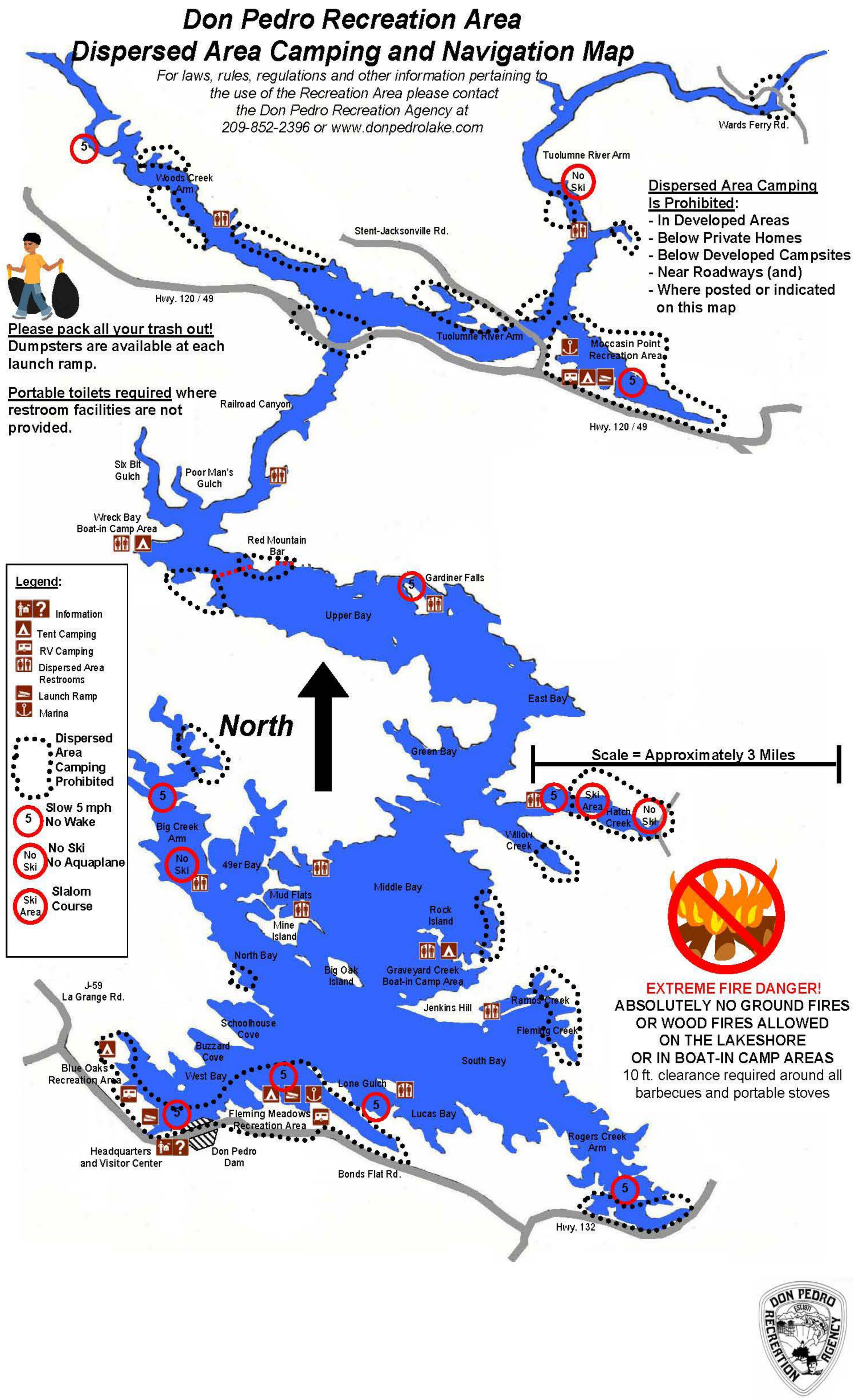


Figure 5.1-1 **Developed facilities to be inventoried and evaluated for the Don Pedro Project recreation facility condition and public use assessment.**

Blue Oaks Recreation Area consists of 195 camp sites (34 with water and electric hookups), 1 group picnic/campground, 1 boat launch ramp, 1 fish cleaning station, and 11 comfort stations (5 with hot showers). Additional on-site amenities include a boat repair yard and a sewage dump station.

Moccasin Point Recreation Area consists of 96 campsites (18 with water, sewer and electric hookups), 2 picnic areas (1 is a group picnic area), 1 boat launch ramp, 1 fish cleaning station, and 8 comfort stations (2 with a hot shower). Additional on-site amenities include houseboat moorings, boat rentals, houseboat rentals, gas and oil facilities, and a sewage dump station.

Twelve remote locations where dispersed recreation (including shoreline camping) is managed will be included in the facility inventory. Shoreline camping is prohibited within the developed recreation areas, along the shoreline adjacent to developed roadways and housing areas, and certain environmentally sensitive areas.

5.2 General Concepts

The following general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study reports.

5.3 Study Methods

The study methods will consist of six steps. These include: (1) an inventory and evaluation of the recreation facilities for condition, Americans with Disabilities Act (ADA) compliance, and use impacts; (2) identifying recreation uses and visitor attitudes, beliefs, and preferences at Project recreation resource areas; (3) estimating the current recreation use at Project recreation resource areas; (4) identifying future use and demand opportunities; and (5) analyzing the data and preparing the report. Each of the steps is described below.

5.3.1 Step 1A – Inventory and Evaluate the Existing Recreation Facilities for Condition, ADA Compliance, and Use Impacts

The Districts will inventory and evaluate the Project's developed recreation facilities (above ground systems only[1]) listed in Table 5.1-1 and at the land based and floating toilet locations identified in Figure 5.1-1. This will include four subtasks: (1) a complete inventory of developed recreation facilities associated with the Project including campgrounds, boat launches, marinas, swimming lagoon, picnic areas, signs, and interpretive displays; (2) an assessment of the condition of each component (tables, fire rings, restrooms, walkways, parking areas, roads, etc.) of the developed recreation facilities; (3) an assessment of whether each component complies

[1] The Districts will only evaluate the above-ground facilities and systems at each of the sites listed in Table 5.1-1. Below-ground facilities and systems such as water distribution and septic systems are monitored as part of routine operation and maintenance; and repaired as needed.

with current ADA accessibility guidelines; and (4) an assessment of the use impacts at each recreation facility. Each of the subtasks is described below.

5.3.1.1 Inventory Recreation Facilities

The Districts will inventory the number and type of recreation facilities at the Project recreation facilities as noted in Section 5.3.1. Photographs will be taken as appropriate as either a representative photograph of similar facilities or of each one-of-a-kind facility. Facilities of interest include picnic sites, campsites, restrooms, walkways, parking areas/spaces, boat launch ramps, boat docks/marinas, and recreation signs.

All signs will be inventoried and each type of sign will be photographed and documented (e.g., type of sign, condition, text, location etc.). The content of signage will be checked for clarity, consistency, and appropriate and understandable wording. In addition (where applicable), The Districts will note incidental information in the vicinity of the developed recreation facilities such as user-created roads and approximate trail lengths; user-created sites; available parking, and any informal fire rings. Representative photographs will be taken as appropriate. The Districts will use a basic inventory form (an example form is provided in Attachment A).

5.3.1.2 Facility Condition Assessment

The Districts will conduct a qualitative assessment of the condition of developed recreation facilities and signs at the facilities listed in Table 5.1-1. The assessment categories are poor, fair, and good condition. Table 5.3.1-1 provides evaluation criteria that will be used by type of recreation facility feature.

Table 5.3.1-1 Facility site condition evaluation categories and criteria.

Variable	Condition Evaluation Categories and Criteria		
	0 – Poor	**1 - Fair**	**2 - Good**
Roads & Parking (circulation and condition of surface paving)	All surfaces are in disrepair and need of immediate reconditioning or replacement. Current conditions create safety hazards.	Need for improved maintenance and repair in some areas. No major safety concerns.	All surfaces in excellent condition and well maintained. No rehabilitation required within the next 5-10 years.
Recreation Site Amenities (condition of vehicle spur, picnic tables, fire ring/grills, boat ramps, etc.)	Facilities require immediate repair or replacement. Little evidence of recent maintenance.	Some facilities damaged or in need of replacement. Could be accommodated through routine maintenance.	Facilities generally in good condition and well maintained.
Recreation Site Buildings (condition of restrooms, maintenance buildings, and other structures)	Structures in disrepair requiring immediate attention. Significant rehabilitation likely. Problems could include rot, leaks, and sagging roofs.	Some structures need minor repairs, such as painting or replacement of roof/shingles. Repairs should be made, but are not needed immediately.	All structures appear in sound, well maintained condition. No significant problems observed.
Signs (presence/condition of project and recreation signs)	Signs do not exist or require immediate repair or replacement.	Some signs damaged or in need of replacement.	Signs generally in good condition and well maintained.

Based on the rating of each variable/site component in the table above, an overall facility evaluation score will be calculated using the following scale.

- Score = 8: Excellent condition
- Score = 6 to 7: Good condition - requiring routine care/maintenance
- Score = 3 to 5: Fair condition - may require some rehabilitation
- Score = 0 to 2: Poor condition - requires immediate rehabilitation work or replacement

In addition, photographic documentation of some facilities (e.g., picnic tables, fire rings) will illustrate a representative range of conditions at each site. The Districts will use a condition form to evaluate each facility, and an example form is provided in Attachment A. The use impact form may be modified based on further review of existing information and field reconnaissance.

5.3.1.3 Accessibility Assessment

The Districts will assess the developed recreation facilities in Table 5.1-1 for their compliance with the ADA and Architectural Barriers Act Accessibility Guidelines (ABAAG) developed by the U.S. Access Board (USAB 2004). The Districts will evaluate each facility based on these standards and use a rating system to categorize the level of accessibility at each facility: inaccessible, partially accessible, and fully accessible. A rating will be assigned using the evaluation criteria in Table 5.3.1-2.

Table 5.3.1-2 Level of accessibility categories and rating system.

Variable	Accessibility Categories 0 – Inaccessible	 1 – Partially Accessible	 2 - Accessible
ADA Compliance (presence of accessible facilities and other ABAAG factors)	Little or no consideration for handicap accessibility. Clearly not in compliance with ADA/ ABAAG standards.	Some handicap facilities, but in disrepair or not up to current ADA/ ABAAG standards (e.g., slopes too steep, docks inaccessible, etc).	High quality of accessibility. Facilities appear fully consistent with current ADA/ ABAAG standards.

An example of the ADA accessibility compliance checklist for outdoor recreation facilities is contained in Attachment A, including an example of schematic guides to support the evaluations. These checklists will be modified to address the specific standards for each of the applicable guidelines – ADA or ABAAG – as needed. In addition, recreation facilities will be assessed for their ability to provide opportunities for persons with disabilities to participate in the Project's primary recreation opportunities (including boating and camping).

5.3.1.4 Assessment of Recreation Use Impacts

The Districts will also assess the recreation use impacts at each of the recreation facilities (see Table 5.1-1). The recreation use impact evaluation at each facility is categorized as low, moderate, or high depending on the amount and dispersion of use impact signs (Table 5.3.1-3). Signs of use impact typically include the presence of litter, dumping, tree cutting, inadequate vegetation clearances around fire pits/rings, visible off-highway vehicle (OHV) use/tracks, trampled vegetation, bare ground, compacted soils, erosion, human waste, toilet paper, etc.

Table 5.3.1-3 Recreation use impact categories and rating system.

Variable	Use Impact Categories		
	0 – Low	1 – Moderate	2 - High
Recreation Use Impact	Few, if any signs of use impact are observed at each site	Several signs of use impact but not extensive or widespread impacts	Extensive signs of use impact; widespread use with many impacts evident

In some instances, selecting a single impact category may not be practical, and as a result, the impact level may span two categories (i.e., low-to-moderate or moderate-to-high). This broader categorization may be used when a site or facility has satellite areas where impact conditions vary significantly from the majority of the site/facility.

5.3.2 Step 1B – Inventory and Evaluate Recurrent Dispersed Shoreline Recreation Use Locations Along the Don Pedro Reservoir Shoreline

The Districts will inventory and evaluate the recurrent dispersed shoreline recreation use locations within the FERC Project Boundary. Specifically, this step includes identifying recurrent dispersed recreation use locations; and assessing the use impacts at the location.

The Districts will conduct a single field survey of the Don Pedro Reservoir shoreline by boat to identify locations that show signs of recurrent dispersed shoreline recreation use. When such a location is observed, a land-based evaluation of the recreation use impacts at the location will be conducted as outlined in Section 5.3.1.4 above, including completing the evaluation form (Attachment A). At each location, the Districts will photograph and map the location with a GPS device. The Districts will also identify any user-created trails adjacent to the identified recurrent recreation use sites.

5.3.3 Step 2 – Identify Recreation Uses and Visitor Attitudes, Beliefs, and Preferences

The Districts will conduct observations and visitor surveys to gather information from visitors at each of the facilities listed in Table 5.1-1.

5.3.3.1 Survey Development

The visitor survey will address the study objectives identified in Section 3.0. Survey topics will address items such as visitors' perceptions of the following:

- Existing and desired recreation facilities
- Reservoir water levels on experience
- Satisfaction with shoreline access and opportunities
- Comparison of Don Pedro Project recreation resources to other regional recreation resource areas that provide similar recreation opportunities
- Personal safety
- Crowding
- Conflict
- Visitor's actual and desired primary destination and activities
- Actual and desired activities

- Constraints or barriers to participation that are potentially within the Districts' control (e.g. lawlessness, trail conditions, campfire use, private property conflict and trespass, parking access and fees)
- Ways to enhance their recreation experience

The draft survey instrument is provided in Attachment B. The survey content will be refined in consultation with Relicensing Participants. Prior to survey implementation, the survey instrument will be pre-tested in the field with recreation users, and, refined for clarity, if necessary.

5.3.3.2 Field Reconnaissance, Logistics, and Preparation

This step will involve logistical preparation for existing use data collection, including: developing draft data forms and associated databases; developing field work logistics and protocols; field crew training; selection of sampling dates; pre-testing field logistics and protocols, and revising schedules, logistics, or protocols based on preliminary findings.

5.3.3.3 Sampling Approach and Data Collection

The target population the Districts will focus on is based on the overall Project recreation use estimate for 2010, which was approximately 400,000 Visitor Days. The total survey sample size for the Project will be at least 384 surveys.

The Districts will make every attempt to secure the target number of surveys. However, even after following survey protocol, there may be sites where the target cannot be met. The Districts will continuously monitor the survey returns, and if survey targets are not being met at survey sites, the sampling frequency will be re-evaluated to determine if additional efforts should be made at these survey sites. Also, for all survey sites, the Districts will continue the survey effort throughout the established seasons, even if the target survey numbers have been met, and will make every effort to achieve the survey target goals.

Pre-Test Survey Instrument

The Districts will conduct a pre-test of the survey questionnaire. The pre-test will include a total of 10 to 15 completed surveys, with the intent to receive feedback on readability, length, and general understanding of survey content. If necessary, minor changes to the survey instrument may be made to make the survey easier to complete and/or understand.

Sampling Frequency

The sampling frequency will be divided into two categories – peak season and off-peak season. The peak season for all recreation use and activities on the Project is April 1 through September 30. The off-peak season is October 1 through March 31.

The monthly sampling frequency for the peak season will be:

- Two randomly selected weekday days per month
- Two randomly selected weekend days (Saturday and Sunday) per month
- One pre-selected holiday day for each three-day holiday weekend (3 holiday days total) (Memorial Day, Independence Day, and Labor Day holiday weekends)

The monthly sampling frequency for the off-peak season will be:

- Two randomly selected weekday days per month
- Two randomly selected weekend days (Saturday and Sunday) per month

To identify visitors' attitudes, beliefs, and preferences at Project recreation resource areas, the Districts will conduct a roving use survey. During the survey, the surveyors will also conduct a recreation observation survey (see Section 5.3.3.4) and a visitor survey (see Section 5.3.3.5) at all the recreation facilities identified in Table 5.1-1. The survey sample will be stratified by recreation area, type of day (weekdays, non-holiday weekends, and holiday weekends), and time of day. The Districts' surveyors will vary the times each survey site is visited to ensure a range of visitation times and potential user groups over the course of the survey period. To ensure the Districts' surveyors visit the facilities/sites at different times, the surveyors will visit each facility following the same circuit or route, but will start at the next facility on the circuit for each successive survey day.

5.3.3.4 Observation Survey

During the observation survey, the Districts' surveyor will count and record the time, date, location, number of vehicles, vehicles with trailers and the type of trailer, vehicles with racks for boats, trailers, boats, people, day groups, overnight groups**,** and the types of recreation activities. The surveyor will also record the percent occupancy by location. Observations will be made, and recorded by site and area to include parking outside provided parking areas, and the number and type of boats at the boat launch facilities. This data will be used to identify the types of recreation activities in which visitors participate. Once the counts are completed, the surveyor will also administer an on-site recreation visitor questionnaire survey to randomly selected recreation visitors (Section 5.3.3.5).

5.3.3.5 Visitor Survey

The visitor survey will collect visitor perceptions, attitudes, and satisfaction levels on current resource conditions (i.e. users' feelings towards current water or use levels), visitors' zip codes, user characteristics, recreational activities, recreation facility development, management concerns, and overall recreation experiences. For all survey efforts, the number of refusals will be recorded. The visitor survey will be administered on-site.

Recreation researchers will train surveyors on random selection techniques for choosing groups at a site and participants within groups, introduction strategies, recording, and tracking refusals. Only members of a group who are 18 years or older will be asked to complete a survey. A target number of users to be surveyed during each period will be established based on target survey completions for the entire recreation season for each recreation area.

5.3.4 Step 3 – Estimate Current Recreation Use

Data routinely collected by DPRA will form the basis of an estimate of the number of Visitor Days (one person for all or part of one day) to the Don Pedro Project. Results of the observation and visitor survey (Section 5.3.3) will be used to characterize participation in various activities.

5.3.5 Step 4 – Identify Future Use and Demand Opportunities

The Districts will identify the future use and demand opportunities from three perspectives: (1) assessing the existing unmet demand; (2) assessing future recreation demand; and (3) assessing the regional uniqueness or significance of the Project for recreation. Each of these perspectives is described in detail below.

5.3.5.1 Existing Unmet Demand Assessment

Existing recreation use does not always represent the total existing recreation demand because there may be constraints that limit participation. While there are many potential constraints on recreation use (e.g., lack of free time, cost, geographic distance, lack of skills or equipment), a subset of participation constraints may be closely associated with site-specific management (e.g., limited access to lands or water, use limits or full occupancies at facilities, project operations that eliminate or diminish the quality of experiences and opportunities, or lack of information about available recreation opportunities). To assess the general level of unmet demand for the Project recreation resources, the Districts will perform the three subtasks described below.

<u>Assess Statewide and Regional Unmet Recreation Demand Information</u>
The Districts will review and summarize relevant information from the 2007 California Public Attitudes Outdoor Recreation Survey (CDPR 2007). In addition, the Districts will contact the California Department of Parks and Recreation (CDPR) and request access to the raw data to determine if the sample size is statistically valid to be used to develop a more regional or even local estimate of unmet demand; and to identify potential constraints that limit participation. If available, other sources of Project vicinity and Project region demand will be assessed. The focus of this assessment will be to identify possible recreation activities with substantial unmet demand with a qualitative discussion of participation constraints and whether these constraints are likely affected by Project operations and maintenance.

<u>Collect Unmet Project Recreation Demand Information</u>
The Districts will collect additional unmet recreation demand information from Project visitors in visitor surveys. The visitor surveys will ask visitors if there are any reservoir-based recreation activities they are interested in participating in at the Project, but cannot because of some form of barrier or other existing condition.

<u>Identify Potential Activities with High Unmet Demand at the Project</u>
The Districts will identify potential activities with high unmet demand at the Project based on the review of unmet demand information derived from the CDPR, the Project visitor survey, Project

monitoring data, and any other regional unmet demand sources (if any). Analysis will also attempt to identify likely barriers or constraints to participation, and whether those are related to Project operations or recreation management decisions.

5.3.5.2 Future Recreation Demand Assessment

This element of the study will provide information regarding the projected future recreation use in the Project over the next 30-50 years. Projecting the future is a speculative activity, especially over a long period. These projections, though, can be useful for general planning purposes to identify potential management issues that may occur in the future. This approach will include four subtasks.

<u>Review Existing Recreation Use Trends</u>
Since past use often helps predict future use, the Districts will review trends of recent Project recreation use. Likely sources of Project use will be: DPRA reports; California fishing license sales; and boating vessel registrations (for the counties where the majority of Project visitors originate from); local fishing guide activity; and recreation equipment sales (where available).

<u>Review Existing Population and Recreation Activity Participation Projections</u>
The Districts will summarize existing information on future projections from the California Department of Finance on projected population growth rates of the counties where the majority of the Project visitors originate. The Districts will also research projections from other available sources such as the U.S. Department of Agriculture, Forest Service (USFS) (i.e. Cordell et al. 1999) and other appropriate sources on future projections.

<u>Review Reasonably Foreseeable Events that May Influence Future Use</u>
Reasonably foreseeable events in the watershed may reasonably be expected to influence recreation use in the watershed over the license period. If an event is determined to be reasonably foreseeable, the Districts will make a qualitative assessment of its potential effect on future recreation use (if feasible).

<u>Estimate Future Recreation Use over the License Period</u>
Based on historical trends, future growth projections, and likely foreseeable actions in the watershed, the Districts will use professional judgment to estimate Project recreation use and facility utilization over the next 30-50 years. These estimates will only provide a general indication of how recreation use is expected to change over the license period. For the Project recreation use estimate projection, the Districts will rely on the population growth rates where the majority of Project visitors reside to project use. For the facility utilization projections (campgrounds and boat launch parking areas), the Districts will rely on the activity participation indices developed by the USFS for developed camping and motorized boating (Cordell et al. 1999).

5.3.5.3 Regional Uniqueness and Significance Assessment

This component of the study will assess the regional uniqueness and significance of the Project's primary recreation opportunities in three subtasks.

Review Results of Visitor Questionnaires

The Districts will review the results of the visitor questionnaires. The Districts anticipate that boating, water sports (water skiing, wakeboarding, etc.), camping, fishing, picnicking, and swimming will likely be among the top water-related recreation activities at the Project.

Identify Regional Recreational Opportunities

The Districts will identify the geographic draw of the Project's top primary recreation opportunities identified in the task above. The Districts will assess the geographic extent of visitors' origins and location of the alternative recreation resource areas where visitors participate in their primary recreation activities. The Districts will identify regional alternatives for comparable facilities or areas from sources such as guidebooks, on-line web resources, state and national parks, BLM, USFS, and county tourism sources.

Assess the Uniqueness and Significance of the Project-Related Recreation Opportunities

First, the Districts will analyze the visitor responses to a survey question that asks visitors to rate the relative uniqueness of the Project reservoir. The question has pre-set responses using a 5-point scale with a rating of 1 meaning the reservoir provided an "extremely common" opportunity and a rating of 5 meaning the reservoir provided an "extremely unique" opportunity. Based on the average responses, the Districts will categorize the relative uniqueness of the Project using the following categories.

- Rating of 1.0 = extremely common
- Rating of 1.1 to 2.0 = common
- Rating of 2.1 to 3.0 = somewhat common
- Rating of 3.1 to 4.0 = somewhat unique
- Rating of 4.1 to 4.9 = unique
- Rating of 5.0 = extremely unique

Second, for the Project's most popular primary recreation activities, the Districts will identify if these recreation opportunities are of local, regional, or state significance. Licensees will determine the level of significance based on the county where visitors reside based on the following definitions.

- Local Significance: visitors from Tuolumne County (where the Project is located)
- Regional Significance: visitors from counties surrounding Tuolumne County)
- State-Wide Significance: visitors from all other counties outside of the local and regional counties

In addition, the Districts will describe what is unique and special about the most popular recreation opportunities based on the comments provided by the visitors.

5.3.6 Step 5 – Data Analysis and Report Preparation

5.3.6.1 Data Analysis

The survey responses provide a rich source of information about visitor use patterns, characteristics, preferences, and perceptions. Following data entry and comprehensive QA/QC procedures, the Districts will address the study objectives and issues through analysis of the responses to questionnaires and observation data. Descriptive statistics will be employed to explain visitor responses to each of the survey questions. Additional statistics may be utilized to check for differences between various recreation groups (e.g., motorized versus non-motorized users; shoreline anglers versus boating anglers). Survey analyses will likely focus on the following perspectives:

- Day users
- Overnight users
- Developed facility users
- Dispersed users
- User groups defined by primary recreation activity (e.g., boaters, anglers, hikers, backpackers, bicyclers)
- Motorized versus non-motorized recreationists

Observation use data will address the types and frequency of use occurring within each Project recreation resource area.

6.0 Schedule

The facility condition and recreation use assessment is planned for 2012.

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

The methods presented in this study plan are consistent with those used in recent relicensings in California, including most recently for the Merced Irrigation District's Lake McClure and McSwain Reservoir. Additional surveys with similar methodology include the Yuba-Bear/Drum-Spaulding Project's Lake Spaulding, Rollins Reservoir, Bowman Lake, Jackson Meadows Reservoir, Fordyce Lake, and Lake Valley Reservoir.

8.0 Deliverables

The Districts will prepare a report on recreation facility condition and public accessibility for inclusion in the Initial Study Report to be filed on or before January 4, 2013.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

California Department of Parks and Recreation (CDPR). 2007. California Outdoor Recreation Plan 2007, An Element of the California Outdoor Recreation Planning Program. California State Parks. Sacramento, CA.

Cordell, Ken H, Betz, C., Green, G.T., Mou, S., Leeworthy, V.R., Wiley, P.C., Barry, J.J., and Hellerstein, D. 1999. Outdoor Recreation for 21st America. A report to the nation: A national survey on recreation and the environment. Venture Publishing, Inc. State College, PA.

U.S. Access Board (USAB). 2004. Americans with Disabilities Act and Architectural Barriers Act Accessibility Guidelines (ABAAG). Washington, D.C. 304 pp.

U.S. Department of Interior, Bureau of Land Management (BLM). 2008. Sierra Resource Management Plan and Record of Decision. U.S. Department of the Interior, Bureau of Land Management Mother Lode Field office, El Dorado Hills, California. pp. 26-27.

ATTACHMENT A

SAMPLE FACILITY EVALUATION FORMS
(Inventory, Condition, Accessibility, and Use Impact)

Facility Inventory and Condition Form

___________Date: ____Facility Name: __________________________________Location:

_______Surveyor: _____ Site Type: Campground / Day Use / Boat Launch / Other:

A. SITE AMENITIES

Type of Amenity		#	ADA	Condition	Notes
Campground	Standard campsite			G / F / P	
	RV campsite			G / F / P	
	Hike-in/tent site			G / F / P	
	Vehicle spur			G / F / P	
	Picnic table			G / F / P	
	Fire ring			G / F / P	
	Cooking grill			G / F / P	
	Tent pad			G / F / P	
	Food locker			G / F / P	
	Water spigot			G / F / P	
Picnic Area	Picnic table			G / F / P	
	Cooking grill			G / F / P	
	Food locker			G / F / P	
	Water spigot			G / F / P	
	Water fountain			G / F / P	
Restroom	Type (Pit/Vault/Flush)			G / F / P	
	Stalls/unit			G / F / P	
	Sink			G / F / P	
Boat Launch	Launch ramp			G / F / P	
	Dock/Pier			G / F / P	
				G / F / P	
Other	Marina			G / F / P	
	Mooring docks			G / F / P	
	Trash Receptacles			G / F / P	
				G / F / P	

B. ROADS, PARKING AND SIGNS

		Condition
PARKING	Total Spaces: _____ Std: _____ ADA: _____ Van ADA: _____ Double: _____ Overflow: _____	Condition
	Surface Type: *Asphalt* *Concrete* *Gravel* *Other:___________*	G / F / P
	Barrier Type: *None* *Curb* *Boulder* *Wood post* *Log* *Other:___________*	G / F / P
ROADS	Road Type: *Loop* *Semi-loop* *In-Out* *Other:___________*	Condition
	Surface Type: *Asphalt* *Concrete* *Gravel* *Other:___________*	G / F / P
	Barrier Type: *None* *Curb* *Boulder* *Wood post* *Log* *Other:___________*	G / F / P

Signs	#	Size	Material	Condition	Comments
FERC Project			wood / metal / other	G / F / P	
Facility ID			wood / metal / other	G / F / P	
Regulations			wood / metal / other	G / F / P	
Directional			wood / metal / other	G / F / P	
Interpretive			wood / metal / other	G / F / P	

C. SITE LAYOUT/SCHEMATIC

D. SITE CONDITION EVALUATION

Component	Score (0 – 2)	Comments
Roads/Parking		
Buildings		
Signs		
Amenities		
OVERALL		

E. ACCESSIBILITY EVALUATION

Component	Score (0 – 2)	Comments
Accessibility		

F. NOTES

Accessibility Evaluation Form

YES	NO	PARKING LOTS
______	______	1. Are accessible spaces approximate to the facility?
______	______	a) Are they identified as reserved for use by individuals with physical abilities?
______	______	2. Are there parking spaces open on one side, allowing room (12’ minimum width) for individuals in wheelchairs or on braces and crutches to get in and out onto a level surface?
______	______	a) Do they allow people to get in and out on a level surface?
______	______	3. Is it unnecessary for individuals in wheelchairs or those using braces and crutches to wheel or walk behind parked cars?
______	______	4. Is distribution of spaces for use by the disabled in accordance with the frequency and persistency of parking needs?

YES	NO	PATHWAYS/WALKS
______	______	1. Are public walks at least 48” wide?
______	______	a) Is the gradient no greater than 5%?
______	______	2. Are walks of a continuing common surface, not interrupted by steps or abrupt changes in level?
______	______	3. Wherever they cross other walks, driveways, or parking lots, do walks blend to a common level?
______	______	4. Do walks have a level platform at the top which is (a) at least 5’ by 5’ if the door swings out onto the platform or toward the walk, or (b) 3’ by 5’ if the door doesn’t swing onto the platform?
______	______	5. Does the platform extend at least 1 foot beyond each side of the doorway?

YES	NO	RAMPS
______	______	1. Do ramps have a slope no greater than 1 foot rise in 12 feet?
______	______	2. Do ramps have handrails on at least one side?
______	______	a) Are they 32” in height measured from the surfaces of the ramp?
______	______	b) Are the surfaces smooth?
______	______	c) Do they extend 1’ beyond the top & bottom of the ramp?
______	______	3. Do ramps have a non-slip surface?
______	______	a) Do platforms comply with Questions B4 & B5?
______	______	4. Do ramps have at least 6 feet of straight clearance at the bottom?
______	______	5. Do ramps have level platforms at 30 foot intervals for purposes of rest and safety, and wherever they turn?

YES	NO	ENTRANCES/EXITS
______	______	1. Is at least one primary entrance to each building usable by individuals in wheelchairs? (It is preferable that all or most entrances/exits should be accessible to, and usable by, individuals in wheelchairs or other forms of physical disability).
______	______	2. Is at least one entrance usable by individuals in wheelchairs on a level that would make the elevators accessible?

YES	NO	DOORS AND DOORWAYS
______	______	1. Do doors have a clear opening of no less than 32” when open?
______	______	a) Are they operable by a single effort? Note: Two-leaf doors are not usable by those with disabilities unless they operate by single effort, or unless one of the two leaves meets the 32” width.
______	______	2. Are the doors operable with pressure or strength, which could reasonably be expected from disabled persons?
______	______	3. Is the floor on the inside and outside of each doorway level for a distance of 5 feet from the door in the direction the door swings?
______	______	a) Does it extend 1’ beyond each side of the door?
______	______	4. Are sharp inclines and abrupt changes in level avoided at doorsills?
______	______	5. Do door closers allow the use of doors by the physically disabled persons?

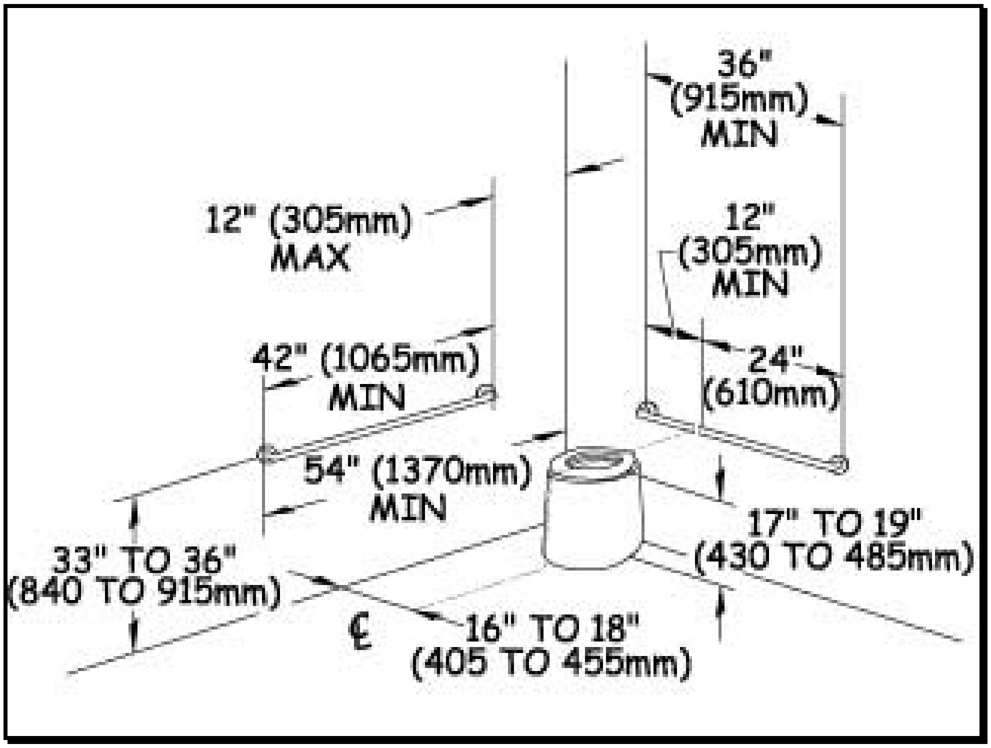
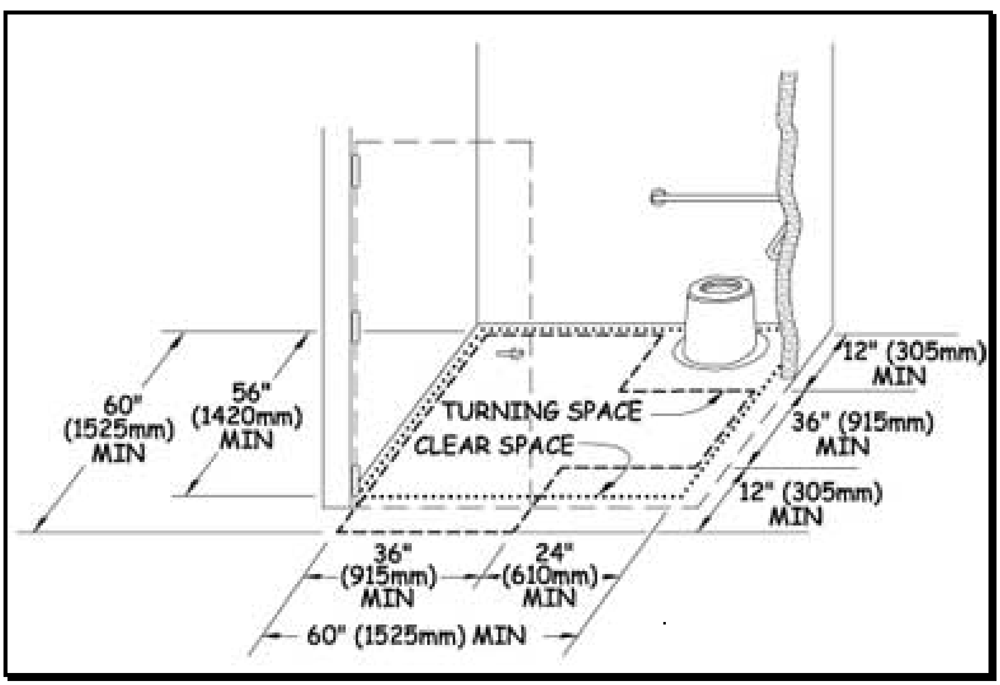
Accessibility Evaluation Form (continued)

YES	NO	RESTROOMS
______	______	1. Are there an appropriate number of toilet rooms for each sex?
______	______	a) Are they accessible to physically handicapped persons?
______	______	b) Are they usable by physically handicapped persons?
______	______	2. Do toilet rooms have turning space 60” x 60” to allow traffic of individuals in wheelchairs?
______	______	3. Do toilet rooms have at least one toilet stall that:
______	______	a) is three feet wide?
______	______	b) is at least 4’8” (preferably 5 feet) deep?
______	______	c) has a door that is 32” wide and swings out?
______	______	d) has grab bars on each side, 33” high and parallel to the floor, 1½” in diameter, with 1½” clearance between rail and wall, fastened securely to the wall at the ends and center?
______	______	e) has a width of at least 48” between the wall and the front of the stall entrance?
______	______	f) has water closet with seat 20” from the floor?
______	______	4. Do toilet rooms have lavatories with narrow aprons, which, when mounted at standard height, are usable by individuals in wheelchairs?
______	______	5. Are drain pipes and hot water pipes covered or insulated?
______	______	6. Are some mirrors and shelves at a height as low as possible and no higher than 40 inches above the floor?
______	______	7. Do toilet rooms for men have wall mounted urinals with the opening of the basin 19” from the floor, or have floor mounted urinals that are level with the main floor of the toilet room?
______	______	8. Do toilet rooms have towel racks mounted no higher than 40” from the floor?
______	______	a) are toilet dispensers mounted no higher than 40” from the floor?
______	______	b) are other dispensers mounted no higher than 40” from the floor?
______	______	c) are disposable units mounted no higher than 40” from the floor?
______	______	9. Are racks, dispensers and disposal units located to the side of the lavatory rather than directly above?

YES	NO	WATER FOUNTAINS
______	______	1. Is there an appropriate number of water fountains?
______	______	a) Are they accessible to physically handicapped persons?
______	______	b) Are they usable by physically handicapped persons?
______	______	2. Do water fountains or coolers have up-front spouts and controls?
______	______	3. Are they hand operated?
______	______	4. Are they hand and foot operated?
______	______	5. If coolers are wall mounted, are they hand operated, with basins 36” or less from the floor?
______	______	6. If there are floor mounted fountains, are spouts no higher than 30”?
______	______	7. Are these fountains accessible to people in wheelchairs?

YES	NO	CONTROLS
______	______	1. Are switches and controls for light, heat, ventilation, window draperies, fire alarms, and all similar controls of frequent or essential use, within the reach of individuals in wheelchairs?

Accessibility Evaluation Form (continued)

ACCESSIBILITY FIGURES DETAILING SIZE AND SPACE REQUIREMENTS FOR PIT TOILETS
 Figure - Grab Bar Requirements for Pit Toilets
 Figure - Turning Space Requirements for Pit Toilets

Recreation Use Impact Evaluation Form

SECTION A – FOR ALL RECREATION SITES		
VARIABLE NAME	QUESTION	RESPONSE CHOICES
ID Number	Identification number	
Resource Area	Which resource area is site located in?	
Litter	In general, how much litter is found at this site?	1. Trace amounts: less than a handful or none 2. Small: about a handful 3. Medium: about a bucketful 4. Large: about a 33 gallon garbage bag full 5. Excessive: over one garbage bag full
Dump	Does this site get used as a dump (not just litter from camping)?	1. No, rarely 2. Yes, sometimes (large items such as cars, beds, etc. in evidence)
Tree cutting	Does the site show signs of tree cutting for firewood?	1. Low: few signs 2. Medium: some signs, especially lower branches of live trees 3. High: many signs, including excessive cutting of live trees
Access Barriers	Are there management- placed barriers to prevent vehicle access to parts of the site & have people moved the barriers?	1. No barriers placed there 2. Barriers there & have not been moved 3. Barriers have been moved
Fire rings/ vegetation clearances	How many fires rings do not have appropriate vegetation clearing?	Report # of fire rings that to do not have 8 to 10 feet vertical & 5 feet horizontal vegetation clearance:
Vegetation	What is dominant vegetation type at site?	Report % vegetation types: Forest_____ Meadow_____ Riparian_____ Other_____
Soil	What is the dominant soil type at the site?	Report the % of soil type: Sandy____Clay_____Rock_____Other____________ Comment on drainage:
Shade	Does the site have good shade from rocks or trees?	1. Low: few trees or rocks with shade 2. Medium: some shade trees/rocks for some parts of the day 3. High: many trees/rocks that offer shade through entire day.
Screening	Does the site screen groups from each other?	0. Not applicable: single site (not cluster) 1. Low: virtually no screening between sites 2. Medium: some screening 3. High: extensive screening
Reservoir views	Does the site have views of the reservoir?	1. Poor or no views. 2. Some views, but not high quality 3. High quality views.
Landscape views	Does the site offer views of the surrounding landscape?	1. Poor or no views. 2. Some views, but not high quality 3. High quality views.
Reservoir proximity	Is the site on or off the reservoir?	1. < 100 feet 2. 100 to 200 feet 3. > 200 feet
Reservoir accessibility	Is the reservoir easy to access from the site?	1. Easy: <20’ above reservoir, obvious trail, shorter trail (<100’), not too steep. 2. Medium difficulty: over 20’ above reservoir less obvious trail, narrower trail, some switchbacks, some scrambling over talus, some poison oak. 3. Hard: >200’ above reservoir; less obvious trail; extensive scrambling; poison oak
Creeks	Is the site close to other creeks or springs?	1. < 100 feet 2. 100 to 200 feet 3. > 200 feet
Hiking Trail Type	Is the trail developed or user-created?	1. Developed trail 2. User-created trail
Hiking Trail Lengths	Length of trail (feet)?	
ORV	Does the site show signs of nearby ORV use?	1. No 2. Yes
Bare ground	Does the site show signs of extensive use & loss of ground vegetation?	1. Low: small areas around fire rings & tent sites 2. Medium: large areas around fire rings & tent sites 3. Large: large contiguous areas & multiple trails to satellite use areas
Erosion	Does the site show signs of erosion?	1. None 2. Low: nominal signs of erosion 3. Medium: visible signs of erosion/steep slopes 3. High: large contiguous areas of erosion on steep slopes
Tent availability	Does the site have good places for tents?	1. Poor: few, small, low quality 2. Fair: more than one, better quality 3. Good: more than two sites with flat, unbrushy areas
White Flowers	# of “White Flowers” present (toilet paper)?	

Adapted from Whittaker & Shelby (2001)

SECTION B – FOR DISPERSED SITES ONLY		
VARIABLE NAME	QUESTION	RESPONSE CHOICES
Site Type	What type of site is it?	1. Single site 2. Cluster site : Max. No. Groups________Typical No. Groups______
Use	Is the site currently used?	1. No 2. Yes, but rarely 3. Commonly used
Access	Is the site primarily accessible by the road, a trail, or by the reservoir?	1. Road (within 50 feet) 2. Trail from road 3. From the reservoir
Existing parking spaces	How many vehicle places are available at the site (or at access to the site)?	Report the # of obviously used parking places if those are distinct. A. An indistinct areas that could accommodate 7 or fewer vehicles B. An indistinct area that could accommodate more than 7 C. No parking associated with the site or you don't know.
Long-Term Use	Is the site used for long term camping (over 14 days at one time)?	1. Rarely or never used long-term 2. Occasionally used long-term 3. Commonly used long-term
Existing camp use	How many parties appear to be able to use the site at one time?	Report # of fire rings or other obviously separated use areas.

Use Impact Area (North-South x East-West):

Comments (user impacts, sensitive areas, general observations, etc.):

Site Diagram:

Adapted from Whittaker & Shelby (2001)

ATTACHMENT B

SAMPLE VISITOR SURVEY INSTRUMENT

Date ___________ Time _______ Survey No. [ ]

Recreation Visitor Survey for the Yuba River Development Project (FERC Project No. 2246)

The following survey has been designed to help Modesto Irrigation District and Turlock Irrigation District understand the needs of users of the recreational facilities and opportunities at the Don Pedro Reservoir.

These questions are generally for the **overall recreation area** (*i.e.*, the Don Pedro Reservoir). However, some questions are for the **specific recreation facility or site** you are currently visiting (*e.g.*, Fleming Meadows, Blue Oaks, Moccasin Point). Please be aware of this distinction when reading each question.

Your Trip Characteristics

1. Please write the name of the recreation site/facility where you have received this survey: ________________________ .

2. If you are staying overnight, where are you staying or camping today? (Check One)
   - ❑ Not staying overnight, this is a day visit only.
   - ❑ RV park or campground. If so, what is the name of the campground you are staying at? ________________ .
   - ❑ Dispersed shoreline camping
   - ❑ Staying at a hotel or motel. If so, which community/town/city? ________________ .
   - ❑ Other (please specify): ________________ .

3. When did you **arrive** and **plan to depart** this Don Pedro Reservoir? *(For the time, please specify AM or PM)*

Arrival		➡	Estimated Departure	
______	______		______	______
Date	Time (am / pm)		Date	Time (am / pm)

4. A) What year did you **first visit** this Don Pedro Reservoir: __________.

   B) Approximately **how many times** have you visited since your first visit: __________.

5. Which of the following best describes your recreation group? (Check One)

   ❑ Alone ❑ Friends ❑ Family & Friends ❑ Other (specify): ________________.
   ❑ Family ❑ Multiple Families ❑ Organized Outing Group

6. How many people, vehicles, boats, and water-related equipment are included with the **group you traveled with** during your current visit to Don Pedro Reservoir? (Write a number for each)

   _____ People (include yourself)
   _____ Vehicles used to travel to the area (include trucks, cars, RVs, etc.)
   _____ Off-Highway Vehicles (OHVs) – 2, 3, or 4 wheels
   _____ Trailer for OHV
   _____ Trailer for Boat/PWC/Raft
   _____ RV/Camper ➔ Length in ft. ________ *(if more than 1, give range)*
   _____ Camper Trailer ➔ Length in ft. ________ *(if more than 1, give range)*
   _____ Tents
   _____ Powerboats (under 15 horsepower)
   _____ Powerboats (15 horsepower or larger)
   _____ Personal Watercraft (PWC)
   _____ Canoes/kayaks/other non-motorized watercraft
   _____ Fishing tubes
   _____ River tubes
   _____ Other, specify: ________________

7. Check each of the activities that **you expect to participate in** during your current visit to Don Pedro Reservoir. (Check All That Apply)

- ❑ Camping
- ❑ Driving for pleasure
- ❑ Fishing
- ❑ Houseboating
- ❑ Flat-water, motorized boating
- ❑ Flat-water, non-motorized boating (*e.g.*, kayaks, canoes)
- ❑ Gold panning
- ❑ Hiking or walking
- ❑ Horseback riding
- ❑ Hunting (specify type): ____________________
- ❑ Mountain biking
- ❑ OHV use
- ❑ Picnicking
- ❑ River/stream boating (*e.g.*, raft, kayak, canoe)
- ❑ Swimming
- ❑ Target Shooting
- ❑ Water skiing
- ❑ Wildlife viewing (birding, etc)
- ❑ Other (specify): ____________________
- ❑ Other (specify): ____________________

8. Please list your **primary recreation activity** for your current visit:____________________ .

9. Please list (up to 3) other areas in central California where you visit to participate in your **primary recreation activity**.

1) ____________________ 2) ____________________ 3) ____________________

Your Thoughts on Existing Conditions at Don Pedro Reservoir ...

10. Please indicate whether or not the **level of the reservoir** or **river** was a problem for each of the following at the recreation area you are currently visiting. (Check One For Each Item)

(Circle one number for each)	Not a problem	A small problem	Neither	A moderate problem	A large problem	No Opinion/ Not Applicable
Ability to use beach area	5	4	3	2	1	❑
Ability to safely swim	5	4	3	2	1	❑
Ability to launch or take out boat	5	4	3	2	1	❑
Ability to safely boat	5	4	3	2	1	❑
Ability to utilize trails	5	4	3	2	1	❑
Ability to fish along the shoreline	5	4	3	2	1	❑
Ability to access the shoreline	5	4	3	2	1	❑
Ability to moor or dock boat	5	4	3	2	1	❑
Scenic quality of shoreline	5	4	3	2	1	❑
Other (specify):____________	5	4	3	2	1	❑

11. A) Did you experience any **conflict** with other recreation users in Don Pedro Reservoir (*i.e.*, anyone who negatively impacted your experience)?

❑ Yes ❑ No

B) If YES, what was the activity of the other recreation user? (Check One)

- ❑ Bird watcher
- ❑ Camper
- ❑ Hiker
- ❑ Motorized boater
- ❑ Non-motorized boater
- ❑ Mountain biker
- ❑ OHV (2, 3, or 4 wheels)
- ❑ Unsure
- ❑ Other (specify): ____________________

C) If you experienced conflict, please check the reasons that contributed to the conflict. (Check All That Apply)

❑ Proximity to where we were ❑ Rowdiness ❑ Loudness ❑ Other (specify): ____________________

12. Please rate the **acceptability** of the following **Existing Conditions** at the Recreation Facility / Site you are currently visiting (*this site is identified at the start of the survey*).
Important: Please only circle a number for the items that you used during your visit to this Specific Recreation Facility / Site. Please **check** the "*Did Not Use*" box, if you did not use the item or it does not exist at the Specific Recreation Facility / Site.

FACILITIES	Acceptable	Slightly Acceptable	Neither	Slightly Unacceptable	Unacceptable	Did Not Use/ Not Applicable
Camp sites	5	4	3	2	1	❑
Camp site parking spur size	5	4	3	2	1	❑
Vegetation or screening between camp sites	5	4	3	2	1	❑
Shading of camp sites	5	4	3	2	1	❑
Picnic sites	5	4	3	2	1	❑
Vegetation or screening between picnic sites	5	4	3	2	1	❑
Shading of picnic sites	5	4	3	2	1	❑
Food storage locker	5	4	3	2	1	❑
Restroom	5	4	3	2	1	❑
Potable water	5	4	3	2	1	❑
Trash receptacle	5	4	3	2	1	❑
Vehicle parking areas	5	4	3	2	1	❑
Trailer parking areas	5	4	3	2	1	❑
Boat ramp parking area	5	4	3	2	1	❑
Boat launch/take out	5	4	3	2	1	❑
Boat mooring/docking	5	4	3	2	1	❑
Other (specify):________________________	5	4	3	2	1	❑

If you rated a condition **"unacceptable"**, please identify the item from the table & describe the location and nature of the unacceptable condition:

ACCESS	Acceptable	Slightly Acceptable	Neither	Slightly Unacceptable	Unacceptable	Did Not Use/ Not Applicable
Width of roads within the site	5	4	3	2	1	❑
Condition of roads within the site	5	4	3	2	1	❑
Foot trails to the shoreline	5	4	3	2	1	❑
Foot trails around the shoreline	5	4	3	2	1	❑
Signage to the recreation site	5	4	3	2	1	❑
Signage within the recreation site	5	4	3	2	1	❑
Other (specify):________________________	5	4	3	2	1	❑

If you rated a condition **"unacceptable"**, please identify the item from the table & describe the location and nature of the unacceptable condition

INFORMATION RESOURCES	Acceptable	Slightly Acceptable	Neither	Slightly Unacceptable	Unacceptable	Did Not Use/ Not Applicable
Interpretive/education information	5	4	3	2	1	❑
Recreation visitor information	5	4	3	2	1	❑
Reservoir water surface elevation information	5	4	3	2	1	❑
River/stream flow information	5	4	3	2	1	❑
Other (specify):________________________	5	4	3	2	1	❑

If you rated a condition **"unacceptable"**, please identify the item from the table & describe the location and nature of the unacceptable condition:

13. A) Did/do you feel **crowded** at any of the following locations during your visit to Don Pedro Reservoir today? (Circle One Number For Each Item)

LOCATION/AREA	Not At All Crowded		Slightly Crowded		Moderately Crowded			Extremely Crowded		Did Not Use/ Not Applicable
Campground	1	2	3	4	5	6	7	8	9	❑
Shoreline camping area	1	2	3	4	5	6	7	8	9	❑
Picnic area	1	2	3	4	5	6	7	8	9	❑
Boat launch	1	2	3	4	5	6	7	8	9	❑
Boat docking/mooring	1	2	3	4	5	6	7	8	9	❑
Trail	1	2	3	4	5	6	7	8	9	❑
Trailhead	1	2	3	4	5	6	7	8	9	❑
Other shoreline area	1	2	3	4	5	6	7	8	9	❑
Water surface	1	2	3	4	5	6	7	8	9	❑
Other (specify): ____________	1	2	3	4	5	6	7	8	9	❑

B) If you felt crowded, did you modify your recreation plans because you felt crowded? ❑ Yes ❑ No ❑ Did Not Feel Crowded

C) If YES, what did you do? ❑ Moved to a new location ❑ Changed your activity ❑ Did nothing ❑ Changed the time of day ❑ Choose not to recreate ❑ Other (specify): ____________

14. A) Are you recreating at your preferred location today? ❑ Yes ❑ No

B) If NOT, what was your preferred location? ____________ .

C) **Why** were you unable to use or go to your preferred location? ____________ .

15. A) Are there any places in Don Pedro Reservoir where you feel unsafe? ❑ Yes ❑ No

B) If YES, please identify why you feel unsafe. (Check All That Apply)

❑ Wild animals ❑ Unattended campfires ❑ Speeding boats/PWC ❑ Other visitors behavior (specify): ____________
❑ Unleashed dogs ❑ Firearm discharge ❑ Speeding vehicles ❑ Other (specify): ____________

C) If YES, please identify the location where you feel unsafe:____________.

16. Are there any barriers that prevent you or a member of your group from participating in desired recreation activities at Don Pedro Reservoir?

❑ Yes ❑ No If YES, please identify the location(s), the type of barrier(s) in the space below.

17. A) Please rate the relative uniqueness of the **recreation opportunities** at Don Pedro Reservoir relative to similar to opportunities within central California:

Extremely Common Opportunity ◄——► Extremely Unique Opportunity

1 2 3 4 5

B) Please explain, what, if anything is **special** or **unique** about this recreation area relative to other recreation areas in central California.

About You

18. How did you learn about Don Pedro Reservoir? ❑ Word of mouth ❑ Internet ❑ Don Pedro Recreation Agency ❑ Other: ____________________

19. What is the zip code for your primary residence? ______________ OR __________________.

Any Additional Comments?

20. Please let us know if you have any additional comments regarding your recreation experience during your visit in the space below.

Thank You For Taking The Time To Participate In This Survey!

STUDY PLAN RR-2

TURLOCK IRRIGATION DISTRICT AND MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT FERC NO. 2299

Whitewater Boating Take Out Improvement Feasibility Study

July 2011

Related Study Requests: AR-18, BLM-05, Cadagan-01, Hackamack-01, NPS-03

1.0 Project Nexus

The Federal Energy Regulatory Commission (FERC) regulations require that the license application include a description of the existing recreation facilities to be continued and maintained during the term of the new license, new measures or facilities proposed by the applicant for the purpose of enhancing recreational opportunities at the Project, and measures to ensure the safety of the public in its use of Project lands and waters. Recreation is a recognized project purpose at FERC-licensed projects under Section 10(a) of the Federal Power Act.

The Ward's Ferry Bridge area at the upstream end of the Don Pedro reservoir is used as a take out location by whitewater boaters who run the whitewater reach of the Wild and Scenic Tuolumne River above the Don Pedro Project. The Don Pedro Recreation Agency (DPRA) maintains a restroom at this location on the shoulder of Ward's Ferry Road above the reservoir to avoid improper waste disposal at this area of the reservoir.

2.0 Resource Agency Management Goals

The U.S. Forest Service (USFS) manages the Tuolumne River Wild and Scenic Corridor. The existing take out used by commercial and private boaters that boat the lower reach of the Corridor is located on federal lands administered by the U.S. Department of Interior, Bureau of Land Management (BLM) within the Don Pedro Project Boundary (known as the Ward's Ferry Bridge Take Out).

The Tuolumne Wild and Scenic River Management Plan (USFS 1988) has established management goals for the wild and scenic river corridor:

- Provide a range of outdoor recreation activities, managing resources for public use, protecting and enhancing Wild and Scenic River values.
- Work with proponents of hydroelectric projects outside of the corridor to minimize adverse environmental impacts and to provide for recreation opportunities created by the project that will meet the objectives of the USFS management plan.

BLM has interests in federal lands that they manage in and adjacent to the Project, including the Ward's Ferry Bridge take out location. These federal lands are part of a larger land unit managed by the BLM in accordance with the Sierra Resource Management Plan (BLM 2008). BLM has established recreation management goals for all the lands managed under this plan:

- Ensure the continued availability of outdoor recreational opportunities while protecting other resources and uses.
- Ensure adequate river flows for boating, fishing, swimming, etc.

3.0 Study Goals

The primary goal of the study is to assess the feasibility of improving the existing take out location for continued use by whitewater boaters on the upstream end of the Don Pedro Project. The Districts will evaluate the feasibility of physical improvements to the Ward's Ferry Bridge location and also assess the feasibility of alternative take out locations.

4.0 Existing Information and Need for Additional Information

The upper Tuolumne River watershed, the subbasin above about River Mile (RM 80), covers approximately 1,300 square miles of drainage area and contains all the major tributaries of the Tuolumne River, including the North Fork, South Fork, Middle Tuolumne, Clavey River, Cherry Creek, and Eleanor Creek. The upper Tuolumne River extends from the confluence of the Dana and Lyell Forks to just below the confluence of the North Fork at approximate elevation 850 feet. The average gradient of the river is roughly 110 feet/mile, but local gradients vary greatly. The upper Tuolumne is dominated by federal land ownership, primarily the Stanislaus National Forest and Yosemite National Park. From upstream of Tuolumne Meadows in Yosemite National Park to about RM 80, a total of 83 miles of the Tuolumne River is designated as a National Wild and Scenic River (an 8-mile stretch at Hetch Hetchy Reservoir is excluded). Flows in the upper Tuolumne River are regulated and controlled by the City and County of San Francisco's (CCSF) Hetch Hetchy Water and Power system, including Hetch Hetchy Reservoir, Lake Eleanor and Cherry Lake, and CCSF's extensive infrastructure of water transmission and water power facilities.

This reach of the Tuolumne River is also a popular whitewater boating resource, with boater access managed by the USFS. The Ward's Ferry Bridge take out site, located within the Don Pedro Project boundary is an established take out location for commercial and private individual whitewater boaters. Over 3,000 whitewater boaters use the Wards Ferry Bridge location annually, with most of the use occurring April through September. Adequate information exists on the level and type of use that is occurring; therefore no observational studies to estimate use are proposed.

Currently, the Ward's Ferry Bridge take out location presents challenges to safe and efficient take out due to topography, condition of the access road, and the frequency of vandalism that occurs at the site. BLM, National Park Service, and other relicensing participants have requested that the Districts research and identify potential improvements to whitewater boating take out opportunities to enhance the boating experience.

5.0 Study Methods

5.1 Study Area

The study area encompasses the upstream reaches of the Don Pedro Reservoir in the Tuolumne River and Moccasin Creek (Figure 5.1-1 located at the end of this Study Plan).

5.2 General Concepts

The Districts propose to conduct a physical assessment of the existing take out and assess the feasibility of alternative locations to characterize site constraints and opportunities for safe and efficient take out activities.

5.3 Study Methods

Site characteristics to be assessed at the existing take out and perhaps alternative locations will include proximity to the terminus of the whitewater run, proximity to improved roads, site topography and bank slope, and presence of sensitive resources. Site conditions will be detailed quantitatively, described narratively, and photographed.

Focus groups, interviews, and/or questionnaires with guides and boaters familiar with the Tuolumne River and the Ward's Ferry Bridge take out will be used to elicit knowledge on use of the existing site, potential improvements, and alternative sites.

Information from the site assessment(s) and guides and boaters will be used to develop proposed alternative take out locations and potential improvements. Study results may be used in relicensing to develop a preferred alternative for a whitewater boating take out site at the upstream end of the Don Pedro Project.

6.0 Schedule

The whitewater boating take out improvement feasibility study is planned for 2012.

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

The proposed methods for this study are consistent with professional practices. Feasibility assessments based on consideration of site characteristics and constraints is commonly used in recreation planning and management, including relicensing proceedings. Opportunities and constraints analysis has been applied successfully at other FERC-licensed hydropower projects.

8.0 Deliverables

The Districts will prepare a report on the whitewater boating take out improvement feasibility assessment for inclusion in the Initial Study Report to be filed on or before January 4, 2013.

9.0 Level of Effort and Cost

Study plan implementation cost will be provided in the Revised Study Plan.

10.0 References

U.S. Department of Interior, Bureau of Land Management (BLM). 2008. Sierra Resource Management Plan and Record of Decision. U.S. Department of the Interior, Bureau of Land Management Mother Lode Field office, El Dorado Hills, California.

U.S. Forest Service. 1988. Tuolumne Wild and Scenic River Management Plan. Produced by Pacific Southwest Region, Stanislaus National Forest. Reprinted 2002.

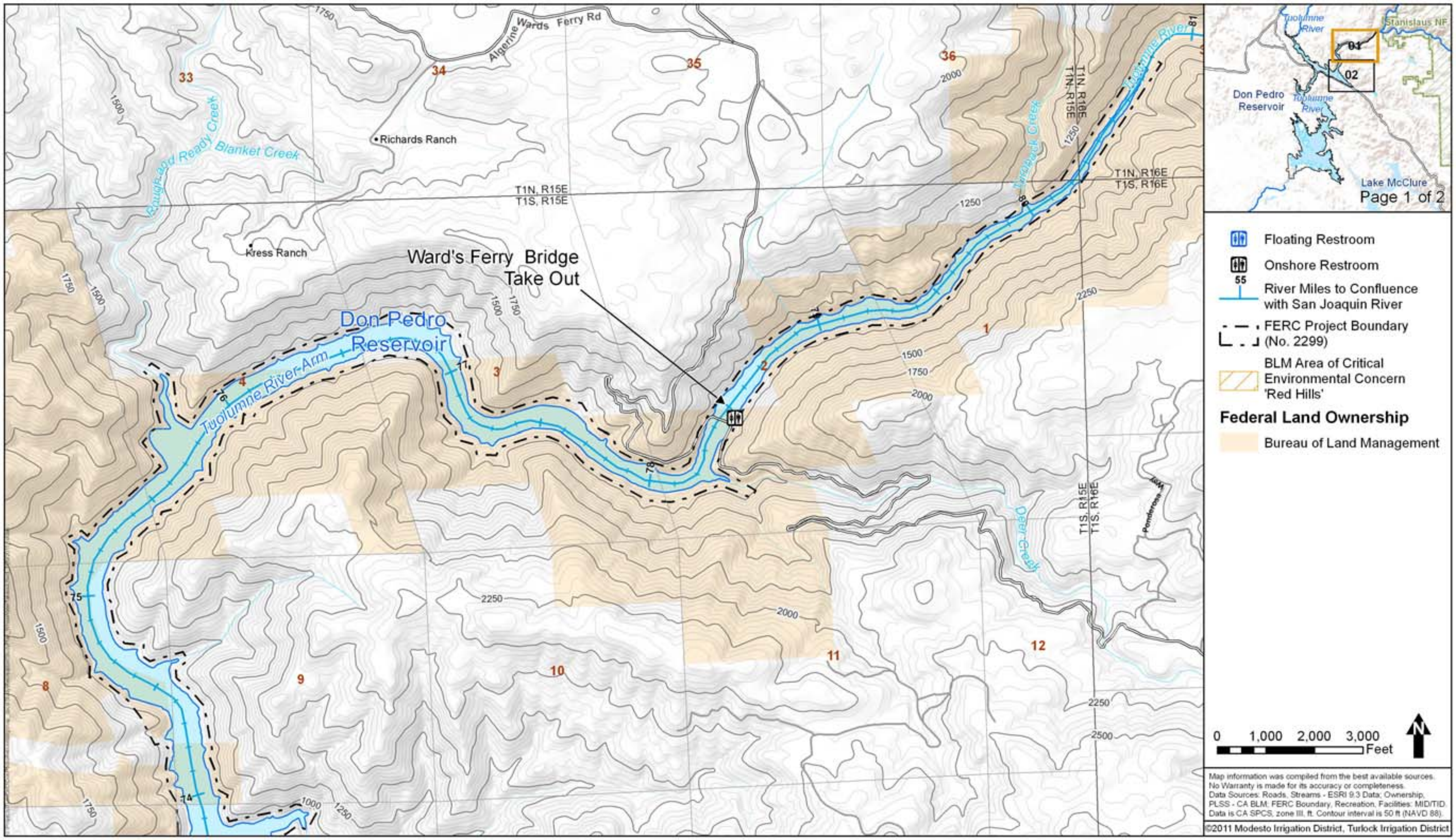


Figure 5.1-1 Project study area (page 1 of 2).

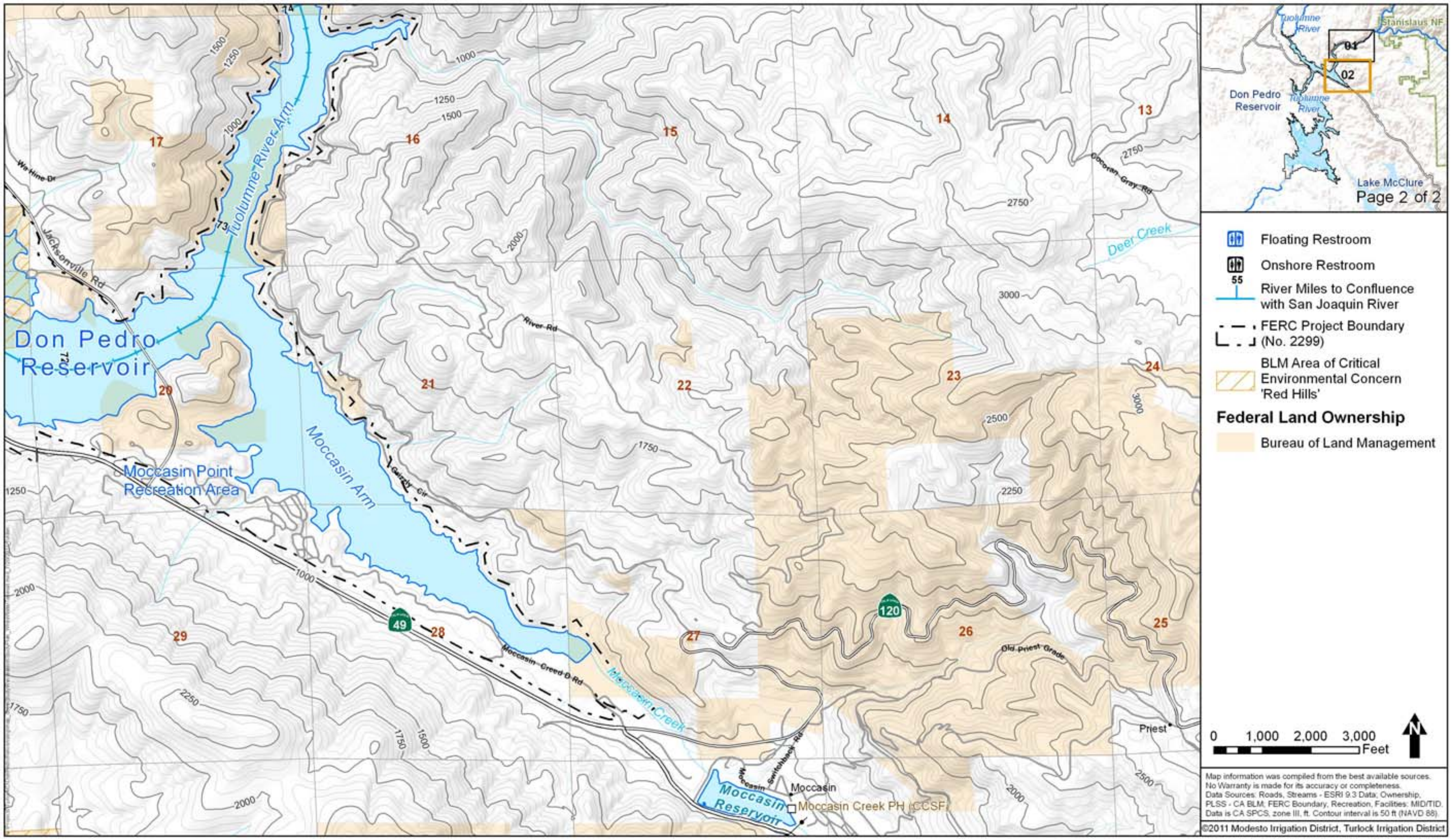


Figure 5.1-1 Project Study Area (page 2 of 2).

STUDY PLAN RR-3

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Lower Tuolumne Boatable Flow Study Plan

July 2011

Related Study Requests: AR-17; BEARD-01; BLM-04; FOT-10, 11; NPS-02

1.0 Project Nexus

Turlock Irrigation District's and Modesto Irrigation District's (Districts) continued operation and maintenance (O&M) of the Don Pedro Project (Project) may contribute to cumulative effects to non-motorized, recreational river boating opportunities in the Tuolumne River below La Grange Dam downstream to the confluence with the San Joaquin River (lower Tuolumne River).

2.0 Resource Agency Management Goals

Planning documents that cover recreation resources within the lower Tuolumne River corridor include the California Department of Parks and Recreation's (CDPR) California Outdoor Recreation Plan (CORP), Stanislaus County's General Plan, Tuolumne River Coalition's Framework for the Future, and relevant portions of local municipal master plans. Below is a summary of the recreation goals identified to date in the planning documents applicable to the lower Tuolumne River.

2.1 California Outdoor Recreation Plan

The 2008 California Outdoor Recreation Plan (CORP) (California State Parks 2008)**,** among other things, identifies and prioritizes outdoor recreation opportunities and constraints most critical in California. The plan lists the following as current statewide major recreation issues:

- lack of access to public park and recreation resources,
- lack of linkages and seamless delivery of recreation opportunities,
- need to protect and manage natural resource values,
- need to preserve and protect California's cultural heritage,
- lack of sufficient financing for parks and recreation,
- need for increasing the status of parks and recreation,
- need for statewide leadership in parks and outdoor recreation, and
- need for workforce development and succession plan.

2.2 Stanislaus County General Plan

The recreation needs for Stanislaus County reside in Chapter 3-*Conservation/Open Space Element* of the General Plan (Stanislaus County 1995). There are no Goals, Policies, or Implementation Measures that speak directly about river recreation needs. However, the *Introduction to the Conservation/Open Space Element* under Item 4 states: "Preserves open space lands for outdoor recreation including scenic, historic, and cultural areas." Goal 1 of this Element States: "Encourage the protection and preservation of natural and scenic areas throughout the County". Goal 4 states: "Provide for the open space recreational needs of the residents of the county."

2.3 Lower Tuolumne River: A Framework for the Future

The Tuolumne River Coalition (Coalition) was formed in the autumn of 2000 to act as a forum for local and regional organizations to discuss and promote a variety of restoration and recreation projects of the lower Tuolumne River corridor. The Coalition is a voluntary group that represents interested persons and entities within the watershed, including local agencies, non-profit organizations, individuals, and property owners, as well as cooperating federal and state agencies. The Districts and the San Francisco Public Utilities Commission are members of the Coalition.

In 2005, the Coalition published *Lower Tuolumne River Parkway: Framework for the Future* to encourage planning for projects along the lower Tuolumne River that carry multiple benefits and build community interest and involvement in the Tuolumne River (Tuolumne River Coalition 2005). The Coalition's vision for the lower Tuolumne River Parkway promotes sound ecological principles, sensible design of park development and river habitat enhancements, and a significant interest in enhancing public interaction in the outdoor environment through diverse recreation and open space opportunities, while respecting current development and private lands. The Coalition presented several common goals in the Framework, including one that is directly relevant to the *Lower Tuolumne River Boatable Flow Study*: Expanding and enhancing public access and recreational opportunities where appropriate.

3.0 Study Goals

The primary goal of the study is to determine if the Project's minimum flows result in boatable flows for non-motorized, recreational river boating in portions of the lower Tuolumne River where put-ins and take-outs are available. The study will be conducted within the minimum flow requirements of the current license.

The study is designed to achieve the following objectives:

- determine whether the Project's minimum flows provide for river boating in portions of the lower Tuolumne River (see Section 5.1-Study Area),
- use existing recreation information, where possible, to assess river boating.
- determine the number of flow days by month at or above the minimum acceptable flow for river boating opportunities (e.g. kayaking, canoeing) under current Project operations,
- determine operational constraints, if any, of providing minimum flows for the river boating opportunities,

- identify put-in and take-out locations for river boating between La Grange Dam and the confluence with the San Joaquin River, and
- evaluate the adequacy of public flow information (i.e. availability, reliability, and real-time access).

4.0 Existing Information and Need for Additional Information

Information related to boating on the lower Tuolumne River, not including flow levels, is currently available at American Whitewater's (AW) website as well as in other boating information sources: http://www.americanwhitewater.org.

A comprehensive search for readily available existing information on the lower Tuolumne River will be part of the Districts' study methods. Additional information collected will be used to close the gaps in the existing information on river boating opportunities.

5.0 Study Methods

A river boating study will be conducted to determine if the Project's minimum flows result in boatable flows for non-motorized river boating in the study area. The study includes identifying the number of individual portions of the river reach that are accessible and used for boating.

5.1 Study Area

For the purpose of the study, the study area includes the 52-mile river reach from La Grange Dam (River Mile 52) to the confluence with the San Joaquin River (River Mile 0). This river reach has a mild gradient, resulting in flat and swift water boating opportunities. The study will be conducted within the limits of the current minimum flows and within the limits of current accessible put-ins and take-outs.

5.2 General Concepts

The following general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner, and
- The Districts will make a good faith effort to obtain permission to access private property where needed in advance of performance of the study. Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study reports.

5.3 Study Methods

The study will use the flows of approximately 50, 75, and 100 cfs, consistent with minimum flow requirements of the current license and the Districts' current minimum flow practices.

5.3.1 River Boating Assessment

Step 1 – Summarize Existing River Recreation Information on the Study Area. The Districts will gather readily available existing information on river boating (i.e., canoe, kayak and raft) and public access locations in the study area. This will include a review of guide books, videos, discussions with boaters who have floated this particular reach, and field reconnaissance. The objective of this information gathering work will be to identify, document and describe the river boating opportunities within this reach.

The Districts will gather additional information about river boating by interviewing local boating experts, residents, and other persons identified with local boating and recreational knowledge, to the degree these people are available.

Subjects for river boating questions will likely include: (1) location of runs; (2) duration of runs; (3) type of craft used; (4) range of crafts that could be used on the run; (5) number and dates of trips; (6) party size; (7) safety concerns; (8) how flow information is obtained; (9) suggestions for improvement (i.e., access, flow, and flow information); (10) opportunity for general comments; and (11) listing of other reaches boated by the individual. In addition, boaters will be asked to identify notable areas where other river recreation activities take place on the lower Tuolumne River.

Step 2 – Summarize the Existing Hydrology and Operational Constraints of the Study Area. The Districts will summarize the hydrology for the reach between La Grange Dam and the confluence of the San Joaquin River. Hydrologic summaries will be provided by water year type (normal, wet, and dry).

Step 3 – Controlled Flow Releases. The Districts will release two or three controlled flow releases to the lower Tuolumne River. The exact number of controlled flow releases will depend on the requirements of the current license and the results of the first and second releases. The flow releases are expected to be 50, 75, and 100 cfs. Releases will be planned and scheduled to be consistent with fishery management goals in the lower Tuolumne River.

For each controlled flow release, the Districts will use a team of volunteer boaters (5 to 8 people for each kind of water craft) with a range of skill levels to paddle portions of the lower Tuolumne River with the preference of two times in succession while the independent variable, flow, is changed. The objective is to record the degree to which the flow is actually boatable for individual participants. The participants will paddle each pre-selected flow in a pre-selected reach, and then individually complete a single flow survey questionnaire querying them on a number of characteristics specific to that flow. Upon completion of the test flows, participants will complete the comparative survey form enabling them to evaluate one flow over another for specific characteristics. Each boater will sign a waiver of liability prior to participating in the study.

The primary data for this study will consist of the boaters' responses to questionnaires completed at the conclusion of each controlled flow release (or boating run). The questionnaire will include a section to gather data for a comparative flow evaluation for each run. Data to be collected will likely include: (1) boatability (number of obstacles struck, number of times boaters had to get out of craft, number of times low hanging vegetation affected or impeded boating progress, etc.); (2)

quality of the reach; (3) suitability of the run for different crafts and boater skill levels; (4) comparison of each run at its different flows; (5) any safety concerns or hazards; and (6) number and difficulty of portages.

In consultation with Relicensing Participants, the Districts will identify the team of boaters to float the proposed flows at a specified time. It is anticipated that two or more different groups would be needed during the same period of controlled flows to evaluate the different reaches identified for the study.

Step 4 – Assessment of Opportunity for Boating. The Districts will estimate the annual number of usable days that occur based on flow information in the historic hydrology record. For the purpose of this study, a usable day is defined as a day when the mean daily flow in the study area is at or above the minimum flow.

Step 5 – Determine the Existing or Potential Boating Opportunities in the Study Reaches with an Emphasis on Minimum Boatable Flows. The results of the study report will document: (1) put-in and take-out locations; (2) constraints; (3) conflicts or complementary opportunities with other recreation opportunities; (4) the types of craft suitable for boating the study areas; and (5) the lowest boatable flow reported by study participants for each type of non-motorized boating opportunity.

5.3.2 Data Analysis and Study Report Preparation

The study objectives and issues will be addressed through analysis of the responses on questionnaires, and professional evaluations. The Districts will synthesize and analyze the data collected in a study report, and will include summary data in tables, attachments, and/or appendices.

6.0 Schedule

The boatable flow study is planned for 2012. The report will be issued in December 2012.

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

The proposed methods for this study are consistent with professional practices. Field work will be conducted following recommendations provided in Whittaker et al. (1993), and studies completed on West Rosebud Creek by PPL Montana (2004-2005). Documentation may include photographs and notes.

8.0 Deliverables

The Districts will prepare a report on the boatable flow study for inclusion in the Initial Study Report to be filed on or before January 4, 2013.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

American Whitewater. 2011. http://www.americanwhitewater.org/content/River/detail/id/5041 Website accessed July 22, 2011.

California State Parks. 2008. California Outdoor Recreation Plan (CORP). California State Parks Planning Division. Sacramento, California

PPL Montana. (2004-2005). West Rosebud Creek Whitewater Flow Study Report 2004-05.

Whittaker, D., B. Shelby, W. Jackson, and R. Beschta. 1993. Instream flows for recreation: a handbook on concepts and research methods. U.S. Department of the Interior, National Park Service, Anchorage, AK.

Whittaker, D., B. Shelby, and J. Gangemi. 2005. Flows and recreation: a guide to studies for river professionals. U.S. Department of the Interior, National Park Service, Washington, DC.

STUDY PLAN RR-4

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Visual Quality Study Plan

July 2011

Related Study Requests: BLM-06

1.0 Project Nexus

Turlock Irrigation District's and Modesto Irrigation District's (the Districts) continued operation and maintenance (O&M) of the Don Pedro Project (Project) has a potential to affect visual resources managed by the U.S. Department of Interior, Bureau of Land Management (BLM) on federal lands within and adjacent to the Project.

2.0 Resource Agency Management Goals

BLM has interests in federal lands that they manage in and adjacent to the Project; and BLM has established visual resource management goals for these lands. BLM management goals are discussed below. The Districts have identified no other land managing agencies or government jurisdictional authorities with visual resource management goals pertinent to the Project.

In all, there are approximately 4,040 acres of federal lands within the Project Boundary. This represents approximately 22 percent of the total lands within the Project Boundary. These federal lands are part of a larger land unit managed by the BLM in accordance with the Sierra Resource Management Plan (SRMP) (BLM 2008). BLM has indentified the lands within the Project Boundary as Visual Resource Management (VRM) areas in the SRMP. In the SRMP, the BLM described the following goals for these lands:

- Protect and enhance the scenic and visual integrity of the characteristic landscapes.
- Maintain the existing visual quality of the Lake Don Pedro/Highway 49 viewshed and the Red Hills Area of Critical Environmental Concern.

The SRMP assigns inventory classes to visual resource areas within the Sierra Resource Management Area (SRMA). Management activities are evaluated in light of the adopted VRM class. The VRM classes within and adjacent to the Project are Class I, Class II, and Class III. Table 2.0-1 describes the three classes and the BLM land areas where they are assigned.

Table 2.0-1 BLM VRM classes in and adjacent to the Don Pedro Project Boundary.

	Description	Where Assigned
Class I	To preserve the existing character of the landscape. Any change to the characteristic landscape should be very low and must not attract attention.	Tuolumne Wild and Scenic River Corridor
Class II	To retain the existing character of the landscape. Any change to the characteristic landscape should be low.	Red Hills Area of Critical Environmental Concern
Class III	To partially retain the existing character of the landscape. Any change to the characteristic landscape may be moderate.	Lake Don Pedro/Highway 49 viewshed and all other BLM areas not specifically identified as having a particular VRM rating

3.0 Study Goals

The goal of this study is to document current visual conditions of the Project as viewed from BLM lands during various times of the year and identify any adverse visual resource effects due to continued O&M of the Project. The objectives of the study are to identify, map, and describe BLM inventories associated with Project facilities and features on public land administered by BLM; and document the existing visual condition (EVC) of all Project facilities and features from associated viewsheds on public land administered by BLM.

4.0 Existing Information and Need for Additional Information

The SRMP identifies and discusses the visual classes assigned to BLM lands within and adjacent to the Project, and adopts management goals for these resources. No specific documentation exists on the inherent aesthetics within these landscapes, or visibility or visual contrast of Project features associated with these BLM lands.

5.0 Study Methods

This study will assess the visual resources of the Don Pedro Project in relation to BLM visual resource management goals.

5.1 Study Area

The study area includes all Project facilities and features on public land administered by BLM, and their associated viewsheds. The viewsheds include travel routes, recreation areas, and water bodies from which the Project facilities and features on BLM-administered public land are visible to the public. Figure 5.1-1 identifies BLM-managed lands within and adjacent to the Don Pedro Project Boundary.

5.2 General Concepts

The following general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.

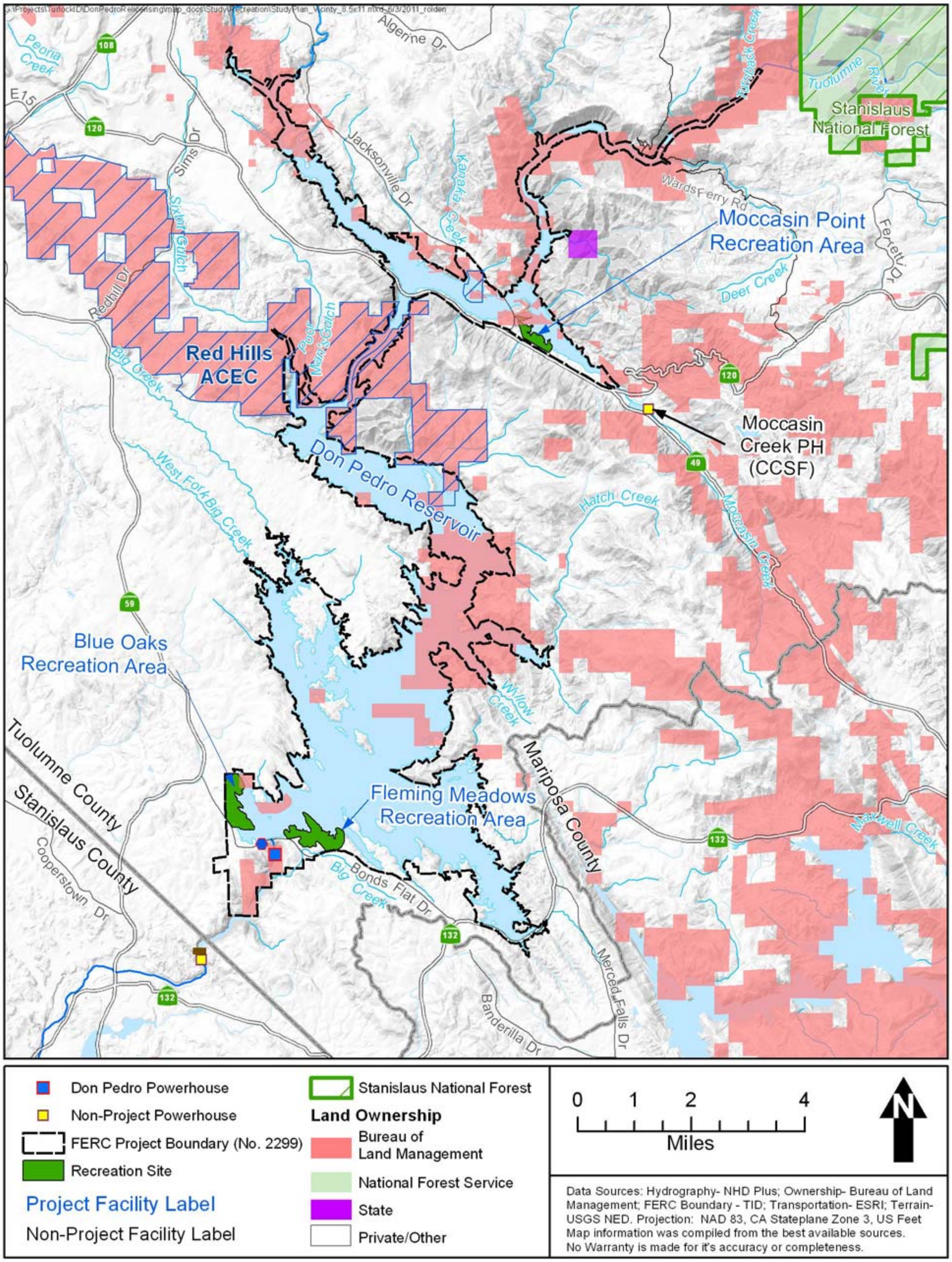


Figure 5.1-1 BLM-managed lands within and adjacent to the Don Pedro Project Boundary.

- The Districts will make a good faith effort to obtain permission to access private property where needed in advance of performance of the study. Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study reports.

5.3 Study Methods

The study methods will follow BLM's VRM, which are described below (BLM 1986a, 1986b).

<u>Step 1 – BLM VRM Inventories</u>. Step 1 will involve identifying the visual resources of the area as viewed from BLM-administered public land. This step includes describing the landscape character of the region associated with the Project and then focusing on landscape character specific to the Project. Information from BLM's visual resource inventory process presented in the SRMP will be used.

<u>Step 2 – Analysis</u>. The analysis stage will involve determining whether the potential visual impacts from the Project, if any, meet the management objectives established for the BLM-administered public land. A visual contrast rating process will be used for this analysis, which involves comparing the Project features on BLM-administered public land with the major features in the existing landscape using the basic design elements of form, line, color, and texture. This process is described in BLM Handbook H-8431-1, Visual Resource Contrast Rating (BLM 1986a). The analysis will be used as a guide for describing any visual impacts. The Districts will:

- Identify and map representative viewsheds in the study area associated with Project facilities and features. Map and summarize the Visual Resource Objectives (VRO) in the study area identified in the SRMP.
- Identify and summarize the BLM land management direction associated with the VRM inventories relative to the Project facilities and features. Map the location of Project facilities and features with respect to their associated viewsheds and VRM inventories including VROs, variety classes, sensitivity levels, and distance zones. Photograph Project facilities from agreed upon Key Observation Points (KOP).

<u>Step 3 – Existing Visual Condition.</u> The Districts will document the EVC of Project facilities and features on BLM-administered public land. The Districts will identify KOPs and photograph Project facilities and features, map and describe the locations of the KOPs, and photograph Project features (e.g., reservoir) from KOPs at various seasons of the year.

<u>Step 4 – Prepare Report</u>. The Districts will prepare a report that includes the following sections: Study Goals and Objectives; Methods and Analysis; Results; Discussion; and Description of Variances from the FERC-approved study plan, if any.

6.0 Schedule

The visual quality study plan is planned for 2012.

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

The methods presented in this study plan are consistent with BLM's visual resource management protocols and study methods used in recent relicensings in California including most recently for the Merced Irrigation District's Lake McClure and McSwain Reservoir. Additional surveys with similar methodology include the Yuba-Bear/Drum-Spaulding Project's Lake Spaulding, Rollins Reservoir, Bowman Lake, Jackson Meadows Reservoir, Fordyce Lake, and Lake Valley Reservoir.

8.0 Deliverables

The Districts will prepare a report on visual resources for inclusion in the Initial Study Report to be filed on or before January 4, 2013.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

U.S. Department of Interior, Bureau of Land Management (BLM). 1986a. Visual Resource Management BLM Handbook H-8431-1, Visual Resource Contrast Rating.

——. 1986b. Visual Resource Management BLM Handbook H-8410-1, Visual Resource Inventory.

——. 2008. Sierra Resource Management Plan and Record of Decision. U.S. Department of the Interior, Bureau of Land Management Mother Lode Field office, El Dorado Hills, California.

STUDY PLAN TR-1

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Special-Status Plants Study Plan

July 2011

Related Study Requests: USFWS-01

1.0 Project Nexus

Certain aspects of operation and maintenance (O&M) of the Don Pedro Project (Project) may have the potential to affect special-status[1] plants. These effects may be direct (e.g., result of ground-disturbing activities, such as mechanical or chemical clearing of vegetation or trampling of plants), indirect (e.g., due to recreation activity that results in erosion of adjacent land), or cumulative (i.e., caused by a Project activity in association with a non-Project activity, such as loss of habitat due to the introduction of invasive plants from a non-Project vector). This study evaluates Project O&M and recreation activities to assess their potential to impact special-status plants.

Plants listed under the federal Endangered Species Act (ESA) or the State of California Endangered Species Act (CESA) are addressed in a separate study plan. Only special-status plants otherwise not listed as FT (federally threatened), FE (federally endangered), ST (state threatened), and SE (state endangered) are addressed in this Special-Status Plants Study Plan.

2.0 Resource Agency Management Goals

The U.S. Department of Interior, Bureau of Land Management (BLM) has developed specific management goals related to the protection and management of special-status plants. In its 2008 Sierra Resource Management Plan (SRMP), the BLM provides the following guidance for management of sensitive species:

> *In compliance with existing laws, including the BLM multiple use mission as specified in the Federal Land Policy and Management Act (FLPMA), the BLM shall designate sensitive species and implement measures to conserve these species and their*

[1] For the purposes of this Relicensing, special-status plants are considered those plants that are: (1) found on BLM land and formally listed by BLM as Sensitive (BLM-S); (2) listed under the federal ESA as Proposed or a Candidate for listing as endangered or threatened or proposed for delisting; (3) listed under the CESA as proposed for listing; (4) found on the California Native Plant Society (CNPS) Inventory of Rare Plants and formally listed as a CNPS 1, 2, or 3 plant (CNPS 1, CNPS 2, CNPS 3); or (5) found on the California Department of Fish and Game's (CDFG) list of California Rare (SR) species listed under the Native Species Plant Protection Act of 1977. Special-status plants do not include plants that are listed as threatened or endangered under the ESA or CESA.

> *habitats,…, to promote their conservation and reduce the likelihood and need for such species to be listed pursuant to the ESA [Endangered Species Act of 1973]…*
>
> *On BLM administered lands, the BLM shall manage Bureau sensitive species and their habitats to minimize or eliminate threats affecting the status of the species or to improve the condition of the species habitat, by determining to the extent practicable, the distribution, abundance, population condition, current threats, and habitat needs for sensitive species.* (BLM 2008a)

In addition, BLM's SRMP provides general guidelines for managing habitat to assist in the recovery of listed species, and preserving and protecting species that have been given special-status by the BLM (BLM 2008a, 2008b). The SRMP also includes management guidelines for the Red Hills Area of Critical Environmental Concern (ACEC), part of which lies within the Project Boundary.

3.0 Study Goals

The goal of this study is to provide information to determine the extent to which certain Project O&M activities and/or recreational activities may have the potential to adversely affect special-status plant species. A Project effect may exist if both of the following occur:

- A special-status plant species is found to occur within the study area as defined in Section 5.1; and
- A specific Project O&M activity has a reasonable possibility of having an adverse effect on the special-status plant species found.

The goal of this study is to gather the information necessary to perform this analysis and evaluate the Project's potential to adversely affect special-status plants.

4.0 Existing Information and Need for Additional Information

Existing and relevant information regarding known and potentially occurring special-status plants in the Project Boundary is available from the California Native Plant Society's (CNPS) Inventory of Rare and Endangered Plants database (CNPS 2010) and the California Natural Diversity Database (CNDDB) (CDFG 2010). Database queries included all U.S. Geological Survey (USGS) 1:24,000 topographic quadrangles that include the existing Project Boundary and the surrounding quadrangles. Quadrangles containing the Project Boundary include Chinese Camp, La Grange, Moccasin, Penon Blanco Peak, Sonora, and Standard. Based on this information, as well as the Project's elevation range and habitats in this region of the Tuolumne River, the Districts identified 31 plants species that are listed as special-status and may have a reasonable potential to be affected by Project O&M and/or recreation activities.

Table 4.0-1 provides for each of the special-status plant species: (1) status, (2) flowering period, (3) elevation range, (4) habitat requirements, and (5) recorded occurrences in the general Project area.

Table 4.0-1 Target list of special-status plant species for the Don Pedro Project.

Common Name / Scientific Name	Status[1]	Flowering Period	Elevation Range (feet)	Habitat Requirements	Occurrence in area surrounding Project[2,3]
Henderson's bent grass *Agrostis hendersonii*	CNPS3	Apr-Jun	200-1,100	Valley and foothill grasslands, vernal pools	New Melones Dam
Jepson's onion *Allium jepsonii*	CNPS1B BLM-S	Apr-Aug	950-4,500	Chaparral, cismontane woodland, lower montane coniferous forest	**Sonora**, Tuolumne
Three-bracted onion *Allium tribracteatum*	CNPS 1B	Apr-Aug	3,600-10,000	Chaparral, lower montane coniferous forest, upper montane coniferous forest, volcanic soils	Columbia SE, Twain Harte
Rawhide Hill onion *Allium tuolumnense*	CNPS 1B, BLM-S	Mar-May	950-2,000	Cismontane woodland, serpentine	**Sonora, Chinese Camp, Moccasin**
Nissenan Manzanita *Arctostaphylos nissenana*	CNPS 1B, BLM-S	Feb-Mar	1,400-3,650	Closed-cone coniferous forest, chaparral	**Sonora**
Big-scale balsamroot *Balsamorhiza macrolepis var. macrolepis*	CNPS 1B, BLM-S	Mar-Jun	290-3,500	Chaparral, cismontane woodland valley and foothill grassland, sometimes serpentine	Hornitos
Hoover's calycadenia *Calycadenia hooveri*	CNPS 1B	Jul-Sep	200-1,000	Cismontane woodland, valley and foothill grassland	**La Grange**, Snelling, Merced Falls, Cooperstown, Keystone
Red Hills soaproot *Chlorogalum grandiflorum*	CNPS 1B, BLM-S	May-Jun	800-4,250	Chaparral, cismontane woodland, lower montane coniferous forest, serpentine, gabbroic and other soils	**Chinese Camp, Sonora** New Melones Dam, Keystone
Small's southern clarkia *Clarkia australis*	CNPS 1B	May-Aug	2,600-6,900	Cismontane woodland, lower montane coniferous forest	Tuolumne, Twain Harte, Coulterville, Hornitos
Mariposa clarkia *Clarkia biloba* ssp. *australis*	CNPS 1B, BLM-S	May-Jul	1,000-3,500	Chaparral, cismontane woodland, serpentine	**Sonora**, Tuolumne, Twain Harte, Coulterville, Hornitos
Beaked clarkia *Clarkia rostrata*	CNPS 1B, BLM-S	Apr-May	190-1,700	Cismontane woodland, valley and foothill grassland	**Penon Blanco Peak, Moccasin**, New Melones Dam, Cooperstown, Snelling, Merced Falls, Coulterville, Hornitos
Hoover's cryptantha *Cryptantha hooveri*	CNPS 1A	Apr-May	0-500	Inland dunes, valley and foothill grassland	Cooperstown
Mariposa cryptantha *Cryptantha mariposae*	CNPS 1B, BLM-S	Apr-Jun	600-2,200	Chaparral, serpentine	**La Grange, Chinese Camp Sonora**, Keystone, Coulterville, Hornitos
Dwarf downingia *Downingia pusilla*	CNPS 2	Mar-May	0-1,500	Valley and foothill grassland, vernal pools	**La Grange**, Cooperstown, Snelling, Merced Falls
Tuolumne button-celery *Eryngium pinnatisectum*	CNPS 1B	May-Aug	700-10,000	Cismontane woodland, lower montane coniferous forest, vernal pools, mesic	**Standard, Sonora, Chinese Camp, Moccasin**, New Melones Dam, Columbia
Spiny-sepaled button-celery *Eryngium spinosepalum*	CNPS 1B	Apr-May	250-900	Valley and foothill grassland, vernal pools	**La Grange**, New Melones Dam, Snelling, Merced Falls
Tuolumne fawn lily *Erythronium tuolumnense*	CNPS 1B, BLM-S	Mar-Jun	1,600-4,200	Broadleafed upland forest, chaparral, cismontane woodland, lower montane coniferous forest	**Standard**, Columbia, Columbia SE, Tuolumne, Twain Harte

Common Name / Scientific Name	Status[1]	Flowering Period	Elevation Range (feet)	Habitat Requirements	Occurrence in area surrounding Project[2,3]
Stink-bells *Fritillaria agrestis*	CNPS 4	Mar-Jun	0-5,200	Chaparral, cismontane woodland, pinyon and juniper woodland, valley and foothill grassland	**Sonora, Chinese Camp, Penon Blanco Peak**
Delicate bluecup *Githopsis tenella*	CNPS 1B	May-Jun	3,500-6,500	Chaparral, cismontane woodland	**Chinese Camp**
Bisbee Peak rush-rose *Helianthemum suffrutescens*	CNPS 3	Apr-Jun	100- 2,800	Chaparral, often serpentine, gabbroic or Ione soils	**Sonora**
Parry's horkelia *Horkelia parryi*	CNPS 1B, BLM-S	Apr-Sep	250-3,500	Chaparral, cismontane woodland, Ione formation	Coulterville
Tuolumne iris *Iris hartwegii* ssp. *columbiana*	CNPS 1B	May-Jun	1,200-4,700	Cismontane woodland, lower montane coniferous forest	Columbia, Columbia SE
Knotted rush *Juncus nodosus*	CNPS 2	Jul-Sep	0-6,600	Meadows, seeps, marshes, swamps	**La Grange**, Cooperstown
Congdon's lomatium *Lomatium congdonii*	CNPS 1B, BLM-S	Mar-Jun	900-7,000	Chaparral, cismontane woodland, serpentine	**Sonora, Chinese Camp, Moccasin**, New Melones Dam, Keystone
Stebbins' lomatium *Lomatium stebbinsii*	CNPS 1B	Mar-May	4,000-6,500	Chaparral, lower montane coniferous forest, gravelly, volcanic clay	Twain Harte
Shaggyhair lupine *Lupinus spectabilis*	CNPS 1B, BLM-S	Apr-May	800-2,800	Chaparral, cismontane woodland, serpentine	**Sonora, Moccasin**, New Melones Dam, Groveland, Coulterville, Hornitos
Slender-stemmed monkeyflower *Mimulus filicaulis*	CNPS 1B, BLM-S	Apr-Aug	2,800-6,000	Cismontane woodland, lower montane coniferous forest, meadows and seeps, upper montane coniferous forest, vernally mesic	Groveland
Pansy-faced monkeyflower *Mimulus pulchellus*	CNPS 1B	Apr-Jul	1,900-6,700	Lower montane coniferous forest, meadows and seeps, vernally mesic, often disturbed areas	**Standard**, Angels Camp, Groveland, Twain Harte
Veiny monardella *Monardella douglasii* ssp. *venosa*	CNPS 1B	May-Jul	150-1,500	Cismontane woodland, valley and foothill grassland, heavy clay	New Melones Dam
Merced monardella *Monardella leucocephala*	CNPS 1A	May-Aug	100-500	Valley and foothill grassland	**La Grange**, Cooperstown
Red Hills ragwort *Packera clevelandii*	CNPS 1B, BLM-S	Jun-Jul	800-1,400	Cismontane woodland, serpentine seeps	**Chinese Camp**, Moccasin

[1] Special-status:
BLM-S: Bureau of Land Management Sensitive Plant Species
CNPS: California Native Plant Society listed species
1A: Species presumed extinct in California
1B: Species considered rare or endangered in California and elsewhere
2: Species considered rare or endangered in California but more common elsewhere
3: More information needed about this species
4: Limited distribution; watch list

[2] Occurrence in area surrounding Project was based on a nine-quad CNPS quadrangle search.

[3] Quads that are fully or partially included within the Project Boundary are indicated by bold font; quads surrounding, but not included within the Project Boundary are listed in regular font.

There were CNDDB records for 30 special-status plant occurrences located within a one-mile buffer of the Project Boundary. There were nine occurrences of Rawhide Hill onion, six occurrences of Red Hills soaproot, four occurrences each of Congdon's lomatium and Red Hills ragwort, two occurrences each of shaggyhair lupine (*Lupinus spectabilis*), Mariposa cryptantha (*Cryptantha mariposae*), and stink-bells (*Fritillaria agrestis*), and one occurrence of Tuolumne button-celery (*Eryngium pinnatisectum*). Congdon's lomatium, shaggyhair lupine, Rawhide Hill onion, Red Hill ragwort, Red Hills soaproot and Mariposa cryptantha are all BLM-S. The dates on the reports ranged from 1937 to 2007 (CDFG 2010).

A botanical survey of the Red Hills Management Area (now the Red Hills ACEC) was completed in 1984. The surveys located Rawhide Hill onion (*Allium tuolumnense*), Congdon's lomatium (*Lomatium congdonii*), Red Hills soaproot (*Chlorogalum grandiflorum*), and Red Hills ragwort (*Packera clevelandii*) (BLM 1985).

Few of the available reports are from surveys within the Project Boundary and, of those that are, many are outdated.[2] Additional information needed to address the study goal is the specific location of special-status plants in relation to Project O&M activities, Project-related recreation, and other Project-related activities that might affect special-status plants.

5.0 Study Methods

5.1 Study Area

The study area consists of the area within the Project Boundary that is subject to Project-related O&M and/or recreation activities, including high-use dispersed recreation areas. The study area is described in Attachment A of this study plan, and includes the following specific areas within the Project Boundary:

- The Blue Oaks, Fleming Meadows, and Moccasin Point Recreation areas and related facilities, including the 3.5 mile Don Pedro Shoreline Trail;
- High-use dispersed recreation areas as described in Attachment A;
- Lands within the Project Boundary designated as part of the Red Hills Area of Critical Environmental Concern;
- Don Pedro Dam, Powerhouse, and Switchyard, including related maintenance and storage facilities and the powerhouse access road;
- The Don Pedro Spillway channel and related access roads;
- The Gasburg Creek diversion dike and related access roads;
- Districts Employee Housing near Don Pedro Dam;
- Don Pedro Recreation Agency headquarters and visitor center;
- Dikes A, B, and C in the vicinity of Don Pedro Dam; and
- The Wards Ferry take-out.

The study area also includes habitats adjacent to each of these project features to the extent they could reasonably be affected by Project O&M and/or recreation, generally understood to be less

[2] Annual or short-lived perennial species may require annual monitoring to accurately document population conditions, while long-lived perennials may only require surveys at five-year intervals (CDFG 2009).

than 100 feet. If special-status plant occurrences are located, the study area will be expanded to the full extent of the occurrence or the Project Boundary, whichever is less.

5.2 General Concepts

These general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study report.

5.3 Study Methods

The study approach will consist of the following five steps:

Step 1 – Gather Data and Prepare for Field Effort. The Districts will identify and map known occurrences of special-status plants within the study area, and prepare field maps for use by survey teams. The maps will include aerial imagery, Project features, and known special-status plant occurrences. Survey timing will be planned based on blooming periods and herbarium collection dates.

Step 2 – Conduct Field Surveys. The Districts' surveyors will conduct special-status plant surveys that generally follow the CDFG's Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities (CDFG 2009).[3] Field surveys will be conducted at the proper times of year when special-status plants potentially occurring in a given survey area and are both evident and identifiable. Surveys will use a random meander technique, and focus additional efforts in high-quality habitats or those with a higher probability of supporting special-status plants (e.g., serpentine outcrops). Surveys will be floristic in nature, documenting all species observed; taxonomy and nomenclature will be based on The Jepson Manual (Hickman 1993). On lands managed by the BLM, surveys will be consistent with BLM survey protocols required for National Environmental Policy Act/ESA compliance.

In the event special-status plants are found within the study area, surveyors will collect the following data, to the edge of the occurrence, or to the edge of the Project Boundary, whichever is less:

- Digital photographs, if needed, to describe the occurrence, its habitat, and any potential threats (at least one digital photograph will be collected for each occurrence, with other photographs to document potential threats, or as needed).
- Estimated area (approximate length and width) covered by the special-status plant population and estimated number of individual plants in the population. If plant population is estimated to cover an area greater than 0.1 acre, surveyors will delineate the

[3] For the purpose of this Relicensing and differing from the CDFG 2009 protocol, ESA- and CESA-listed plants are not considered special-status and are addressed in separate study proposals.

occurrence boundary using a handheld GPS, collecting either polygon data, or sufficient point data that a realistic occurrence polygon can be constructed from the point data using GIS.

- For occurrences less than 0.1 acre in size, location of the approximate center of the occurrence taken as point data using a handheld GPS unit.
- Dominant and subdominant vegetation in the area, and topographic features.
- Estimated distance to nearest Project facility, feature, or Project-related activity.
- Activities observed in the vicinity of the population that have a potential to adversely affect the population (e.g., recreational trails and uses).
- Estimated phenology and descriptions of reproductive state.

For all special-status species observations, the appropriate CNDDB form or spreadsheet will be completed. A copy of the CNDDB form or spreadsheet will be provided to BLM if the occurrence is on or immediately adjacent to federal lands.

<u>Step 3 – Compile Data and Perform Quality Assure/Quality Control.</u> Following field surveys, the Districts will develop separate GIS maps depicting special-status plant and noxious weed occurrences, Project facilities, features, and specific Project-related activities which have the potential to affect the special-status species (e.g., dispersed use camping) and other information collected during the study including the complete floristic list. Field data will then be subject to QA/QC procedures, including spot-checks of transcription and comparison of GIS maps with field notes to verify locations of special-status plant occurrences.

<u>Step 4 – Threats Assessment.</u> Once the location of special-status plants in the study area is determined, Districts will assess all potential threats to these species, including noxious weeds, Project operations, and Project-related recreation. In particular, Don Pedro Recreation Agency staff will be consulted to identify Project O&M and recreation activities that occur in the area of the plant occurrences that have a potential to affect special-status plants.

<u>Step 5 – Prepare Report.</u> The Districts will prepare a report that includes the following sections: (1) Study Goals, (2) Methods, (3) Results, (4) Discussion, and (5) Conclusions. The Districts will make the report available to Relicensing Participants upon completion.

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC issues its Study Plan Determination by December 31, 2011, and the study is not disputed by a mandatory conditioning agency:

- Planning (Step 1) .... January 2012 – March 2012
- First Study Season (Step 2) .... March 2012 – July 2012
- QA/QC Review (Step 3) .... August 2012
- Threats Assessment (Step 4) .... August 2012
- Study Report Preparation (Step 5) .... September 2012 – December 2012
- Report Issuance .... January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Principles

This study is consistent with the goals, objectives, and methods outlined for FERC relicensing efforts in California and uses standard botanical survey methods as defined by the CDFG.

8.0 Deliverables

The Districts will prepare a report, GIS-based maps showing findings and, if applicable, submit records to the CNDDB.

8.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

9.0 References

California Department of Fish and Game. 2009. Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities. Available online at: <www.fws.gov/sacramento/es/.../Listed_plantsurvey_guidelines.PDF>.

——. 2010. Biogeographic Data Branch. California Natural Diversity Database (CNDDB). Available online at: <www.dfg.ca.gov/biogeodata/cnddb/pdfs/TEPlants.pdf.> Accessed July 6, 2010.

California Native Plant Society. 2010. Inventory of Rare and Endangered Plants (online edition, v7-08a). California Native Plant Society. Sacramento, California. Available online at: <http://www. cnps.org/inventory>. Accessed July 6, 2010.

Hickman, J.C., editor. 1993. The Jepson Manual, 3rd Edition. University of California Press, Berkeley, California.

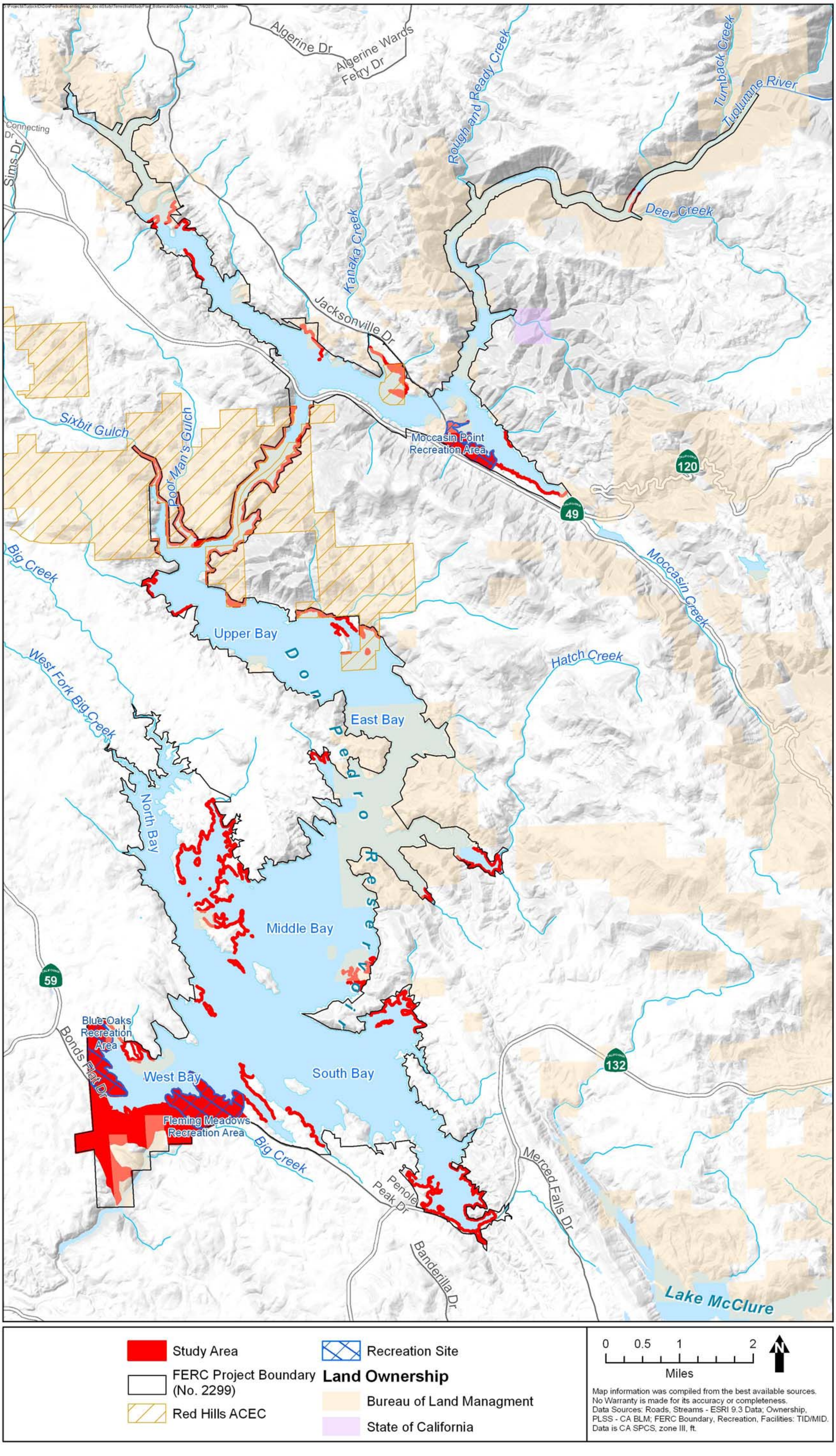
U.S. Department of the Interior, Bureau of Land Management (BLM). 1985. Final Red Hills Management Plan and Environmental Assessment. Bakersfield, California.

——. 2008a. BLM Manual 6840 - Special Status Species Management.

——. 2008b. Sierra Resource Management Plan and Record of Decision. February 2008. Folsom, California.

ATTACHMENT A

SPECIAL-STATUS PLANTS STUDY AREA



Algerine Dr
Algerine Wards Ferry Dr
Rough and Ready Creek
Turnback Creek
Tuolumne River
Connecting Dr
Sims Dr
Deer Creek
Kanaka Creek
Jacksonville Dr
Sixbit Gulch
Poor Man's Gulch
Moccasin Point Recreation Area
120
49
Big Creek
Moccasin Creek
Upper Bay
Don Pedro Reservoir
Hatch Creek
West Fork Big Creek
East Bay
North Bay
Middle Bay
59
Blue Oaks Recreation Area
132
West Bay
South Bay
Bonds Flat Dr
Fleming Meadows Recreation Area
Big Creek
Penole Peak Dr
Merced Falls Dr
Banderilla Dr
Lake McClure
Study Area
FERC Project Boundary (No. 2299)
Red Hills ACEC
Recreation Site
Land Ownership
Bureau of Land Managment
State of California
0 0.5 1 2
Miles
N
Map information was compiled from the best available sources.
No Warranty is made for its accuracy or completeness.
Data Sources: Roads, Streams - ESRI 9.3 Data; Ownership, PLSS - CA BLM; FERC Boundary, Recreation, Facilities: TID/MID.
Data is CA SPCS, zone III, ft.

STUDY PLAN TR-2

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

ESA- and CESA- Listed Plants Study Plan

July 2011

Related Study Requests: USFWS-06, 07, 08

1.0 Project Nexus

Certain activities associated with the ongoing operation and maintenance (O&M) of the Don Pedro Project (Project) and/or Project-related recreation activities may have the potential to affect plants listed under the federal Endangered Species Act (ESA) as endangered (FE) or threatened (FT) and/or plants listed under the California Endangered Species Act (CESA) as endangered (SE) or threatened (ST). These effects may be direct (i.e., result of ground-disturbing activities, such as mechanical or chemical clearing of vegetation or trampling of plants), indirect (i.e., due to activities, such as soil compaction, which limits plant growth), or cumulative (i.e., caused by a Project activity in association with a non-Project activity, such as loss of habitat due to the introduction of invasive plants from a non-Project vector). This study evaluates the potential for Project-related activities to impact ESA- or CESA-listed plants.

Special-status plants[1] are addressed in a separate study plan: the Special-status Plants Study Plan. Note that if a plant is listed as FT, FE, ST, or SE, but also meets the definition of a special-status plant, that plant species is addressed under this ESA- and CESA-listed plants study plan.

2.0 Resource Agency Management Goals

Several resource agencies have resource management responsibilities related to ESA and CESA-listed plants at the Project: the U.S. Department of Interior, Bureau of Land Management (BLM) on federal lands administered by BLM; the California Department of Fish and Game, for species listed under the CESA, and the U.S. Fish and Wildlife Service (USFWS) which has responsibility for administering the ESA. In order to meet its obligations under Sections 2 and 7 of the ESA, FERC must consult with the USFWS regarding the effects of the Project on ESA-

[1] For the purposes of this Relicensing, special-status plants are considered those plants that are: (1) found on BLM land and formally listed by BLM as Sensitive (BLM-S); (2) listed under the federal ESA as proposed or a candidate for listing as endangered or threatened or proposed for delisting; (3) listed under the CESA as proposed for listing; (4) found on the California Native Plant Society (CNPS) Inventory of Rare Plants and formally listed as a CNPS 1, 2 or 3 plant (CNPS 1, CNPS 2, CNPS 3); or (5) found on the CDFG list of California Rare (SR) species listed under the Native Species Plant Protection Act of 1977. Special-status plants do not include plants that are listed as threatened or endangered under the ESA or CESA.

listed species. A primary purpose of this study is to provide FERC with information adequate to complete its consultation efforts.

BLM's resource management goals are consistent with the ESA and BLM implementing policy. The ESA, Section 7(a)(1) states:

> *All federal agencies shall… utilize their authorities in furtherance of the purposes of this Act, by carrying out programs for the conservation of endangered species and threatened species listed pursuant to section 4 of this Act.*

BLM's implementing policy for ESA compliance in Manual 6840 states:

> *Actions authorized by BLM shall further the conservation and/or recovery of federally listed species…*
>
> *Section 7(a)(1) (Conservation Programs). Section 7(a)(1) requires the BLM to use its authorities to further the purposes of the ESA by implementing programs for the conservation of threatened and endangered species and the ecosystems on which they depend. Ways in which BLM can carry out these responsibilities include, but are not limited to:*
>
> > *determining to the extent practicable, the occurrence, distribution, population, and habitat condition of all ESA-listed species on BLM-administered lands; and*
> >
> > *Monitoring and evaluating ongoing management activities to ensure conservation objectives for listed species are being met* (BLM 2008a).

BLM's Sierra Resource Management Plan (SRMP) (BLM 2008b) provides general guidelines for managing ESA-listed plants. These guidelines include managing edaphically unique areas that often support both sensitive plant species and federally listed species to assist in the recovery of listed species, and coordinating with the USFWS on implementation of recovery plans for ESA-listed plants to promote the recovery of listed species. The SRMP also includes management guidelines for the Red Hills Area of Critical Environmental Concern (ACEC), part of which lies within or adjacent to the Project Boundary.

The USFWS' management goal for ESA-listed plants is to recover listed species to levels where protection under the Act is no longer necessary (USFWS 1988).

Two agencies have management responsibilities for CESA-listed plants within the Project. The BLM in California recognizes species listed by the State of California under CESA as BLM-sensitive species. BLM guidance for sensitive species states:

> *In compliance with existing laws, including the BLM multiple use mission as specified in Federal Land Policy and Management Act (FLPMA), the BLM shall designate sensitive species and implement measures to conserve these species and their habitats….to promote their conservation and reduce the likelihood and need for such species to be listed pursuant to the ESA (Endangered Species Act of 1973)…*

> *On BLM administered lands, the BLM shall manage Bureau sensitive species and their habitats to minimize or eliminate threats affecting the status of the species or to improve the condition of the species habitat, by determining the extent practicable, the distribution, abundance, population condition, current threats, and habitat needs for sensitive species…* (BLM 2008a).

BLM's SRMP (BLM 2008b) provides general guidelines for managing special-status species. These guidelines include managing unique edaphic areas that support unusual floras to both conserve BLM-sensitive species, including state-listed species. There is also discussion of coordination with CDFG on implementation of recovery plans and conservation strategies for CESA-listed plants and promoting the recovery of state-listed species. The SRMP also includes management guidelines for the Red Hills ACEC.

The CDFG also has management responsibility for CESA-listed plants. The CESA requires state lead agencies preparing California Environment Quality Act (CEQA) documents to consult with CDFG regarding potential impacts of projects on state-listed species. The state lead agency must adopt reasonable and prudent alternatives as specified by CDFG to prevent jeopardizing the continued existence of the CESA-listed plant.

3.0 Study Goals

The goal of this study is to provide information to determine the extent to which Project O&M and/or recreational activities may have the potential to adversely affect ESA- or CESA-listed plant species. A Project effect may occur if each of the following conditions are met:

- An ESA- or CESA-listed plant species is found to occur within the study area; and
- A specific Project O&M or recreation activity has a reasonable possibility of having an adverse effect on the ESA- or CESA-listed plant species found.

The goal of this study is to gather the information necessary to identify whether Project-related activities have the potential to impact ESA- or CESA-listed plant species.

4.0 Existing Information and Need for Additional Information

Existing and relevant information regarding known and potentially occurring ESA- and CESA-listed plants in the Project area is available from the California Native Plant Society (CNPS) Inventory of Rare and Endangered Plants database (CNPS 2010), the USFWS Endangered Species Program (USFWS 2010), and the California Natural Diversity Database (CNDDB) (CDFG 2010). Database queries included all U.S. Geological Survey (USGS) 1:24,000 topographic quadrangles that include the existing Project Boundary and the surrounding quadrangles. Quadrangles containing the Project Boundary include Chinese Camp, La Grange, Moccasin, Peno Blanco Peak, Sonora, and Standard. Based on this information, as well as the Project's elevation range and potential habitats, 10 plant species were identified that are listed as FT, FE, SE, or ST and that have a reasonable potential to be affected by the Project.

Table 4.0-1 provides the following information for each of these ESA- and CESA-listed target plant species: status; flowering period; elevation range; habitat requirements; and recorded occurrence in the general Project area.

There were CNDDB records for 10 ESA-listed plant occurrences located within a one-mile buffer of the Project Boundary. There were five occurrences each of Layne's ragwort (*Packera layneae*) and Red Hills vervain (*Verbena californica*) (CDFG 2010). A botanical survey of the Red Hills Management Area (now the Red Hills ACEC) was completed in 1984. The survey located the ESA-listed Layne's ragwort and Red Hills vervain (BLM 1985).

Few of the available reports are from surveys within the Project Boundary, and, of those that are, many are outdated.[2] Additional information needed to address the study goal is the specific location of ESA- and CESA-listed plants in relation to Project O&M activities, Project recreation, and any other Project-related activities that might affect listed plants.

5.0 Study Methods

5.1 Study Area

The study area consists of the area within the Project Boundary that is subject to Project-related O&M and/or recreation activities, including high-use dispersed recreation areas. The study area is described in Attachment A of this study plan, and includes the following specific areas within the Project Boundary:

- The Blue Oaks, Fleming Meadows, and Moccasin Point Recreation areas and related facilities, including the 3.5 mile Don Pedro Shoreline Trail;
- High-use dispersed recreation areas as described in Attachment A;
- Lands within the Project Boundary designated as part of the Red Hills Area of Critical Environmental Concern;
- Don Pedro Dam, Powerhouse, and Switchyard, including related maintenance and storage facilities and the powerhouse access road;
- The Don Pedro Spillway channel and related access roads;
- The Gasburg Creek diversion dike and related access roads;
- Employee Housing near Don Pedro Dam;
- Don Pedro Recreation Agency headquarters and visitor center;
- Dikes A, B, and C in the vicinity of Don Pedro Dam; and
- The Wards Ferry take-out.

The study area also includes habitats adjacent to each of these Project features to the extent they could reasonably be affected by Project O&M and/or recreation, generally understood to be less than 100 feet. If noxious weed occurrences are located, the study area will be expanded to the full extent of the occurrence or the Project Boundary, whichever is less.

[2] Annual or short-lived perennial species may require annual monitoring to accurately document population conditions, while long-lived perennials may only require surveys at five-year intervals (CDFG 2009).

Table 4.0-1 Target list of ESA-listed plant species for the Don Pedro Project.

Common Name/ Scientific Name	Status[1]	Flowering Period	Elevation Range (feet)	Habitat Requirements	Occurrence in Area Surrounding the Project[2,3]
Chinese Camp brodiaea *Brodiaea pallida*	CNPS 1B, FT, SE	May-Jun	1,000-1,250	Ultramafic, valley and foothill grassland, cismontane woodland, vernal streambeds, often serpentine	**Chinese Camp, Sonora**, New Melones Dam
Succulent owl's clover *Castilleja campestris* ssp. *Succulent*	CNPS 1B, FT, SE	Apr-May	150-2,500	Vernal pools	Cooperstown, Snelling, Merced Falls
Hoover's spurge *Chamaesyce* hooveri	CNPS 1B, FT	Jul-Sep (Oct)	75-900	Vernal pools	Cooperstown, Turlock Lake
Delta button-celery *Eryngium racemosum*	CNPS 1B, SE	Jun-Oct	0-350	Riparian scrub	Turlock Lake
Colusa grass *Neostapfia colusana*	CNPS 1B, FT, SE	May-Aug	0-700	Vernal pools	Cooperstown, Turlock Lake
Hairy Orcutt grass *Orcuttia pilosa*	CNPS 1B, FE, SE	May-Sep	100-700	Vernal pools	Cooperstown, Turlock Lake
Layne's ragwort *Packera layneae*	CNPS 1B, FT, SR	Apr-Aug	0-3,300	Chaparral, cismontane woodland, serpentine or gabbroic, rocky	**Chinese Camp, Moccasin**
Hartweg's golden sunburst *Pseudobahia bahiifolia*	CNPS 1B, FE, SE	Mar-Apr	0-500	Cismontane woodland, valley and foothill grassland	**La Grange**, Cooperstown, Snelling, Merced Falls, Tuolumne
Greene's tuctoria *Tuctoria greenei*	CNPS 1B, FE, SR	May-Jul (Sep)	0-3,600	Vernal pools	Cooperstown
Red Hills vervain *Verbena californica*	CNPS 1B, FT, ST	May-Sep	800-1,400	Cismontane woodland, valley and foothill grassland, usually serpentine seeps and creeks	**Sonora, Chinese Camp**, Keystone

1 Special-status:
- FE: Federal Endangered Species
- FT: Federal Threatened Species
- SE: California Endangered Species
- SR: California Rare Species
- ST: California Threatened Species
- CNPS: California Native Plant Society listed species
  - 1B: Species considered rare or endangered in California and elsewhere

2 Occurrence in area surrounding Project results based on a CNPS nine quadrangle search.

3 Quads that are fully or partially included within the existing Project Boundary are indicated by bold font; quads surrounding, but not included within the Project Boundary are listed in regular font.

5.2 General Concepts

These general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study report.

5.3 Study Methods

The study will be completed in five steps:

<u>Step 1 – Gather Data and Prepare for Field Effort.</u> The Districts will identify and map known occurrences of ESA- and CESA-listed plants within the study area, and prepare field maps for use by survey teams. The maps will include aerial imagery, Project features, and known plant occurrences. Survey timing will be planned based on blooming periods and herbarium collection dates.

<u>Step 2 – Conduct Field Surveys.</u> The Districts' surveyors will conduct plant surveys that generally follow CDFG's Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities (CDFG 2009).[3] Field surveys will be conducted at the proper times of year when ESA- and CESA-listed plants potentially occurring in a given survey area and are both evident and identifiable. Surveys will use a random meander technique, and focus additional efforts in high-quality habitats or those with a higher probability of supporting plants (e.g., serpentine outcrops).

Surveys will be floristic in nature, documenting all species observed; taxonomy and nomenclature will be based on The Jepson Manual (Hickman 1993).

In the event ESA- and/or CESA-listed plants are found within the study area, surveyors will collect the following data, to the edge of the occurrence, or to 500 feet outside the Project Boundary, whichever is less:

- Digital photographs, if needed, to describe the occurrence, its habitat, and any potential threats (at least one digital photograph will be collected for each occurrence, with other photographs to document potential threats, or as needed).
- Estimated area (approximate length and width) covered by the occurrence and estimated number of individual plants in the population. If a plant occurrence is estimated to cover an area greater than 0.1 acre, surveyors will delineate the occurrence boundary using a handheld GPS, collecting either polygon data, or sufficient point data that a realistic occurrence polygon can be constructed from the point data using GIS.
- For occurrences less than 0.1 acre in size, location of the approximate center of the occurrence taken as point data using a handheld GPS unit.
- Dominant and subdominant vegetation in the area, and topographic features.

[3] For the purpose of this relicensing and differing from the CDFG 2009 protocol, ESA- and CESA-listed plants are not considered special-status and are addressed in separate study proposals.

- Estimated distance to nearest Project facility, feature, or Project-related activity.
- Activities observed in the vicinity of the occurrence that have a potential to adversely affect the population (e.g., recreational trails and uses).
- Estimated phenology and descriptions of reproductive state.

For all ESA- and CESA-listed species observations, the Districts will complete the appropriate CNDDB form or spreadsheet and transmit the form to the CNDDB. The Districts will provide a copy of the CNDDB form or spreadsheet to BLM.

<u>Step 3 – Prepare Data and Quality Assure/Quality Control.</u> Following field surveys, the Districts will develop GIS maps depicting ESA- and CESA-listed plant occurrences, Project facilities, features, and specific Project-related activities (e.g., dispersed use camping) and other related information collected during the study, including the complete floristic list. Field data will then be subject to QA/QC procedures, including spot-checks of transcription and comparison of GIS maps with field notes to verify locations of ESA- and CESA-listed plant occurrences.

<u>Step 4 – Threats Assessment.</u> Once the location of ESA- and CESA-listed plants in the study area is determined, Districts will assess all potential threats to these species, including noxious weeds, Project operations, and Project-related recreation. In particular, Don Pedro Recreation Agency staff will be consulted to identify Project O&M and recreation activities that occur in the area of the plant occurrences that have a potential to affect ESA and CESA-listed species.

<u>Step 5 – Prepare Report.</u> The Districts will prepare a report that includes the following sections: (1) Study Goals, (2) Methods, (3) Results, (4) Discussion, and (5) Conclusions. The Districts will make the report available to Relicensing Participants upon completion.

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC issues its Study Plan Determination by December 31, 2011, and the study is not disputed by a mandatory conditioning agency:

- Planning (Step 1) .... January 2012 – March 2012
- Field Season (Step 2).. March 2012 – July 2012
- QA/QC Review (Step 3) .... August 2012
- Threats Assessment (Step 4) .... August 2012
- Study Report Preparation (Step 5) .... September 2012 – December 2012
- Report Issuance .... January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Principles

This study is consistent with the goals, objectives, and methods outlined for FERC relicensing efforts in California, and uses standard botanical survey methods as defined by the USFWS and CDFG.

8.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

9.0 References

California Department of Fish and Game. 2009. Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities. Available online at: <www.fws.gov/sacramento/es/.../Listed_plant_survey_guidelines.PDF>.

——. 2010. Biogeographic Data Branch. California Natural Diversity Database (CNDDB). Available online at: www.dfg.ca.gov/biogeodata/cnddb/pdfs/TEPlants.pdf. Accessed July 6, 2010.

California Native Plant Society. 2010. Inventory of Rare and Endangered Plants (online edition, v7-08a). California Native Plant Society. Sacramento, California. Available online at: http://www.cnps.org/inventory. Accessed July 6, 2010.

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U.S. Department of the Interior, Bureau of Land Management. 1985. Final Red Hills Management Plan and Environmental Assessment. Bakersfield, California.

——. 2008a. BLM Manual 6840 - Special Status Species Management.

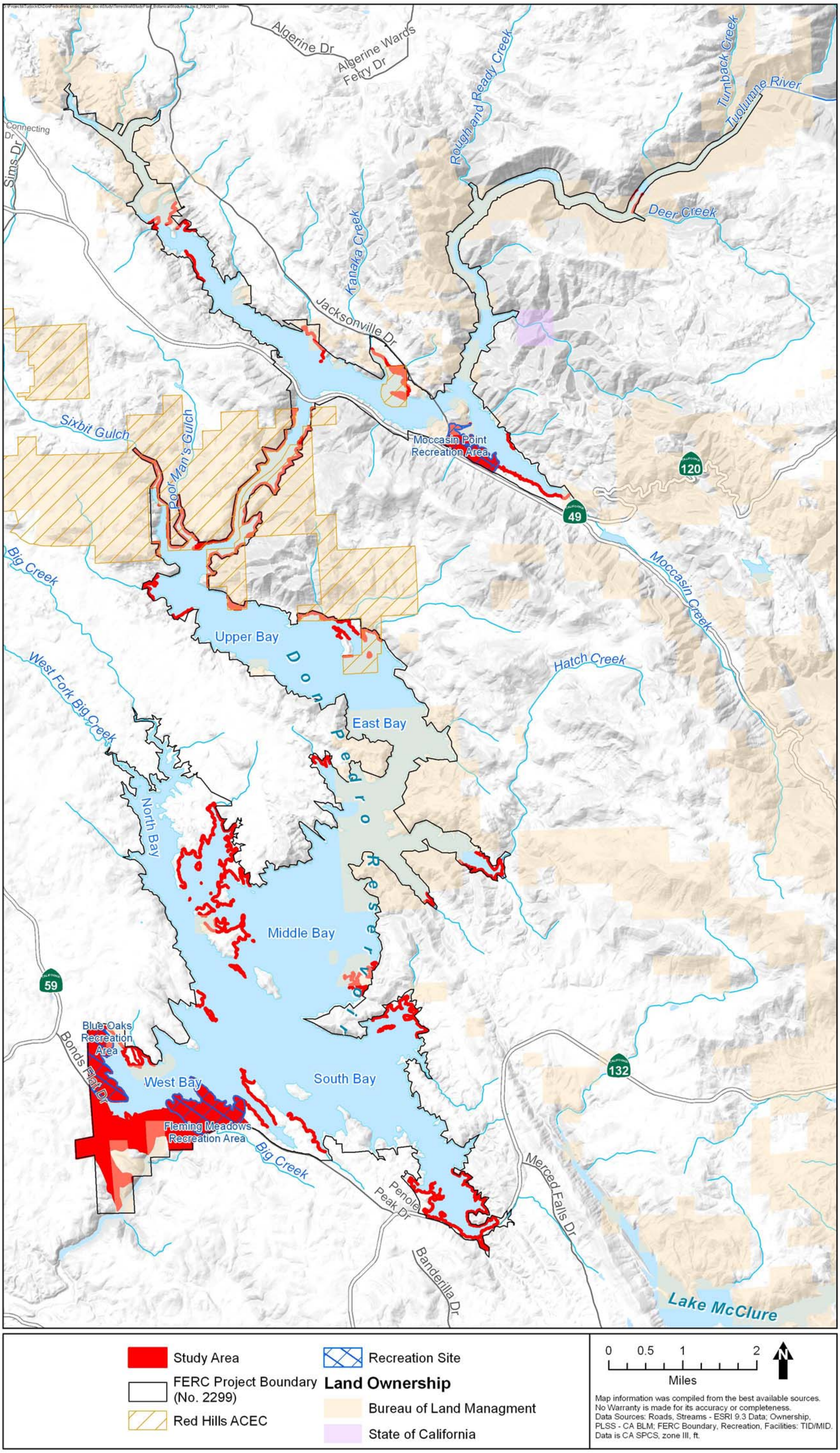
——. 2008b. Sierra Resource Management Plan and Record of Decision. February 2008. Folsom, CA.

U.S. Department of the Interior, U.S. Fish and Wildlife Service. 1988. Endangered Species Act of 1973 [(16 U.S.C. 1531-1544, 87 Stat. 884)], as amended through the 100th Congress.

_____. 2010. Sacramento Fish and Wildlife Office. Endangered Species Lists. Query ran for the following quads: Chinese Camp (458C), La Grange (440B), Moccasin (458D), Penon Blanco Peak (440A), Sonora (458B), and Standard (458A). Available online at: <http://www.fws.gov/sacramento/es/spp_lists/auto_list_form.cfm>. Accessed July 16, 2010.

ATTACHMENT A

ESA- AND CESA- LISTED PLANTS STUDY AREA



Algerine Dr
Algerine Wards Ferry Dr
Rough and Ready Creek
Tumback Creek
Tuolumne River
Connecting Dr
Sims Dr
Deer Creek
Kanaka Creek
Jacksonville Dr
Sixbit Gulch
Poor Man's Gulch
Moccasin Point Recreation Area
120
49
Big Creek
Moccasin Creek
Upper Bay
Don Pedro Reservoir
Hatch Creek
West Fork Big Creek
East Bay
North Bay
Middle Bay
59
Blue Oaks Recreation Area
West Bay
South Bay
132
Bonds Flat Dr
Fleming Meadows Recreation Area
Big Creek
Penole Peak Dr
Merced Falls Dr
Banderilla Dr
Lake McClure
Study Area
FERC Project Boundary (No. 2299)
Red Hills ACEC
Recreation Site
Land Ownership
Bureau of Land Managment
State of California
0 0.5 1 2
Miles
N
Map information was compiled from the best available sources.
No Warranty is made for its accuracy or completeness.
Data Sources: Roads, Streams - ESRI 9.3 Data; Ownership,
PLSS - CA BLM; FERC Boundary, Recreation, Facilities: TID/MID.
Data is CA SPCS, zone III, ft.

STUDY PLAN TR-3

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Wetland Habitats Associated with Don Pedro Reservoir

July 2011

Related Study Requests: AR-15; BLM-09; SWRCB-03, 14; WSS-01

1.0 Project Nexus

The Districts' operation and maintenance (O&M) of the Don Pedro Project (Project) may affect riparian and wetland habitats. Project facilities, recreational use, and access roads may interrupt or change hydrologic function in a manner that alters wetland habitats, and Project-related recreation may impact wetland habitats by physical disturbance or the introduction of noxious weeds.

This study addresses the following resource issue identified in Section 4.2.3 of FERC's Scoping Document for the Project :

Effects of project operation, including water level fluctuations, ground-disturbing activities, and maintenance activities on wetland, riparian and littoral vegetation communities.

2.0 Resource Agency Management Goals

The Districts have identified four agencies that have resource management goals related to wetland habitats in the Project vicinity: (1) U.S. Department of Interior (USDOI), Bureau of Land Management (BLM) on United States-owned land administered by BLM; (2) USDOI, Fish and Wildlife Service (USFWS); (3) California Department of Fish and Game (CDFG); and (4) U.S. Army Corps of Engineers (ACOE).

The BLM's Sierra Resource Management Plan (BLM 2008) provides general guidelines for managing riparian and wetland areas, including conserving, improving and restoring riparian and wetland habitat and improving riparian vegetation. The USFWS' stated wetlands management goal is to work with others to protect and restore wetlands and the species that depend on them (USFWS 2008). One of the CDFG's major goals for wetlands management is to meet the wetlands protection, restoration, and enhancement goals of the Central Valley Habitat Joint Venture (CDFG 2007). The ACOE's management goals for wetlands include protecting aquatic resources, while allowing reasonable development, through restoring, enhancing, creating and preserving aquatic functions (ACOE 2008).

3.0 Study Goals

The goal of this study is to map and describe wetland habitats within the study area and to characterize their functional condition. The study objective for individual study sites is to describe specific wetland habitats and collect data sufficient to complete a California Rapid Assessment Method (CRAM) evaluation and scoring for each wetland.

4.0 Existing Information and Need for Additional Information

The Districts' Pre-Application Document (PAD) contains information wetland habitats occurring in the study area, including CalVeg maps and National Wetland Inventory (NWI) maps on a 1:24,000 scale, shown with U.S. Geological Survey topographic features and Project facilities.

Section 5.4.3 of the PAD includes tables of mapped wetlands surrounding Project reservoirs and impoundments within 0.25 mile of the Project Boundary, including acreages within the Project area for each of the palustrine and riverine wetlands mapped by NWI. Also included in this section is ground survey information, photographic data, and mapped vegetation communities, where available. NWI mapping identified five classes of palustrine wetlands and three classes of riverine wetlands in the FERC Project Boundary: palustrine emergent (22.4 acres), palustrine scrub-shrub (1.2 acres), palustrine unconsolidated bottom (10.5 acres), palustrine unconsolidated, shore (0.4 acre), riverine unconsolidated bottom (30.9 acres), riverine unconsolidated shore (1.7 acres), and riverine streambed (15.3 acres).

The Districts' PAD also described existing CalVeg vegetation mapping efforts that have been completed for the study area and much of California (USFS 2004). CALVEG mapping identified all riparian habitats in the Project area as Riparian Mixed Hardwood. Typical hardwoods species mixtures for these habitats in the Central Valley include willows (*Salix* spp.), Valley oak (*Quercus lobata*), Fremont cottonwood (*Populus fremontii*), California sycamore (*Platanus racemosa*), and white alder (*Alnus rhombifolia*). Approximately 5.5 acres of Riparian Mixed Hardwood habitat were mapped in the Project Boundary.

5.0 Study Methods

5.1 Study Area

The study area consists of the area within the Project Boundary that is subject to Project-related O&M and/or recreation activities, including high-use dispersed recreation areas. The study area is described in Attachment A of this study plan, and includes the following specific areas within the Project Boundary:

- The Blue Oaks, Fleming Meadows, and Moccasin Point Recreation areas and related facilities, including the 3.5 mile Don Pedro Shoreline Trail;
- High-use dispersed recreation areas as described in Attachment A;
- Lands within the Project Boundary designated as part of the Red Hills Area of Critical Environmental Concern;
- Don Pedro Dam, Powerhouse, and Switchyard, including related maintenance and storage facilities and the powerhouse access road;
- The Don Pedro Spillway channel and related access roads;
- The Gasburg Creek diversion dike and related access roads;
- Employee Housing near Don Pedro Dam;
- Don Pedro Recreation Agency headquarters and visitor center;
- Dikes A, B, and C in the vicinity of Don Pedro Dam; and
- The Wards Ferry take-out.

The study area also includes habitats adjacent to each of these Project features to the extent they could reasonably be affected by Project O&M and/or recreation, generally understood to be less than 100 feet. If wetland habitats are located, the study area will be expanded to the full extent of the occurrence or the Project Boundary, whichever is less.

5.2 General Concepts

These general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study report.

5.3 Study Methods

Study methods will consist of these steps:

<u>Step 1 – Collect and Review Existing Data and Information</u>. Existing data, including GIS data, reports, maps, and aerial photography relevant to wetland habitat will be collected and reviewed where available. These sources may to provide documentation on geology, topography, soils, vegetation coverage and type, invasive species, and land use (i.e., mining, timber management, recreation, road development, fires, grazing, and water diversions). Aerial photos of the study area will be reviewed and used in conjunction with other information to determine the likely location of wetland habitats in the study area, and to direct field survey efforts.

<u>Step 2 – Conduct Field Surveys and Assess Functionality</u>. The Districts will conduct CRAM (Collins et al. 2008) assessments for all wetland habitats located in the study area that exceed 0.1 acre in size. CRAM is an empirically validated, peer-reviewed protocol developed to “provide rapid, scientifically defensible, standardized, cost effective assessments of the status and trends in the condition of wetlands” in California. At each site, the CRAM protocol will be conducted

by qualified botanists with experience in wetland and riparian ecology and expertise in plant identification.

At all sites, observations of representative conditions and noteworthy atypical conditions (e.g., channel encroachment or site-specific erosion) will be documented by geo-referenced photographs. In addition, recorded site information will include dominant and sub-dominant species; evidence of periodic recruitment; and descriptions of the wetland indicator status of dominant and subdominant plants onsite. In riverine habitats, the CRAM protocol will be supplemented with additional description of size class distributions for the four most-dominant riparian tree species and evidence of browse, if any. Fremont cottonwood (*Populus fremontii*) size class distributions will be described regardless of dominance.

At all sites, the CRAM protocol will include or be supplemented by the following: wetland location as derived from a handheld GPS unit; photographs of the upstream and downstream ends of riverine study sites; vegetation composition, observed hydrologic characteristics and wildlife observations; occurrences of noxious weeds as defined in the Districts' Noxious Weed Study Plan Proposal; documentation of observed disturbances, with emphasis on roads and recreational use; and, representative digital photographs.

<u>Step 3 – Prepare Data and Quality Assure/Quality Control Data</u>. Following field surveys, Licensee will develop GIS maps depicting riparian habitat and other related information collected during the study. Field data will then be subject to quality assurance/quality control (QA/QC) procedures, including spot-checks of transcription and comparison of GIS maps with field notes to verify site data.

<u>Step 4 – Prepare Report</u>. The Districts will prepare a report that includes the following sections: (1) Study Goals, (2) Methods, (3) Results, (4) Discussion, and (5) Conclusions. The report will include GIS maps, site data, and photo documentation, and will be included with the Districts' Initial Study Report.

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC issues its Study Plan Determination by December 31, 2011, and the study is not disputed by a mandatory conditioning agency.

- Planning (Step 1) .... January 2012 – March 2012
- Field Study (Step 2) .... March 2012 – July 2012
- QA/QC Review (Step 3) .... August 2012
- Operations Staff Consultation (Step 4) .... August 2012
- Study Report Preparation (Step 5) .... September 2012 – December 2012
- Report Issuance .... January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

The study methodology proposed is consistent with generally accepted practice in the scientific community. The proposed methodology uses an empirically tested, peer-reviewed assessment methods appropriate for use in the habitats present in the study area.

8.0 Deliverables

Deliverables for this study are described in Step 4 of Section 5.3, Study Methods.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

California Department of Fish and Game (CDFG). 2007. Wetlands Management. Available online at: <http://ceres.ca.gov/wetlands/agencies/dfg.html>.

Collins, J.N., E.D. Stein, M. Sutula, R. Clark, A.E., Fetscher, L. Grenier, C. Grosso, and A. Wiskind. 2008. California Rapid Assessment Method (CRAM for Wetlands and Riparian Areas. Available online at: <www.cramwetlands.org>.

United States Army Corps of Engineers (ACOE). 2008. Regulatory Program Mission Statement. Available online at: <http://www.usace.army.mil/cw/cecwo/reg/mission.htm>.

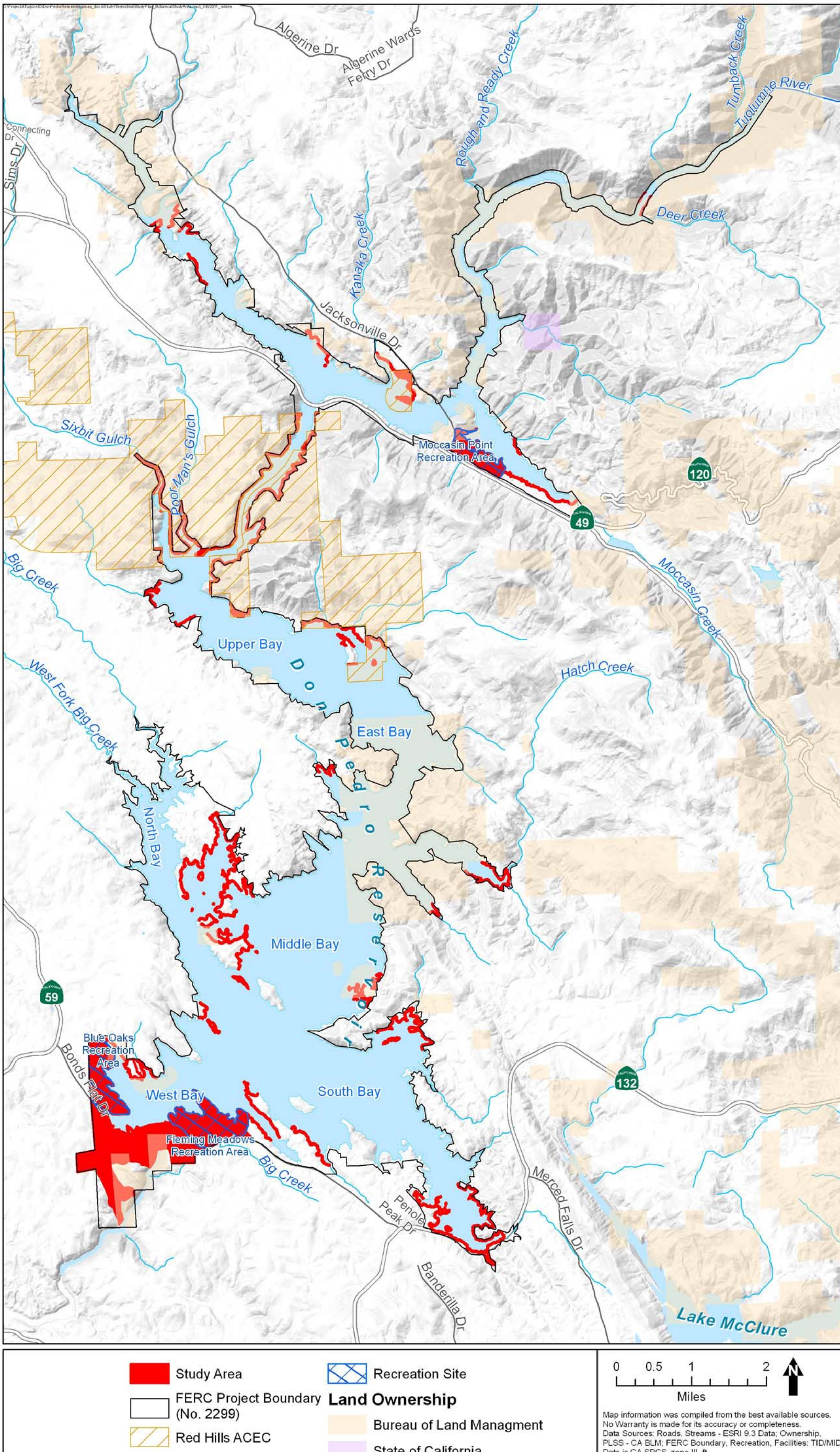
U.S. Department of Agriculture, Forest Service (USFS). 2004. Vegetation Classification: CALVEG Zones and Alliances - Vegetation Descriptions. U.S. Department of Agriculture, Forest Service. Available online at: <http://www.fs.fed.us/r5/rsl/projects/classification/zone-map.shtml>. Accessed August 4, 2010.

U.S. Department of the Interior, Bureau of Land Management (BLM). 2008. Sierra Resource Management Plan and Record of Decision. Folsom, CA.

U.S. Department of the Interior, Fish and Wildlife Service (USFWS). 2008. Service Wetlands Program. Available online at: <http://www.fws.gov/nwi/Service Programs.htm>.

ATTACHMENT A

WETLAND HABITAT STUDY AREA


Algerine Dr
Algerine Wards Ferry Dr
Connecting Dr
Sims Dr
Rough and Ready Creek
Tulloch Creek
Tuolumne River
Deer Creek
Kanaka Creek
Jacksonville Dr
Sixbit Gulch
Poor Man's Gulch
Moccasin Point Recreation Area
120
49
Big Creek
Moccasin Creek
Upper Bay
Don Pedro Reservoir
West Fork Big Creek
Hatch Creek
East Bay
North Bay
Middle Bay
59
Blue Oaks Recreation Area
West Bay
South Bay
132
Fleming Meadows Recreation Area
Bonds Flat Dr
Big Creek
Penole Peak Dr
Merced Falls Dr
Banderilla Dr
Lake McClure
Study Area
FERC Project Boundary (No. 2299)
Red Hills ACEC
Recreation Site
Land Ownership
Bureau of Land Managment
State of California
0 0.5 1 2
Miles
N
Map information was compiled from the best available sources.
No Warranty is made for its accuracy or completeness.
Data Sources: Roads, Streams - ESRI 9.3 Data; Ownership, PLSS - CA BLM; FERC Boundary, Recreation, Facilities: TID/MID.
Data is CA SPCS, zone III, ft.

STUDY PLAN TR-4

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Noxious Weed Survey Study Plan

July 2011

Related Study Requests: BLM-08

1.0 Project Nexus

Certain aspects of operation and maintenance (O&M) of the Don Pedro Project (Project) may increase the spread of noxious weeds. The spread may be the result of direct actions (i.e., result of ground disturbing activities such as construction) or cumulative (i.e., caused by a Project activity in association with a non-Project activity such as introduction of noxious weeds from a non-Project vector). This study evaluates Project O&M and recreation activities to assess their potential to spread noxious weeds.

2.0 Resource Agency Management Goals

The following laws, acts, plans, manuals, and policies provide a foundation for noxious and invasive weed management by the U.S. Department of Interior, Bureau of Land Management (BLM):

- The Carlson-Foley Act of 1968 directs agency heads to enter upon lands under their jurisdiction and destroy noxious plants growing on such land.
- The Federal Noxious Weed Act of 1974, as amended by Section 15, Management of Undesirable Plants on Federal Lands, 1990, authorizes the Secretary "...to cooperate with other Federal and state agencies and others in carrying out operations or measures to eradicate, suppress, control, prevent, or retard the spread of any noxious weed."
- The Federal Land Policy and Management Act of 1976 directs BLM to "...take any action necessary to prevent unnecessary and or undue degradation of the public lands."
- The Public Rangelands Improvement Act of 1978 requires that BLM will manage, maintain, and improve the condition of the public rangelands so that they become as productive as feasible.
- Interior Departmental Manual 609 prescribes policy to control undesirable or noxious weeds on the lands, waters, or facilities under its jurisdiction to the extent economically practicable, as needed for resource protection and accomplishment of resource management objectives.
- BLM Manual 9015 provides policy relating to the management and coordination of noxious weed activities among BLM, organizations, and individuals.

The BLM's Sierra Resource Management Plan (BLM 2008) provides general guidelines for managing noxious weeds, including managing vegetation (including noxious weeds removal) to improve habitat and control noxious weeds using early detection, rapid response, and prevention measures. The Food and Agricultural Code of California (Part 4, Chapter 1, Section 7270-7276) directs the California Department of Food and Agriculture (CDFA) to control and abate noxious weeds through mapping, research, and direct control measures. The Project area includes acreages of the BLM Red Hills Area of Critical Environmental Concern (ACEC). The Red Hills ACEC has been designated to protect the important and relevant values which include Delpiedra soils derived from dunite and serpentine, two federally listed species, four BLM sensitive species, and the serpentine buckbrush chaparral plant community. As outlined in the BLM's Sierra Resource Management Plan (2008), nonnative invasive weed control is a prioritized goal for the Red Hills ACEC.

3.0 Study Goals

The goal of this study is to provide information to determine whether continued Project O&M or recreational use of certain facilities may have a measurable, adverse effect (i.e., the facilitation or spread of) on noxious weeds. The criteria to determine a Project effect resulting from the spread of an existing noxious weed population already within or adjacent to the FERC Project Boundary includes both of the following:

- A noxious weed is found to occur within the study area as defined in Section 4.1; and
- A specific Project O&M activity has a reasonable possibility of having an adverse effect on the ecosystem by fostering the increase or spread of the noxious weed found.

4.0 Existing Information and Need for Additional Information

Existing and relevant information regarding known and potentially occurring noxious weeds in the Project vicinity is available from the Sierra-San Joaquin Noxious Weeds Alliance and Tuolumne Country Agricultural Department. This information is useful in developing a target list of noxious weeds and identifying their flowering periods and habitat. Information needed to address the study goal is the specific location of noxious weeds in relation to Project facilities, normal Project O&M activities, Project recreation, and any other Project-related activities that might affect these populations.

Based on this information, the Districts identified 28 noxious weed species with a reasonable potential to be affected by the Project. Table 4.0-1 provides a target list of noxious weeds for this study including the following general information for each plant: (1) scientific name, (2) common name, (3) CDFA status, and (4) types of data to be collected for that species.

Table 4.0-1 Target species for noxious weed survey efforts.

Scientific Name	Common name	Status[1]	Data to be collected[2]
Acroptilon repens	Russian knapweed	B	Full
Aegilops triuncialis	barbed goat grass	B	Qualitative
Ailanthus altissima	tree-of-heaven	C	Qualitative
Arundo donax	giant reed	B	Full
Cardaria chalepensis	lens-pod whitetop	B	Full
Cardaria spp.	Hoarycress	B	Full
Carduus pycnocephalus	Italian thistle	C	Qualitative

Carthamus spp.	distaff thistle	A, B	Full
Centaurea calcitrapa	purple starthistle	B	Full
Centaurea diffusa	diffuse knapweed	A	Full
Centaurea iberica	Iberian starthistle	A	Full
Centaurea maculosa	spotted knapweed	A	Full
Centaurea solstitialis	yellow starthistle	C	Qualitative
Chondrilla juncea	rush skeletonweed	A	Full
Cirsium arvense	Canada thistle	B	Qualitative
Cynodon dactylon	bermudagrass	C	Qualitative
Cytisus scoparius	Scotch broom	A	Full
Euphorbia oblongata	oblong spurge	B	Full
Hypericum perforatum	Klamathweed	C	Qualitative
Isatis tinctoria	dyer's woad	B	Full
Lepidium latifolium	perennial pepperweed	B	Full
Lythrum salicaria	purple loosestrife	B	Full
Salsola tragus	Russian thistle	C	Qualitative
Solanum elaeagnifolium	white horsenettle	B	Full
Taeniatherum caput-medusae	medusahead	C	Qualitative
Tamarix spp.	tamarisk	B	Full
Tribulus terrestris	puncturevine	C	Qualitative

Source: Sierra-San Joaquin Noxious Weeds Alliance 2003; Tuolumne County 2010.

[1] CDFA Noxious Weed Rating: A-rated weeds are highest priority for eradication in the State, followed by B- and then C-rated.

[2] Data to be collected:

Full = use GPS to delineate an occurrence polygon for any occurrence > 0.1 acre; an occurrence line delineated for any linear occurrence > 100' (e.g., along a road); smaller occurrences mapped by a single GPS point central to the occurrence.

Qualitative = distribution of species to be described generally but with specific reference to Project features. For discrete occurrences, collect a single GPS point taken near the center of the occurrence.

For description of other (non-GPS) data to be collected, see text.

5.0 Study Methods

5.1 Study Area

The study area consists of the area within the Project Boundary that is subject to Project-related O&M and/or recreation activities, including high-use dispersed recreation areas. The study area is described in Attachment A of this study plan, and includes the following specific areas within the Project Boundary:

- The Blue Oaks, Fleming Meadows, and Moccasin Point Recreation areas and related facilities, including the 3.5-mile Don Pedro Shoreline Trail;
- High-use dispersed recreation areas as described in Attachment A;
- Lands within the Project Boundary designated as part of the Red Hills Area of Critical Environmental Concern;
- Don Pedro Dam, Powerhouse, and Switchyard, including related maintenance and storage facilities and the powerhouse access road;
- The Don Pedro Spillway channel and related access roads;
- The Gasburg Creek diversion dike and related access roads;
- Employee Housing near Don Pedro Dam;

- Don Pedro Recreation Agency headquarters and visitor center;
- Dikes A, B, and C in the vicinity of Don Pedro Dam; and
- The Wards Ferry take-out.

The study area also includes habitats adjacent to each of these Project features to the extent they could reasonably be affected by Project O&M and/or recreation, generally understood to be less than 100 feet. If noxious weed occurrences are located, the study area will be expanded to the full extent of the occurrence or the Project Boundary, whichever is less.

5.2 General Concepts

These general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study report.

5.3 Study Methods

Study methods will consist of these steps:

<u>Step 1 – Gather Data and Prepare for Field Effort</u>. The Districts will identify and map known occurrences of noxious weeds within the study area, and prepare field maps for use by survey teams. The maps will include aerial imagery, Project features, and known noxious weed occurrences. Survey timing will be planned based on herbarium collection dates.

<u>Step 2 – Conduct Field Surveys</u>. The Districts' surveyors will conduct noxious weed surveys in conjunction with special-status plant surveys, using the similar field survey methods. Because the phenology of many weeds is later in the growing season relative to many rare plant species, noxious weeds may not be fully identifiable at the time that special-status plant surveys are occurring. As a result, return visits to some sites for weed identification may be necessary.

When noxious weeds listed in Table 4.0-1 are found within the study area, surveyors will collect:

- Digital photographs, if needed, to describe the occurrence.
- For those species where "full" data is indicated in Table 4.0-1, if a plant population is estimated to cover an area greater than 0.1 acre, or if the occurrence is linear (e.g., as along a road) and greater than 100 feet long, surveyors will delineate the approximate occurrence boundary, or end-points in the case of a linear occurrence, using a handheld GPS. If occurrences are smaller than those dimensions, only a single central GPS point is needed to indicate the location of the occurrence. If a single GPS point is used to map an occurrence, the area of the infestation will be estimated using one of two acreage classes: 0-0.01 acre, and 0.01-0.1 acre. The weed cover of the occurrence will be characterized as either concentrated or diffuse.

- Those species indicated with the descriptor "qualitative" in Table 4.0-1 will be described more generally, but with specific reference to nearby Project features. These species tend to produce large or diffuse populations that are infeasible to map in detail.
- Estimated distance to nearest Project facility, feature, or Project-related activity.
- Activities observed in the vicinity of the occurrence that have a potential to spread noxious weeds (*e.g.*, recreational trails and uses).
- Estimated phenology and descriptions of reproductive state of that weed occurrence.

Step 3 – Prepare Data and Quality Assure/Quality Control Data. Following field surveys, the Districts will develop GIS maps depicting noxious weed occurrences, Project facilities, features, and other related information collected during the study. Field data will then be subject to quality assurance/quality control (QA/QC) procedures, including spot-checks of transcription and comparisons of GIS maps with field notes to verify locations of noxious weed occurrences.

Step 4 – Consult with the Districts' Project Operations Staff. Once the location of noxious weeds in the study area is defined, Project operations staff will be consulted to identify Project O&M or other Project-related activities that typically occur in the area of the noxious weed populations that have a potential to spread noxious weeds.

Step 5 – Prepare Report. The Districts will prepare a report that includes the following sections: (1) Study Goals, (2) Methods, (3) Results, (4) Discussion, and (5) Conclusions. The Districts plan to make the report available to Relicensing Participants when completed, and ideally in time to be included in the Initial Study Report. The report will also be included in the appropriate license applications.

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC issues its Study Plan Determination by December 31, 2011, and the study is not disputed by a mandatory conditioning agency:

- Planning (Step 1) .... January 2012 – March 2012
- First Study Season (Step 2) .... March 2012 – July 2012
- QA/QC Review (Step 3) .... August 2012
- Operations Staff Consultation (Step 4) .... August 2012
- Study Report Preparation (Step 5) .... September 2012 – December 2012
- Report Issuance .... January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

This study is consistent with the goals, objectives, and methods outlined for FERC relicensing efforts in California, and uses standard botanical survey methods as defined by the CDFG.

8.0 Deliverables

In addition to the study report, results will include GIS maps that show noxious weed population locations in respect to Project facilities and features. The GIS layer of noxious weeds will be made available to the appropriate agencies.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

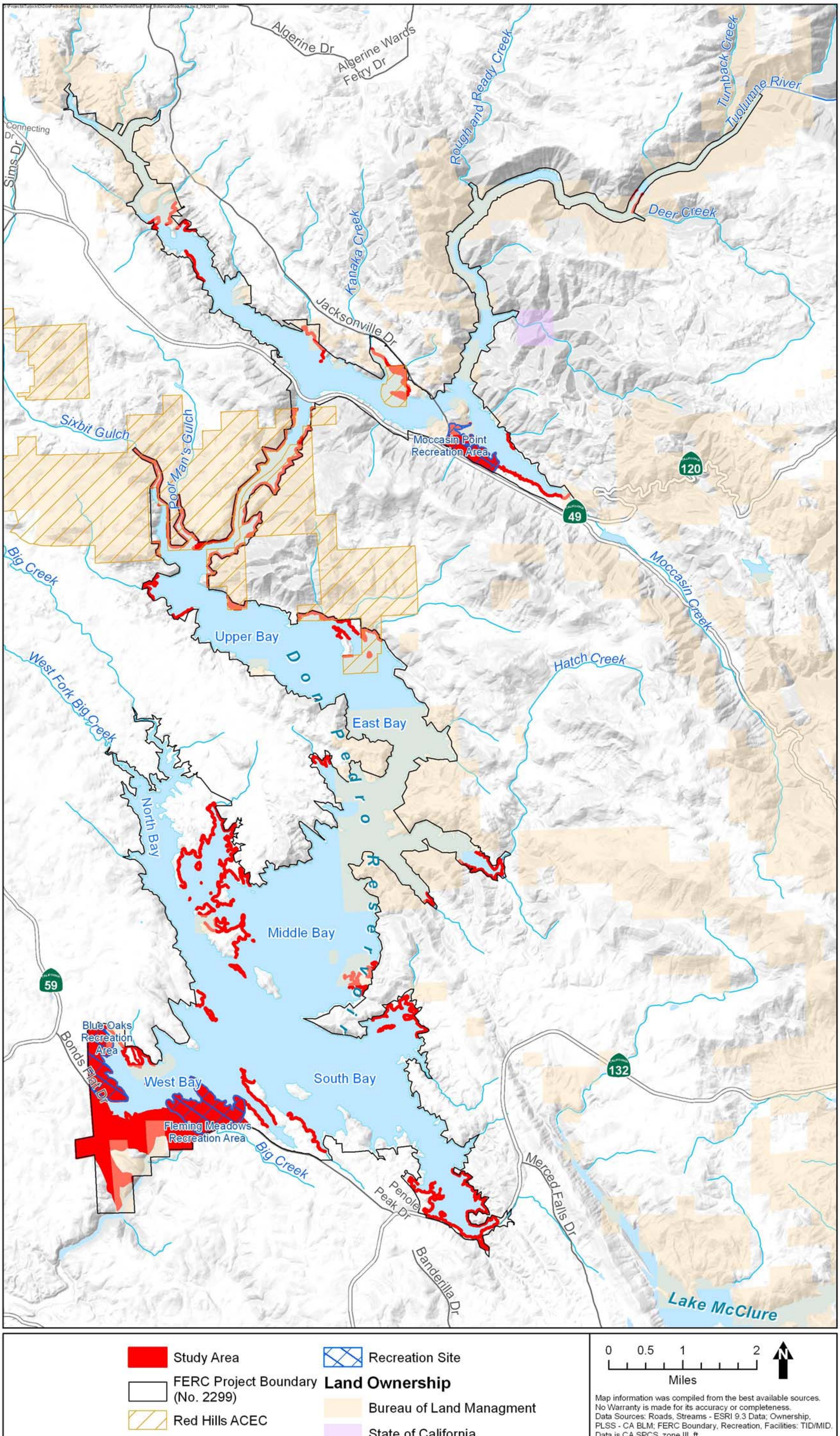
Sierra-San Joaquin Noxious Weeds Alliance (SSJNWA). 2003. Field Guide to Invasive Non-native Weeds of Mariposa, Madera and Fresno Counties.

Tuolumne County. 2010. Tuolumne County Noxious Weed Treatment Areas Projects and Participants.

U.S. Department of the Interior, Bureau of Land Management (BLM). 2008. Sierra Resource Management Plan and Record of Decision. February 2008. Folsom, CA.

ATTACHMENT A

DON PEDRO PROJECT STUDY AREA


Algerine Dr
Algerine Wards Ferry Dr
Rough and Ready Creek
Tumback Creek
Tuolumne River
Connecting Dr
Sims Dr
Deer Creek
Kanaka Creek
Jacksonville Dr
Sixbit Gulch
Poor Man's Gulch
Moccasin Point Recreation Area
120
49
Big Creek
Moccasin Creek
Upper Bay
Don Pedro Reservoir
West Fork Big Creek
Hatch Creek
East Bay
North Bay
Middle Bay
59
Blue Oaks Recreation Area
West Bay
South Bay
132
Bonds Flat Dr
Fleming Meadows Recreation Area
Big Creek
Penole Peak Dr
Merced Falls Dr
Banderilla Dr
Lake McClure
Study Area
FERC Project Boundary (No. 2299)
Red Hills ACEC
Recreation Site
Land Ownership
Bureau of Land Managment
State of California
0 0.5 1 2
Miles
Map information was compiled from the best available sources.
No Warranty is made for its accuracy or completeness.
Data Sources: Roads, Streams - ESRI 9.3 Data; Ownership,
PLSS - CA BLM; FERC Boundary, Recreation, Facilities: TID/MID.
Data is CA SPCS, zone III, ft.

STUDY PLAN TR-5

**TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT**

**DON PEDRO PROJECT
FERC NO. 2299**

ESA-Listed Wildlife - Valley Elderberry Longhorn Beetle Study Plan

July 2011

Related Study Requests: USFWS-04, 05

1.0 Project Nexus

Certain aspects of the ongoing operation and maintenance (O&M) of the Don Pedro Project (Project) may potentially affect valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (VELB) populations. Project O&M activities including vegetation management and routine maintenance at Project facilities may disrupt VELB habitat. This study focuses on the presence of VELB habitat, which may potentially be affected by Project O&M and/or Project-related recreation activities.

VELB is a terrestrial wildlife species that is listed as threatened under the federal Endangered Species Act (ESA). VELB has a reasonable potential to occur in the Project Boundary and may be affected by certain Project O&M or recreation activities.

2.0 Resource Agency Management Goals

The U.S. Department of Interior (USDOI), Fish and Wildlife Service (USFWS) administers the ESA as it relates to VELB. Potential impacts to VELB are also of interest to the USDOI, Bureau of Land Management (BLM) on federal lands administered by the BLM.

USFWS has issued conservation guidelines for VELB (USFWS 1999), which include survey protocols and compensation requirements for elderberries with one or more stems measuring one inch or greater in diameter at ground level that may be directly or indirectly impacted by the construction or operation of a project. Where impacts to plants are anticipated as a result of an action, elderberry plants with stems that meet the one-inch-diameter threshold on or adjacent to the site must be thoroughly searched for beetle exit holes and the number of stems tallied by diameter size class and location (i.e., riparian or upland) for determination of compensation ratios. Elderberry plants lacking stems one inch or greater in diameter at ground level are considered unsuitable for use by the beetle and are not protected under the guidelines. Surveys are valid for a period of two years.

The BLM's resource management goals are consistent with the ESA and BLM implementing policy. The ESA, Section 7(a)(1) states:

> *All federal agencies shall… utilize their authorities in furtherance of the purposes of this Act, by carrying out programs for the conservation of endangered species and threatened species listed pursuant to section 4 of this Act.*

BLM's implementing policy for ESA compliance in Manual 6840 states:

> *Policy. Actions authorized by BLM shall further the conservation and/or recovery of federally listed species…*
>
> *Section 7(a)(1) (Conservation Programs). Section 7(a)(1) requires the BLM to use its authorities to further the purposes of the ESA by implementing programs for the conservation of threatened and endangered species and the ecosystems on which they depend. Ways in which BLM can carry out these responsibilities include, but are not limited to:*
>
> *Determining to the extent practicable, the occurrence, distribution, population, and habitat condition of all ESA-listed species on BLM-administered lands…*
>
> *Monitoring and evaluating ongoing management activities to ensure conservation objectives for listed species are being met* (BLM 2008a).

BLM's Sierra Resource Management Plan (SRMP) (BLM 2008b) provides general guidelines for sustaining existing VELB populations on BLM land and sustaining and managing viable habitat for VELB through conservation and management of its host plant, elderberry.

3.0 Study Goals

The goal of this study is to provide information to the relicensing participants concerning VELB presence and distribution within the Project Boundary. The specific objective of this study is to gather information, including:

- Identify and map the location of appropriate elderberry shrubs.
- Classify habitat where shrubs are found into riparian or non-riparian, and whether shrubs are isolated or clumped.
- Document the presence or absence of VELB or evidence of VELB when surveys are performed.

4.0 Existing Information and Need for Additional Information

VELB were historically distributed throughout the Central Valley, extending upstream in river canyons in the Sierra Nevada foothills to an elevation of about 3,000 feet. The beetle is completely dependent upon its host plant, elderberry, which is a common component of the remaining riparian forests and adjacent uplands. The beetles' use of elderberries is not readily apparent; often the only exterior evidence is an exit hole created by the larva just prior to pupation. The life cycle takes one or two years to complete with most of that time spent as larva living within the stems of the plant. Adults generally emerge from late March through June, and adults are short-lived (USFWS 1999).

All existing and available information regarding previous surveys in the Project are occurrences outside of the Project Boundary. The Districts located a total of four California Natural Diversity Database (CNDDB) reports spanning from 2000 to 2007. These reports pertained to two occurrences in each of two U.S. Geological Survey 7.5-minute quadrangles: Sonora and Standard. Of these, two are reported VELB sightings and two are reports of VELB exit holes (CDFG 2010).

Existing information is not adequate to meet the goal of the study. Information necessary to address the study goal includes a current assessment of elderberry plants and VELB in the Project.

5.0 Study Methods

5.1 Study Area

The study area consists of the area within the Project Boundary that is subject to Project-related O&M and/or recreation activities, including high-use dispersed recreation areas. The study area is described in Appendix A of the Districts' Special-Status Plants Study Plan (Study Plan 3.3-1), and includes the following specific areas within the Project Boundary:

- The Blue Oaks, Fleming Meadows, and Moccasin Point Recreation areas and related facilities, including the 3.5 mile Don Pedro Shoreline Trail;
- High-use dispersed recreation areas as described in Appendix A;
- Lands within the Project Boundary designated as part of the Red Hills Area of Critical Environmental Concern;
- Don Pedro Dam, Powerhouse, and Switchyard, including related maintenance and storage facilities and the powerhouse access road;
- The Don Pedro Spillway channel and related access roads;
- The Gasburg Creek diversion dike and related access roads;
- Employee Housing near Don Pedro Dam;
- Don Pedro Recreation Agency headquarters and visitor center;
- Dikes A, B, and C in the vicinity of Don Pedro Dam; and
- The Wards Ferry take-out.

The study area also includes habitats adjacent to each of these Project features to the extent they could reasonably be affected by Project O&M and/or recreation, generally understood to be up to 100 feet. If elderberry occurrences are located, the study area will be expanded to the full extent of the occurrence or the Project Boundary, whichever is less.

5.2 General Concepts

These general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.

- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study report.

5.3 Study Methods

The study will be completed in six steps, each of which is described below.

Step 1 – Known Occurrences. The Districts will identify and map known occurrences of elderberry plants and VELB within the study area.

Step 2 – Conduct Field Surveys for Elderberry Plants. In conjunction with the Special-Status Plants Study, the Districts will document all occurrences of elderberry within the study area with GPS and take photographs of each occurrence. Occurrences will be documented by classifying the largest stem at ground level of the shrub into one of three categories: (1) greater than or equal to one inch but less than or equal to three inches, (2) greater than three inches but less than five inches, and (3) greater than five inches. The habitat surrounding the shrub will be classified as either riparian or non-riparian, and whether the shrub was isolated or part of a larger clump. In addition, surveyors will collect a total stem count by size class.

Step 3 – Conduct Surveys for Evidence of VELB. All elderberry shrubs with one or more stems measuring one inch or greater in diameter at ground level that occur within the study area must be thoroughly searched for beetle exit holes (external evidence of beetle presence). The exit holes should be characterized as to whether they are recent (shavings may be present) or not. Incidental observations of VELB on the plants will be noted and reported to the appropriate agencies (see Section 6.0).

Step 4 – Compile Data and Perform Quality Assurance/Quality Control. Following field surveys, the Districts will develop GIS maps depicting VELB occurrences, potential habitat, Project facilities, and features, and other information collected during the study. Field data will then be subject to QA/QC procedures, including spot-checks of transcription and comparison of GIS maps with field notes on locations of any VELB occurrences.

Step 5 – Consult with the Districts' Project Operations and Don Pedro Recreation Agency Staff. Once the locations of VELB and habitat in the study area are defined, Project operations and Don Pedro Recreation Agency staff will be consulted to identify O&M and recreation activities in those areas that may have the potential to adversely affect the population.

Step 6 – Prepare Report. The Districts will prepare a report that includes the following sections: (1) Study Goals, (2) Methods, (3) Results, (4) Discussion, and (5) Conclusions. Confidential information will not be included in the report, but provided to appropriate resource agencies.

6.0 Study-Specific Consultation

The Districts, as FERC's non-federal representatives, intend to undertake this study as part of their informal consultation under Section 7 of the ESA, and plan to consult with USFWS prior to, during, and following study implementation.

7.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC issues its Study Plan Determination by December 31, 2011, and the study is not disputed by a mandatory conditioning agency.

- Planning (Step 1) .... January – March 2012
- Field Season (Step 2).. March – July 2012
- Compile Data and QA/QC Review (Steps 3 and 4) .... August 2012
- Operations and DPRA Staff Consultation (Step 4) .... August 2012
- Study Report Preparation (Step 5) .... September – December 2012
- Report Issuance .... January 2013

8.0 Consistency of Methodology with Generally Accepted Scientific Principles

This study is consistent with the goals, objectives, and methods outlined for recent FERC relicensing efforts in California, and uses methods from the USFWS, BLM, and other expert sources.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

California Department of Fish and Game. 2010. Biogeographic Data Branch. California Natural Diversity Database (CNDDB). Available online at: <www.dfg.ca.gov/biogeodata/cnddb/ pdfs/TEPlants.pdf>. Accessed July 6, 2010.

U.S. Department of Interior, Bureau of Land Management (BLM). 2008a. BLM Manual 6840 - Special Status Species Management.

——. 2008b. Sierra Resource Management Plan and Record of Decision. February 2008. Folsom, California.

U.S. Department of Interior, Fish and Wildlife Service (USFWS). 1999. Conservation Guidelines for the Valley Elderberry Longhorn Beetle. U.S. Fish and Wildlife Service, Sacramento, California.

STUDY PLAN TR-6

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Special-Status Amphibians and Aquatic Reptiles Study Plan

July 2011

Related Study Requests: FOT-8

1.0 Project Nexus

Certain operation and maintenance (O&M) activities and recreation activities at the Don Pedro Project (Project) have a potential to affect special-status amphibians (Class Amphibia) and aquatic turtles (Class Chelonia).[1] Two such special status-species may occur in the Project area: foothill yellow-legged frog (FYLF; *Rana boylii*) and western pond turtle (WPT; *Actinemys* [formerly *Emys* or *Clemmys*] *marmorata*). The Project may provide suitable habitat for these species. Water level changes in reservoir tributaries, ground-disturbing activities, recreation foot traffic, and vegetation clearing are Project-related activities that could directly and indirectly affect special-status amphibians and aquatic turtles and their habitat.

FYLF is a stream-associated species affected by seasonal flow regimes that influence water stage, velocity, and temperature. Project effects on water levels at the mouths of reservoir tributaries could affect habitat availability and suitability for all life stages. Project operations that may result in changes in water levels and velocity may affect the suitability of instream habitat and if water levels decline, has the potential to strand egg masses and tadpoles. However, the Don Pedro Reservoir is not likely to be suitable FYLF habitat. FYLF may occur in the Tuolumne River in the upper most reaches of Don Pedro Reservoir or in tributaries that flow into the reservoir; however, the Project does not include any facilities or features upstream of Don Pedro Reservoir, nor do the Districts perform any Project O&M activities upstream of Don Pedro Reservoir.

Project O&M activities may affect WPT if this species is present in the Project reservoirs, slow-moving stream reaches, or other water bodies within the Project Boundary tributary to the

[1] For the purpose of this relicensing, special-status amphibians and aquatic turtles are considered those amphibian and aquatic turtle species: (1) potentially-occurring on U.S. Department of Interior, Bureau of Land Management (BLM) land and formally listed by BLM as a Sensitive Species; (2) listed by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) as Sensitive; (3) listed under the federal Endangered Species Act (ESA) as Proposed or Candidate for listing as endangered or threatened or proposed for delisting; (4) listed under the California Endangered Species Act (CESA) as proposed for listing; or (5) formally listed by California Department of Fish and Game (CDFG) as a Species of Concern. Species listed as threatened or endangered under the ESA or CESA are addressed separately and not considered special-status for the purpose of the relicensing proceedings.

Project. The Project is well within the elevational range of this species. More specifically, Project water level changes could result in inundation of potential nesting habitat.

2.0 Resource Agency Management Goals

Two agencies are likely to have a direct interest in the two special-status species addressed by this Study Plan: CDFG and BLM. CDFG has designated these species as species of concern. BLM, which administers public land in the Project area, has issued resource management plans that also relate to these two species. The Districts understand that BLM's resource management goals regarding special-status species, including special-status amphibians and aquatic turtles, are to maintain, improve or enhance native fish and wildlife populations and the ecosystems upon which they depend; ensure that all management activities and BLM authorization are consistent with the conservation needs of special-status species; manage special-status species habitat to assist in the recovery of listed species; protect and manage significant and sensitive resources on BLM lands; maintain and/or improve meadow and wetland habitat and riparian and aquatic habitat for all life stages of native fish, macroinvertebrates, other aquatic species, and special-status species; and to sustain and manage viable populations of the FYLF in the planning area.

3.0 Study Goals

The goal of this study is to provide information to the relicensing participants concerning FYLF and WPT associated with the Project, and related Project recreation features or activities. The specific objectives of this study are:

- Identify, compile, and map known occurrences of FYLF and WPT, including life history stage and associated habitat information as available. At a minimum, produce a map of known occurrences with a supplemental table that includes information on the location, date found, how many individuals (if available), and the source of the sighting (museum database, agency record, etc.).
- Identify and map habitats in the study area potentially suitable for FYLF and WPT, including potential WPT nesting habitat surrounding the Project reservoir, and evaluate the suitability of these habitats for the species.
- Document the distribution and abundance of FYLF and WPT in the study area.
- Perform FYLF and WPT surveys in suitable habitats where there is some evidence of a potential adverse Project effect.
- Compile incidental observations of FYLF and WPT and other aquatic special-status species and non-native amphibians, turtles, and crayfish from other aquatic studies.
- Provide information to enable an assessment of Project impacts.

4.0 Existing Information and Need for Additional Information

Existing and relevant information regarding known and potentially occurring locations of special-status amphibians and aquatic turtles in the Project vicinity is available from California Natural Diversity Database (CNDDB), museum records, and other sources. WPT is the only special-status turtle in the area (there are no special-status reptiles, i.e., Class Reptilia, snakes, and lizards, in the area). This information and a life history description of each species, included in Section 5.3 of the Pre-Application Document (PAD), are useful in identifying preferred habitats and documenting where the species have been found to date. Table 4.0-1 summarizes habitat requirements of each species by life stage.

Table 4.0-1 Special-status amphibians and aquatic turtle habitat requirements by life stage.[1]

Species	Egg Masses	Larvae/Hatchling Turtles	Adults
Foothill yellow-legged frog	Egg masses are deposited in low to moderate gradient streams, usually within shallow, edgewater areas of low velocity with cobble/boulder substrate in open, sunny areas with little riparian vegetation; often adjacent to low gradient cobble/boulder bars, tributary confluences, side and backwater pools, or pool tail-outs with coarse substrates. In small streams may occur in step pools and other microhabitats that meet basic conditions for substrate, water depth, and velocity.	Generally in low velocity segments of streams, such as edgewater habitat adjacent to riffles or cascades, in main channel pools, and plunge-pools that provide escape cover (e.g., substrate interstices, vegetation, and detritus for cover). Larvae, at least in early stages, show affinity to oviposition sites, but may disperse to shallow, warm, low velocity near-shore habitats with smaller substrate (i.e., gravel/sand) as the season progresses.	Perennial streams and ephemeral creeks with pools. Prefer areas that provide exposed basking sites and cool shady areas adjacent to water's edge. Shallow, flowing water, preferentially in small to moderate-sized streams with some cobble-sized substrate.
Western Pond Turtle	Upland, low gradient slopes (less than 15 degrees) with high clay or silt content in the vicinity of aquatic habitats. Eggs are deposited in a shallow excavation ("nest") in a dry location in summer. Nests are typically located on an unshaded slope that may be partly south-facing.	Hatchlings emerge from nests in spring. Require shallow water with dense submergent vegetation or short emergent vegetation.	Permanent ponds, lakes, reservoirs, low-flow regions of rivers, river side channels, and backwater areas. Isolated occurrences in lakes and reservoirs sometimes represent deliberate releases of pets. May also use seasonal streams or ponds when these are available. The presence of basking sites is important and these may be provided by emergent large woody debris, overhanging vegetation, rock outcrops, and mats of submergent vegetation. Deep pools and undercut banks may represent overwintering refugia. Often aestivate or overwinter in terrestrial habitats, including forests and riparian thickets, where they burrow in leaf litter.

1 Sources of information: Ashton et al. 1997; Holland 1991; Rathbun et al. 1992; Jennings and Hayes 1994, PG&E 2001, Lind 2005; Vollmar 2002.

4.1 Western Pond Turtle

WPT is a habitat generalist occurring in a wide variety of aquatic habitats with still- or slow-moving water up to about 6,000 feet elevation; the species is uncommon in high-gradient streams

(Jennings and Hayes 1994). Adult WPT have been documented traveling long distances from perennial watercourses for both aestivation and nesting, with long range movements to aestivation sites averaging about 820 feet and nesting movements averaging about 295 feet (Rathbun et al. 2002). Reese and Welsh (1997) documented WPT away from aquatic habitats for as much as seven months per year and suggested that terrestrial habitat use was at least in part a response to seasonal high flows.

WPT breeding activity may occur year-round in California, but egg-laying tends to peak in June and July in colder climates, when females begin to search for suitable nesting sites upslope from water. During the terrestrial period, Reese and Welsh (1997) found that radio-tracked WPT were burrowed in leaf litter.

Introduced species of turtles (e.g., red-eared sliders [*Trachemys scripta*]) may out-compete WPT for basking sites and the American bullfrog (*Lithobates catesbeianus*) [formerly *Rana catesbeiana*] is known to consume hatchling WPT.

There are several reports of WPT in the Project vicinity including records at: (1) Moccasin Creek; (2) Piney Creek, north of Lake McClure and east of Don Pedro Reservoir; and (3) Table Mountain; (4) First Creek; and (5) on an unnamed tributary west of Moccasin Peak. WPT are also reported from Bobcat Flat downstream of the Project, at approximately River Mile 43. In most cases, existing information is too general to meet the objectives of the study. Additional information needed includes specific and current localities of the species and its habitats in relation to Project facilities; and sufficient information on normal Project O&M activities that might affect populations.

4.2 Foothill Yellow-Legged Frog

FYLF is a stream-adapted species and is not associated with ponds, lakes, or other lentic habitats. Current distribution of FYLF is predominately between 600 and 5,000 feet elevation (Moyle 1973, Laabs et al. 2002, Seltenrich and Pool 2002, ECORP Consulting, Inc. 2005). Within large streams, FYLF often occurs near tributaries, which may provide important seasonal habitats (e.g., in winter and during the hottest part of the summer) (VanWagner 1996; Seltenrich and Pool 2001). Breeding tends to occur in spring or early summer and eggs are laid in areas of shallow, slow moving, waters near the shore. FYLF are infrequent in habitats where introduced fish and American bullfrog occur (Jennings and Hayes 1994).

A review of CNDDB, Museum of Vertebrate Zoology (2010), California Academy of Sciences (2010), and BLM records from the Project area indicates that FYLF has five observations within the Project vicinity: (1) one occurrence at Hatch Lake (on BLM and private land); (2) one occurrence at Second Lake (on private land); (3) one occurrence near the confluence of Big Jackass Creek and Moccasin Creek (on BLM land); (4) one occurrence south of Table Mountain (on private land); and (5) one occurrence on an unnamed tributary west of Moccasin Peak.

In most cases, existing information is too general to meet the objectives of the study. Additional information needed includes: (1) specific and current localities of the species and its habitats in relation to Project facilities; and (2) more detailed information on normal Project O&M activities that might affect populations.

5.0 Study Methods

5.1 Study Area

The study area consists of suitable aquatic habitats within the existing FERC Project Boundary and extends 0.5 mile from the normal maximum water surface elevation of the Project reservoir and Project-affected stream reaches, including the section of the Tuolumne River up to River Mile 79. In addition, the study area includes tributaries up to 1.0 mile upstream of the reservoirs. FYLF and WPT may make seasonal movements between tributaries and mainstem streams.

5.2 General Concepts

The following general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study report.

5.3 Study Methods

The study will be completed in six steps, each of which is described below. Prior to conducting fieldwork, the necessary CDFG scientific collection permits will be obtained. Field investigation will adhere to accepted decontamination guidelines to minimize the likelihood of transmitting diseases (USFWS 2005).

Step 1 – Identify and Map Known Occurrences. Known occurrences of FYLF and WPT will be mapped and identified based on agency consultation and review of the latest existing information, including a query of the CNDDB, agency records, museum records, and consultation with regional experts. The map will be supplemented with a table that includes information on the exact location, date found, how many individuals (if available), and the source of the sighting (museum database, agency record, etc.).

Step 2 – Identify and Map Potential Habitat. Available data sources will be reviewed to identify areas of potentially suitable habitat for each of the two special-status species based on the description of habitat elements presented in Table 4.0-1. Data sources may include aerial photographs and Google Earth, National Wetland Inventory maps, U.S. Geological Survey (USGS) 1:24,000 topographic quadrangles, hydrologic data, and other sources of information that would allow for assessment of habitat conditions within the study area.

Potential WPT nesting (oviposition) habitat within the Project Boundary will be identified and mapped in Geographic Information System (GIS) based on certain attributes associated with known WPT nest sites, including distance from aquatic habitats, percent slope, aspect, and soil type (Holland 1991; PG&E and NID 2008). The mapping criteria for WPT are defined as follows:

- Within 100 meters of the Project reservoir and other water bodies associated with the Project;
- Slope of 2 to 15 degrees;
- Southeast, south or southwest aspect;
- Canopy cover of less than 10 percent; and
- Compacted soils of clay or loam (this criterion will be used if suitable soil maps exist).

A field reconnaissance may be conducted at specific locations to assess on-site habitat conditions for FYLF and WPT if other data sources are not adequate to this purpose. Sites will be logged by GPS position, photographs will be taken of each site from various angles, and a preliminary habitat assessment will be conducted. Pertinent habitat characteristics to be recorded will include habitat type, hydrologic regime, vegetation types (e.g., aquatic, emergent, overhanging, and canopy), gradient, aquatic substrate, and stream channel form.

Step 3 – Select Survey Sites. Based on the results of Step 2, a representative set of sites with potentially suitable aquatic habitat within or immediately adjacent to the Project Boundary will be selected for FYLF and WPT surveys. The selection of survey sites will take into account site-specific conditions, including safety, accessibility (i.e., road or trail access, topography), permission from landowners to survey on private lands, and potential impact from Project O&M activities. To the extent reasonable, WPT survey sites will be co-located with other relicensing study sites.

Step 4 – Conduct Surveys and Compile Incidental Observations.

Foothill Yellow-Legged Frog

Visual Encounter Survey Procedures

Surveys for FYLF will occur during the breeding season and will follow the visual encounter survey (VES) standard protocols developed by Pacific Gas & Electric Company (PG&E) for hydroelectric project applications (Seltenrich and Pool 2002; PG&E and NID 2009).

Specifically, two surveyors working in tandem will search stream banks, back channel areas, and potential instream habitats for FYLF walking slowly while one observer scans ahead. Habitats along each bank will be searched. To aid in the detection of eggs and larvae, surveyors will use a viewing box in shallow margin areas. In water too deep to survey by wading, or where substrate configuration (e.g., large boulders) or other factors render the viewing box ineffective, snorkeling will be employed in appropriate habitats during searches where safely accessible. Survey site length will range from 750 to 1,000 meters based on the extent of suitable habitat and access. Data collected during each survey includes:

- **Sampling Site:** time of survey (start, end and total search effort), GPS locations (start and end), weather conditions, and water and air temperatures (at start, mid-day, and end of survey) in both the channel margin and main channel, and;
- **Observation**: lifestage, sex, size, GPS location, as well as associated habitat data based on procedures described in Seltenrich and Pool (2002) and as updated in PG&E and NID (2009).

Survey Schedule

Three FYLF VES visits per site will be conducted; two visits in the spring/early summer for the detection of eggs and early tadpoles, and one in the late summer/early fall to detect older tadpoles and recently metamorphosed frogs. The first spring visit will be completed when river temperatures have reached a daily average of 11°C and/or when breeding has been verified in one or more comparison sites or the survey sites. Following the initial VES, surveyors will complete a habitat characterization of each study location, following standard operating procedures (PG&E and NID 2009). A reduced (single visit) VES effort may be performed in locations where the primary objective is to confirm habitat suitability.

Western Pond Turtle

The distribution of WPT will be evaluated by two means: (1) visual surveys at representative suitable sites within the Project Boundary as selected in Step 3, and (2) compilation of opportunistic observations incidental to the performance of other field studies for the relicensing (e.g., FYLF surveys, CRLF habitat assessments, botanical surveys, etc.). Incidental observations of turtles will include identification (i.e., WPT, exotic species, such as red-eared slider, or "unknown species"), estimated size, turtle behavior (e.g., basking on log), location, time, and a brief description or photograph of the habitat.

In general, incidental observations of WPT are most likely to occur during studies that involve quiet observation (e.g., scanning a site with binoculars), snorkeling, rafting or boat work associated with deep pools and backwaters. Turtles may also be observed when a site is first approached (WPT typically dive from basking sites when approached even at a long distance [Holland 1991; Reese undated]) or on roads when turtles make overland movements. Personnel performing other studies will be trained in how best to observe WPT. Field crews will also be instructed to document skeletal remains and evidence of WPT nests, such as the scrapes produced by females when digging nest-holes, signs of nests opened by predators, and remnants of hatched eggshells.

Visual surveys for WPT are adapted from USGS (2006) and will be supplemented by deployment of artificial basking platforms at survey sites where appropriate (Alvarez 2006). The use of basking platforms is an efficient and effective technique that has been shown to substantially increase detection rates, particularly at sites where existing basking sites are limited (Alvarez 2006). Surveys will be conducted at a time of day and under weather conditions when turtles are likely to be basking (e.g., sunny mornings May-July). Sites will be initially searched by binoculars from a distance to identify potential basking locations, such as sunlit rocks, logs, exposed banks, and floating vegetation. If turtles are observed, the species, number, and relative size of turtles will be recorded. The observer will then slowly and quietly approach the site, assume a suitable viewing position, and continue to scan the site for at least 30 minutes, focusing on basking sites and the surrounding water. Splashes of water that may signify a turtle entering the water will be noted. The length of time devoted to scanning each site will be recorded; and the locations of turtle sightings and possible evidence of WPT, including splashes, and locations where photographs are taken will be marked on a sketch of the site. Observers will also identify locations where the addition of artificial basking platforms may increase the likelihood of turtle detections. Artificial basking platforms will be placed at survey sites in suitable open water areas where potential basking substrates are scarce or obscured by vegetation. Each floating platform will consist of a rough-textured rectangular wood board; additional floatation at one end; and a tethered concrete anchor (Alvarez 2006). Platforms will be left in place for five to seven days to allow turtles to become acclimated and adopt platforms for basking. Sites will then be surveyed again for basking turtles.

Where turtles are found, the following data will be collected: (1) presence and name of exotic plant species; (2) presence of exotic turtles or bullfrogs; (3) percent overhead canopy; (4) percent submergent and emergent vegetation; (5) type of upland and riparian vegetation community; (6) presence and type of potential aquatic refugia (undercut banks, submerged tree roots, woody debris, rock crevices, aquatic submerged vegetation, emergent vegetation, and floating material); and (7) presence and type of any recent site disturbance. At the beginning of each survey, the following data will be recorded: date, observer, time, general weather description, ambient air temperature, average wind speed, water temperature, and estimated water velocity. Changes in weather conditions during surveys that could affect turtle detection (e.g., increased cloud cover or wind) will be noted. All survey sites will be photographed from multiple vantage points and the following information recorded: presence or absence of slow moving water and water depths ≥0.5 meters; quantity (none, few, or many) and types of basking sites (sunny rocks, open banks, fallen logs, and other); aquatic and streamside refugia, and upland habitat.

Survey sites for WPT will be assessed for the presence of American bullfrog by listening for calls, scanning suitable areas with binoculars or spotting scope for egg masses and basking frogs, and looking in shallow edges for larvae. After a site has been surveyed for WPT from a stationary position, at least one observer will walk along the shoreline listening and scanning ahead for jumping frogs—juvenile American bullfrogs often vocalize as they jump in alarm.

This study is not specifically designed to trap or capture WPT or other turtles. However, when a turtle is observed during this or other studies, capture may be attempted if feasible and without injuring or unduly stressing the animal. Field staff will be authorized by CDFG permits to capture WPT. Turtles that are captured will be measured (amphibian and turtle study teams will use calipers; other study teams will use a ruler photographed next to the turtle). Captured turtles will be categorized by sex (if determinable) and photographed in dorsal (carapace) and ventral (plastron) view alongside a ruler for later measurements and estimating age (counting scutal rings).

The Districts will complete and submit the appropriate California Native Species Field Survey Form to the CNDDB (Attachment A).

<u>Step 5 – Prepare, Format, and Quality Assurance/Quality Control Data</u>. Following field surveys, the Districts will develop GIS maps depicting special-status species occurrences, potential habitat, project facilities and features, and other information collected during the study. Field data will then be subject to QA/QC procedures, including spot-checks of transcription and comparison of GIS maps with field notes.

<u>Step 6 – Prepare Report</u>. The Districts will prepare a report that includes the following sections: (1) Study Goals, (2) Methods, (3) Results, (4) Discussion, and (5) Conclusions. At a minimum, the following summaries/data presentations will be provided in the report with the supporting data (in Excel spreadsheet and GIS layers, as appropriate):

- Presence/absence of each special-status species by survey period (e.g., spring, summer), sample reach tributary, and river.
- Abundance of FYLF egg masses by survey period and location.
- Abundance of FYLF tadpoles/tadpole groups by survey period and location.
- Abundance of FYLF young-of-the-year (metamorphs), subadults, and adults by survey period and location.
- Descriptive summaries of FYLF egg mass and tadpole habitat characteristics (at least n, mean, minimum, maximum, and standard error values) overall and by site.
- Numbers of WPT detections by life stage (e.g., juvenile or adult) in the Project reservoir, Project-affected streams, or other study locations.
- Maps of and descriptive information on the occurrence of potential WPT nesting habitat and its relationship to the study area.

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC issues its Study Plan Determination by December 31, 2011, and the study is not disputed by a mandatory conditioning agency:

- Identify and Map Habitat, and Select Survey Sites (Steps 1-3) .... November 2011 – April 2012
- Conduct Surveys (Step 4) .... May 2012 – September 2012
- Prepare Report (Step 5) .... September 2012 – January 2013
- QA/QC (Step 6) .... November 2012 – January 2013
- Report Issuance .... January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

This study is generally consistent with the goals, objectives, and methods outlined for recent FERC relicensing efforts in California, and uses well-established data from CDFG and other reputable sources for the analysis.

8.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

9.0 References

Alvarez, J.A. 2006. Use of artificial basking substrate to detect and monitor western pond turtles (*Emys marmorata*). Western North American Naturalist 66:129-131.

Ashton, D.T., A.J. Lind, and K.E. Schlick. 1997. Western Pond Turtle (*Clemmys marmorata*). Natural History. USDA Forest Service, Pacific Southwest Research Station, Arcata, California.

California Academy of Sciences. 2010. Herpetology Records. Available online at: <http://www. calacademy.org/research/herpetology/catalog/Index.asp>. Accessed January 25, 2010.

ECORP Consulting, Inc. 2005. Draft results of the 2004 (Year 1) amphibian monitoring program for foothill yellow-legged frog and mountain yellow-legged frog. El Dorado Hydroelectric Project (FERC Project No. 184). Report to El Dorado Irrigation District, May 18, 2005.

Holland, D.C. 1991. A synopsis of the ecology and status of the western pond turtle (*Clemmys marmorata*) in 1991. Prepared for USFWS, National Ecology Research Center, San Simeon Field Station. 141 pp. + appendices.

Jennings, M.R., and M.P. Hayes. 1994. Amphibian and reptile species of special concern in California. Final Report to the California Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California. 225 pp.

Laabs, D.M., S.G. Orloff, and M.L. Allaback. 2002. Chapter 5. Pond and Stream-breeding Amphibians. In: Vollmar, J.A., editor. Wildlife and Rare Plan Ecology of Eastern Merced County's Vernal Pool Grasslands. Vollmar Consulting, Berkley, California.

Lind, A. 2005. Reintroduction of a declining amphibian: determining an ecologically feasible approach for the foothill yellow-legged frog (*Rana boylii*) through analysis of decline factors, genetic structure, and habitat associations. Ph.D. Dissertation, University of California, Davis. 169 pp.

Moyle, P.B. 1973. Effect of introduced bullfrogs, *Rana catesbeiana*, on the native frogs of the San Joaquin Valley, California. Copeia 1973:18-22.

Museum of Vertebrate Zoology. 2010. Herpetological records for Yuba, Sierra, and Nevada, Yuba, and Sierra counties, California. University of California, Berkeley. Available online at: <http://mvzarctos.berkeley.edu/SpecimenSearch.cfm>. Accessed January 25, 2010.

Pacific Gas and Electric Company (PG&E). 2001. Survey protocols, standard operating procedures, and data sheets for amphibian surveys and habitat assessments. May 2001. Unpublished.

PG&E and Nevada Irrigation District (NID). 2008. Study 2.3.9, Special-Status Aquatic Reptiles-Western Pond Turtle. Prepared for the Relicensings of NID's Yuba-Bear Hydroelectric Project (FERC Project No. 2266) and PG&E's Drum-Spaulding Project (FERC Project No. 2310).

_____. 2009. Study 2.3.6. Foothill Yellow-Legged Frog Surveys Study. Revised Study Plan, Drum Spaulding Project and Yuba Bear Hydroelectric Project.

Rathbun, G., N. Siepel, and D. Holland. 1992. Nesting behavior and movements of western pond turtles, *Clemmys marmorata*. The Southwestern Naturalist 37:319-324.

Rathbun, G. B., N. J. Scott, and T. G. Murphey. 2002. Terrestrial habitat use by Pacific pond turtles in a Mediterranean climate. The Southwestern Naturalist 47:225-235.

Reese, D.A. Undated. Western pond turtle survey techniques. 12pp.

Reese D.A. and H.H. Welsh. 1997. Use of terrestrial habitat by western pond turtles, *Clemmys marmorata*: implications for management. In: Proceedings: Conservation, Restoration, and Management of Tortoises and Turtles, pp. 352-357. New York Turtle and Tortoise Society.

Seltenrich, C. and A. Pool. 2002. A Standardized Approach for Habitat Assessments and Visual Encounter Surveys for the Foothill Yellow-Legged Frog (*Rana boylii*). Pacific Gas and Electric Company. Available online at: <http://www.canvamphibs.com/pdf/FYLFMethods052002.pdf>. Accessed July 29, 2010.

U.S. Department of Interior, Fish and Wildlife Service. 2005. Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog. Available online at: <www.fws.gov/sacramento/es/documents/crf_survey_guidance_aug2005.doc>. Accessed November 2007.

U.S. Geological Survey. 2006. USGS western pond turtle (*Emys marmorata*) visual survey protocol for the southcoast ecoregion - Draft. U. S. Geological Survey protocol. San Diego, CA. 56 pp.

Van Wagner, T. 1996. Selected life history and ecological aspects of a population of foothill yellow-legged frogs (*Rana boylii*) from Clear Creek, Nevada City, California. M.S. thesis, California State University Chico. 143 pp.

Vollmar, J.E. (Ed.). 2002. Wildlife and Rare Plant Ecology of Eastern Merced County's Vernal Pool Grasslands. Vollmar Consulting, Berkeley, CA.

ATTACHMENT A

CALIFORNIA NATIVE SPECIES FIELD SURVEY FORM

Mail to:
California Natural Diversity Database
Department of Fish and Game
1807 13th Street, Suite 202
Sacramento, CA 95811
Fax: (916) 324-0475 email: CNDDB@dfg.ca.gov

Date of Field Work (mm/dd/yyyy): ____________

For Office Use Only	
Source Code ______	Quad Code ______
Elm Code ______	Occ. No. ______
EO Index No. ______	Map Index No. ______

Reset

California Native Species Field Survey Form

Send Form

Scientific Name:

Common Name:

Species Found? ☐ Yes ☐ No ____________ If not, why?

Total No. Individuals ______ Subsequent Visit? ☐ yes ☐ no

Is this an existing NDDB occurrence? ______ Yes, Occ. # ☐ no ☐ unk.

Collection? If yes: ______ Number ____________ Museum / Herbarium

Reporter: ____________

Address: ____________

E-mail Address: ____________

Phone: ____________

Plant Information

Phenology: ____% vegetative ____% flowering ____% fruiting

Animal Information

____ # adults ____ # juveniles ____ # larvae ____ # egg masses ____ # unknown

☐ wintering ☐ breeding ☐ nesting ☐ rookery ☐ burrow site ☐ other

Location Description ***(please attach map AND/OR fill out your choice of coordinates, below)***

County: ____________ Landowner / Mgr.: ____________

Quad Name: ____________ Elevation: ____________

T____ R____ Sec ____, ____ ¼ of ____ ¼, Meridian: H☐ M☐ S☐ Source of Coordinates (GPS, topo. map & type): ____________

T____ R____ Sec ____, ____ ¼ of ____ ¼, Meridian: H☐ M☐ S☐ GPS Make & Model ____________

DATUM: **NAD27** ☐ **NAD83** ☐ **WGS84** ☐ Horizontal Accuracy ____________ meters/feet

Coordinate System: UTM Zone 10 ☐ UTM Zone 11 ☐ ***OR*** Geographic (Latitude & Longitude) ☐

Coordinates:

Habitat Description (plants & animals) *plant communities, dominants, associates, substrates/soils, aspects/slope:*
Animal Behavior *(Describe observed behavior, such as territoriality, foraging, singing, calling, copulating, perching, roosting, etc., especially for avifauna):*

Please fill out separate form for other rare taxa seen at this site.

Site Information Overall site/occurrence quality/viability (site + population): ☐ Excellent ☐ Good ☐ Fair ☐ Poor

Immediate AND surrounding land use:

Visible disturbances:

Threats:

Comments:

Determination: *(check one or more, and fill in blanks)*

- ☐ Keyed (cite reference): ____________
- ☐ Compared with specimen housed at: ____________
- ☐ Compared with photo / drawing in: ____________
- ☐ By another person (name): ____________
- ☐ Other: ____________

Photographs: *(check one or more)*

	Slide	Print	Digital
Plant / animal	☐	☐	☐
Habitat	☐	☐	☐
Diagnostic feature	☐	☐	☐

May we obtain duplicates at our expense? yes☐ no☐

STUDY PLAN TR-7

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

ESA-Listed Amphibians - California Red-Legged Frog Study Plan

July 2011

Related Study Requests: USFWS-03

1.0 Project Nexus

The Districts' ongoing operation and maintenance (O&M) of the Don Pedro Project (Project) have a potential to affect the California red-legged frog (CRLF; *Rana draytonii*), a federally threatened species listed under the federal Endangered Species Act (ESA), and potentially occurring in the Project area. These effects could involve activities related to Project operations that impact suitable habitat or to Project-related recreation activities.

2.0 Resource Agency Management Goals

The U.S. Department of Interior (USDOI), Fish and Wildlife Service (USFWS) administers the ESA related to federally listed threatened and endangered species. The ESA prohibits any person from "taking" a listed species. Consultation with USFWS is required to ensure than any federal action is not likely to jeopardize the continued existence of a listed species, or result in the destruction or adverse modification of critical habitat. The Districts are unaware of specific management goals for CRLF specifically relevant to the Project.

The California Department of Fish and Game (CDFG) administers the California Endangered Species Act (CESA). CRLF is currently listed as a species of special concern (CSC). The CESA requires state lead agencies preparing California Environmental Quality Act documents to consult with CDFG regarding potential impacts of projects on state-listed species. If jeopardy is determined for listed species, the state lead agency must consider adopting reasonable and prudent actions as provided by CDFG.

The USDOI, Bureau of Land Management (BLM) administers federal lands in the immediate Project area. BLM's resource management goals regarding special-status species, including special-status amphibians and aquatic reptiles, are to maintain, improve or enhance native populations and the ecosystems upon which they depend; ensure that all BLM management activities and authorizations are consistent with the conservation needs of special-status species; manage special-status species habitat to assist in the recovery of listed species; protect and manage significant and sensitive resources on BLM lands; to maintain and/or improve meadow and wetland habitat and riparian and aquatic habitat for all life stages of special-status species; and to sustain and manage viable populations of the CRLF in the BLM planning area.

3.0 Study Goals

The goal of this study is to provide current and useful information to the relicensing participants concerning CRLF and its relationship to the Don Pedro Project. The specific objectives of this study are as follows:

- Identify, compile, and map known occurrences of CRLF and the distribution of suitable habitats for CRLF.
- Evaluate the likelihood that CRLF currently exists in the Project Boundary using site assessments of habitat suitability and information from historical records.
- Compile incidental observation of CRLF observations from other aquatic studies.
- Through incidental observations, document the presence and provide estimates of number of exotic species (e.g., bullfrogs, non-native crayfish, bass, catfish, or mosquitofish) (USFWS 2002), which may limit the occurrence of CRLF in otherwise suitable habitats.
- Provide information on Project-affected tributary streams to the Don Pedro Reservoir for evaluation of potential Project-related effects on CRLF populations.
- Provide information that can be used to develop a draft Biological Assessment.

4.0 Existing Information and Need for Additional Information

Existing relevant information regarding known or potentially occurring locations of special-status amphibians and reptiles in the Project area is available from California Natural Diversity Database (CNDDB), museum records, and other sources. This information and a life history description of CRLF, included in Section 5.3 of the Districts' Pre-Application Document (PAD), are useful in identifying preferred habitats and documenting where the species have been found to date. Table 4.0-1 summarizes CRLF habitat requirements by life stage, and briefly summarizes historically known occurrences in the Project area.

The historical range of the CRLF includes the west slope foothills of the Sierra Nevada Range, although only about six populations are known to be extant in the Sierra Nevada region, most of which contain few adults (Shaffer et al. 2004; USFWS 2006).

The CRLF occupies a fairly distinct habitat, combining both specific aquatic and riparian components. Aquatic habitat consists of low-gradient freshwater bodies, including ponds, marshes, sag ponds, dune ponds, stock ponds, lagoons, seeps, springs, and backwaters within streams and creeks, where water remains long enough for breeding and development of young to occur (i.e., a minimum of 20 weeks) (Jennings and Hayes 1994; USFWS 2006). While CRLF can occur in either seasonal or perennial streams or ponds, populations generally cannot be sustained in streams in which surface water disappears before metamorphosis (July to September) during most years. The adults require dense, shrubby or emergent riparian vegetation closely associated with deep (2 to 4.5 feet) still or slow moving water, but frogs have been observed in shallow sections of streams and ponds that are devoid of vegetative cover.

Table 4.0-1 California red-legged frog habitat requirements by life stage and summary of records in the Project area.

Egg Masses	Larvae	Juveniles and Adults	Occurrence in Project Area[1]
In ponds or backwater pools of streams, usually attached to emergent vegetation (cattail and bulrush). Sometimes found at sites without emergent vegetation (e.g., some stock ponds). The presence of dense riparian vegetation (particularly willows) is also a positive indicator of suitable breeding habitat. Permanently or seasonally flooded water bodies may be used.	Same habitat as eggs; also in slow-moving, shallow riffle zones, and shallow margins of pools. Larvae spend most time in submergent vegetation or organic debris.	Frogs may stay at breeding sites or move to summer habitats. Emergent and/or riparian vegetation, undercut banks, semi-submerged root masses; open grasslands with seeps or springs with dense growths of woody riparian vegetation, willows; cattail, bulrush, and willow are good indicators for suitable habitat. Associated with deep (<0.7 - 1.5 m), still or slow-moving water. Juveniles prefer open, shallow aquatic habitats with dense submergent vegetation.	No known occurrences in Project area; nearest known recent occurrence is at Piney Creek, where adult CRLF were last observed in 1984 and the species is presumed to be extirpated at this location (USFWS 2002). Piney Creek is within the Merced River drainage and flows into the northwest arm of Lake McClure, 0.97 miles from Don Pedro Reservoir.

[1] Records were reviewed from the following sources: CAS 2010; CDFG 2010; MVZ 2010; USFWS 2005.

Locations with the highest densities of CRLF are associated with deep-water pools with dense stands of overhanging willows (*Salix* spp.) and an intermixed fringe of cattails (*Typha* spp.). Well-vegetated terrestrial areas within the riparian corridor may provide important sheltering habitat during winter. Also, the species is known to utilize well-vegetated riparian zones for foraging habitat and facilitating dispersal. During summer, CRLF often disperse from breeding habitat to forage and seek aestivation habitat if water is not available (USFWS 2002).

Telemetry and other detection methods indicate that CRLF utilize small-mammal burrows, moist leaf litter, water troughs, incised streambed channels, and other moist sites as much as 200 feet from riparian areas (Jennings and Hayes 1994; USFWS 2002, 2006, 2008). CRLF has also been found up to 100 feet from water in adjacent dense riparian vegetation. The absence or near-absence of introduced predators such as American bullfrog (*Lithobates catesbeianus*) and predatory fish, particularly centrarchids (i.e., bass and sunfishes), is generally predictive of habitat quality (Hayes and Jennings 1988). However, bullfrogs and CRLF can coexist and persist under certain natural and managed regimes, and nonnative predatory fish can have a significant effect on juvenile CRLF survival in ponds where they co-occur. Freshwater wetlands, plunge pools in intermittent streams, seeps, and springs that are not suitable for breeding may provide habitat for aestivation, shelter, foraging, predator avoidance, and juvenile dispersal. During wet periods, long distance dispersal of up to a mile may occur between aquatic habitats, which may require traversing upland habitats or ephemeral drainages (USFWS 2006).

The Districts have not found any existing information that indicates CRLF presence within the Project Boundary or Project area; however, based on the species elevational range (below 5,000 feet), the Districts acknowledge that the absence of records for the Project area does not preclude the possibility that CRLF is present. However, the robust population of basses and sunfish in Don Pedro Reservoir may be indicative of unsuitable habitat for CRLF.

Information necessary to address the study goals include a site-specific assessment of habitat suitability for CRLF in relation to Project facilities and normal O&M activities that might affect CRLF.

5.0 Study Methods

5.1 Study Area

The study area for the CRLF habitat assessment consists of suitable aquatic habitats within the existing FERC Project Boundary and extends one mile from the Project Boundary.

5.2 General Concepts

The following general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study report.

5.3 Study Methods

The steps below outline the Districts' approach to performing the study:

Step 1 – Site Assessment. Known occurrences of CRLF within the study area will first be identified, based on agency consultation, museum records, and other existing information. Locations of habitats in the study area potentially suitable for CRLF breeding, and adjacent upland habitats, will then be identified and mapped based on review of existing aerial photography or Google Earth, National Wetland Inventory (NWI) maps, on-the-ground photographs, and other pertinent GIS layers as available. Habitat identification and mapping is expected to be at a scale of 1:6,000 (1"=500').

After habitat mapping is completed, field visits to potentially suitable aquatic habitat will be conducted in accordance with *Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog, August 2005* (Guidance; Attachment A; USFWS 2005). The Districts will select locations in the study area for site evaluations in order to further characterize habitats. A Habitat Site Assessment Data Sheet (Appendix D of USFWS 2005) will be completed at each site that is examined, along with photographs depicting habitat and other notable findings. Areas that do not appear to represent suitable habitat will not be field examined but will instead be characterized from aerial imagery, existing site photographs, and other existing descriptive information. CRLF are typically associated with low gradient streams (Hayes and Jennings 1988), backwaters, and lentic habitat with emergent vegetation. Large, deep backwater pool areas; ponds, and reservoir edges with appropriate vegetation characteristics may constitute suitable habitat for CRLF; other potential habitats as described in USFWS (2005) will also be considered. Locations for site evaluations will be selected as follows:

- All potential breeding locations within the existing Project Boundary.
- Representative breeding locations which are publicly accessible (and private lands where permission to enter can be obtained) within 1 mile of the Project Boundary.

Aquatic and adjacent upland habitats will be mapped and characterized by habitat type (e.g., pond, creeks, or pool), apparent seasonality, dominant vegetation type (e.g., emergent or overhanging shrubs), water depth at the time of the site assessment, bank-full depth, stream gradient (i.e., percent slope), substrate, and description of bank. The presence of fish, non-native crayfish, American bullfrog, and other incidental observations of amphibians and reptiles will be noted. Upland habitats will be characterized based on description of upland vegetation communities, land uses, and any potential barriers to CRLF movement.

Step 2 – Prepare, Format, and Quality Assurance/Quality Control Data. Following field assessment, the Districts will develop GIS maps depicting known CRLF occurrences site assessment locations, potential habitat, Project facilities and features, and other information collected during the study. Field data will then be subject to quality assurance and quality control (QA/QC) procedures, including spot-checks of transcription and comparison of GIS maps with field notes.

Step 3 – Consult with the Districts' Project O&M Staff. Project operations staff will be consulted to identify typical O&M activities of potential CRLF habitat in the study area to identify the potential for Project activities to adversely affect CRLF.

Step 4 – Prepare Report. The Districts will prepare a report that includes the following sections: (1) Study Goals, (2) Methods, (3) Results, (4) Discussion, and (5) Conclusions. Confidential information will not be included in the report, but provided to appropriate agencies.

This report will be submitted to USFWS, with submittals to BLM for any site assessments that take place on BLM lands. The report will include the following:

- Copies of data sheets
- Copies of field notes
- GPS data for all field reconnaissance sites
- List of known occurrences of CRLF locations within the study area
- Photographs of the reconnaissance sites including a map of photo locations
- GIS map of potential CRLF habitat
- Summaries of site habitat assessments
- Supporting data in Excel spreadsheet and GIS layers, as appropriate

Step 5 – Consult with USFWS. Districts will consult with USFWS to determine if additional data gathering is needed and to discuss the potential for Project activities to affect CRLF.

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC issues its Study Plan Determination by December 31, 2011, and the study is not disputed by a mandatory conditioning agency:

- Site Assessment (Step 1) .... November 2011 – March 2012
- QA/QC (Step 2).......... March 2012 – April 2012
- Consult with Districts' Project O&M Staff (Step 3) .... May 2012 – June 2012
- Prepare Report (Step 4) .... June 2012 – September 2012
- Consult with USFWS (Step 5) .... September 2012 – January 2013
- Report Issuance .... January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

This study is consistent with the goals, objectives, and methods outlined for most recent FERC relicensing efforts in California where CRLF has a potential to be affected.

8.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

9.0 References Cited

California Academy of Sciences (CAS) Collection Database. 2010. Online Data Request, July 26, 2010. California Academy of Sciences San Francisco, California. Queried Herpetology Collection Database. Available online at: <http://research. calacademy.org/redirect?url=http:// researcharchive.calacademy.org/research/ herpetology/catalog/index.asp>. Accessed July 26, 2010.

California Department of Fish and Game. 2010. California Natural Diversity Database: A Program that Inventories the Status and Locations of Rare Plants and Animals in California. State of California, Resources Agency, Department of Fish and Game, Sacramento, California. Available online at: <http://www.dfg.ca.gov/biogeodata/ cnddb/>. Accessed July 15, 2010.

Hayes, M.P. and M.R. Jennings. 1988. Habitat correlates of distribution of the California red-legged frog. (*Rana aurora draytonii*) and the foothill yellow-legged frog (*Rana boylii*): Implications for management. Pages 144-158 In: R.C. Szaro, K.E. Severson, and D.R. Patton (technical coordinators), Proceedings of the symposium on the management of amphibians, reptiles, and small mammals in North America. U.S. Department of Agriculture, Forest Service, General Technical Report (RM-166):1-458.

Jennings, M.R. and M.P. Hayes. 1994. Amphibians and Reptiles of Special Concern. California Department of Fish and Game, Inland Fisheries Division.

Museum of Vertebrate Zoology (MVZ). 2010. Herpetological records for Tuolumne River and Tuolumne County. University of California, Berkeley. Available online at: <mvzarctos.berkeley.edu/SpecimenSearch.cfm>. Accessed October 5, 2010.

Shaffer, H. Bradley, G.M. Fellers, S.R. Voss, J.C. Olive and G.B. Pauly. 2004. Species boundaries, phylogeography and conservation genetics of the red-legged frog (*Rana aurora/draytonii*) complex. Molecular Ecology 13(9): 2667-2677.

U.S. Department of Interior, Fish and Wildlife Service (USFWS). 2002. Recovery Plan for the California Red-legged Frog (*Rana aurora draytonii*). U.S. Fish and Wildlife Service, Portland, Oregon. viii + 173 pp.

——. 2005. Revised guidance on site assessments and field surveys for California red-legged frog. August 2005.

——. 2006. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the California Red-Legged Frog, and Special Rule Exemption Associated With Final Listing for Existing Routine Ranching Activities; Final Rule. Federal Register 71: 19244-19346.

——. 2008. Species Account. Sacramento Fish and Wildlife Office Species Account California red-legged frog (*Rana aurora draytonii*). Available at: http://www.fws.gov/sacramento/es/animal_spp_acct/ca_red-legged_frog.pdf.

ATTACHMENT A

REVISED GUIDANCE ON SITE ASSESSMENTS AND FIELD SURVEYS FOR THE CALIFORNIA RED-LEGGED FROG, AUGUST 2005

U.S. Fish and Wildlife Service

Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog

August 2005

I. Introduction

The U.S. Fish and Wildlife Service (Service) issued guidance on conducting site assessments and surveys for the California red-legged frog (*Rana aurora draytonii*) (CRF) on February 18, 1997 (1997 Guidance). Since then, the Service has reviewed numerous CRF site assessments and surveys results, accompanied wildlife biologists in the field during the preparation and performance of site assessments and CRF surveys, and consulted with species experts on the effectiveness of the 1997 Guidance. Based on our review of the information, the Service has determined that the survey portion of the 1997 Guidance is less likely to accurately detect CRF than previously thought, especially in certain portions of the species range and particularly where CRF exist in low numbers. In response to the need for new guidance, the Service has prepared this *Revised Guidance on Site Assessment and Field Surveys for the California Red-legged Frog* (Guidance).

Similar to the 1997 Guidance, two procedures are recommended in the new Guidance to accurately assess the likelihood of CRF presence in the vicinity of a project site: (1) an assessment of CRF locality records and potential CRF habitat in and around the project area and, (2) focused field surveys of breeding pools and other associated habitat to determine whether CRF are likely to be present.

Because CRF are known to use aquatic, riparian, and upland habitat, they may be present in any of these habitat types, depending on the time of year, on any given property. For sites with no suitable aquatic breeding habitat, but where suitable upland dispersal habitat exists, it is difficult to support a negative finding with the results of any survey guidance. Therefore, this Guidance focuses on site assessments and surveys conducted in and around aquatic and riparian habitat.

This Guidance was developed by the Service's Sacramento Fish and Wildlife Office in coordination with the Ventura Fish and Wildlife Office. Input by field biologists and scientists experienced in surveying for the CRF was also used in the development of this Guidance.

If the following Guidance is followed in its entirety, the results of the site assessments and surveys will be considered valid by the Service for two (2) years, unless determined otherwise on a case-by-case basis by the appropriate Service Fish and Wildlife Office. After two (2) years, new surveys conducted under the most current Service Guidance may be required, if deemed necessary by the appropriate Service Fish and Wildlife Office.

Modifications of this Guidance for specific projects or circumstances may be approved by the appropriate Fish and Wildlife Office; however, we strongly recommend that all modifications be reviewed and approved by the Service prior to implementation.

II. Permit Requirements

Unless otherwise authorized, individuals participating in site assessments and surveys for CRF may **NOT** take the California red-legged frog during the course of site assessments or survey activities. Take may only be authorized via section 7 or section 10 of the Endangered Species Act of 1973, as amended. Typically, take associated with survey activities is authorized via issuance of section 10(a)(1)(A) permits. For reference, an application for a section 10(a)(1)(A) permit is available through the appropriate Fish and Wildlife Office or online at: http://forms.fws.gov/3-200-55.pdf.

The site assessment and survey methods recommended in this Guidance do NOT require the surveyor to have a permit. As stated below, the surveyor must be otherwise qualified to conduct the surveys.

It is the responsibility of the surveyor to ensure all other applicable permits are obtained and valid (*e.g.,* state scientific collection permits), and that permission from private landowners or land managers is obtained prior to accessing a site and beginning site assessments and surveys.

III. Site Assessments

To prevent any unnecessary loss of time or use of resources, it is essential that completed site assessments be submitted to the appropriate Service Fish and Wildlife Office for review in order to obtain further guidance from the Service before conducting surveys.

Surveyors are encouraged to implement the decontamination guidelines provided in Appendix B before conducting a site assessment to prevent the spread of parasites and diseases to CRF and other amphibians.

Careful evaluation of the following information about CRF and their habitats in the vicinity of a project or other land use activities is important because this information indicates the likelihood of the presence of CRF. This information will help determine whether it is necessary to conduct field surveys.

To conduct a site assessment for CRF, complete the data sheet in Appendix D and return it with any necessary supporting documentation to the appropriate Service Fish and Wildlife Office for review prior to initiating surveys. The following information is critical to completing a proper site assessment:

1. Is the site within the current or historic range of the CRF?

Since knowledge of the distribution of the CRF is likely to change as new locality information becomes available, biologists are expected to contact the appropriate Fish and Wildlife Office (see section IV below) to determine if a project site is within the range of this species.

2. Are there known records of CRF at the site or within a 1.6-kilometer* (1-mile) radius of the site?

The biologist should consult the California Natural Diversity Data Base (CNDDB) maintained by the California Department of Fish and Game's (CDFG) Natural Heritage Division as a starting point to determine if there are reported localities of CRF within a 1.6-kilometer (1-mile) radius of the site. Information on the CNDDB is attached to the end of this document. Data entry into the CNDDB is not always current nor do all surveyors submit reports to the CNDDB, thus it is essential that other information sources on local occurrences of CRF be consulted. These sources may include, but are not limited to, biological consultants, local residents, amateur herpetologists, resource managers and biologists from municipal, State, and Federal agencies, environmental groups, and herpetologists at museums and universities. The biologist should report to the Service all known CRF records at the project site and within a 1.6-kilometer (1-mile) radius of the project boundaries. One-point-six (1.6) kilometers (1 mile) was selected as a proximity radius to a project site based on telemetry data collected by Bulger *et al.* (2003), rounded to the nearest whole mile. This distance may be subject to change when new data becomes available, or based on site-specific conditions, so it is advised that surveyors check with the appropriate Service Fish and Wildlife Office to ensure they are using the most up-to-date information.

*** IMPORTANT**: One-point-six (1.6) kilometers (1 mile) radius is a general guideline. The appropriate Service Fish and Wildlife Office will advise surveyors of the most appropriate distance for each specific project location on a case-by-case basis.

3. What are the habitats within the project site and within 1.6 kilometers* (1 mile) of the project boundary?

In order to properly characterize the habitat within 1.6 kilometers (1 mile) of the project site, individuals conducting site assessments must visit the project site and as much of the surrounding habitat within 1.6 kilometers (1 mile) of the project site as possible. Aerial photographs, maps, and other resources should be consulted as well to ensure all possible accessible habitats are considered. Based on this reconnaissance assessment, the surveyor shall describe the upland and aquatic habitats within the project site and within 1.6 kilometers (1 mile) of the project boundary. The aquatic habitats should be mapped and characterized (*e.g.*, ponds vs. creeks, pool vs. riffle, ephemeral vs. permanent (if ephemeral, give date it goes dry), vegetation (type, emergent, overhanging), water depth at the time of the site assessment, bank full depth, stream gradient (percent slope), substrate, and description of bank). The presence of bullfrogs (*Rana catesbeiana*) and other aquatic predators such a centrarchid fishes (bass, perch, sunfish) should be documented even though their presence does not negate the presence of CRF. Upland habitats should be characterized by including a description of upland vegetation communities, land uses, and any potential barriers to CRF movement. The information provided in Appendix A serves as a guide to the features that will indicate possible CRF habitat.

4. Report the results of the site assessment

A site assessment report shall be provided to the appropriate Fish and Wildlife Office for review. Reports should include, but are not limited to, the following information:

1) Copies of the data sheet provided at Appendix D;

2) Copies of field notes and all other supporting documentation including:

    A. A list of all known CRF localities within 1.6 kilometers* (1 mile) of the project site boundaries;
    B. Photographs of the project site (photopoints shall be indicated on an accompanying map);
    C. A map of the site showing all of the habitat types and other important features as well as the location of any species detected during the site assessment within 1.6 kilometers (1 mile) of the project site boundaries. Maps shall be either copies of those portions of the U.S. Geological Service 7.5-minute quadrangle map(s) *or* geographic information system (GIS) data;
    D. A description of the project and/or land use that is being proposed at the site.

Based on the information provided in the site assessment report, the Service will provide guidance on how CRF issues should be addressed, including whether field surveys are appropriate, where the field surveys should be conducted, and whether incidental take authorization should be obtained through section 7 consultation or a section 10 permit pursuant to the Endangered Species Act.

IV. Field Surveys

<u>Surveyors are encouraged to implement the decontamination guidelines provided in Appendix B before conducting surveys to prevent the spread of parasites and diseases to CRF and other amphibians.</u>

To avoid and minimize the potential of harassment or harm to CRF, no additional surveys will be conducted in an area once occupancy has been established, unless the surveying effort is part of a Service-approved project to determine actual numbers of frogs at a site.

<u>The Service should be notified in writing (*e.g.*, email) by the surveyor within three (3) working</u>

days once a CRF is detected. The Service will provide guidance to the surveyor regarding the need to collect additional information such as population size, age class, habitat use, *etc*.

A. Qualifications of Surveyors

Surveyors must be familiar with the distinguishing physical characteristics of all life stages of the CRF, other anurans of California, and with introduced, exotic species such as the bullfrog and the African clawed frog (*Xenopus Laevis*) prior to conducting surveys according to this Guidance.

Surveyors must submit their qualifications to the Service along with their survey results.

A field guide should be consulted (*e.g.*, Wright and Wright 1949; Stebbins 2003) to confirm the identification of amphibians encountered during surveys. Surveyors also should be familiar with the vocalizations of the CRF and other amphibians found in California. Recordings of these vocalizations are available through various sources (*e.g.,* Davidson 1995). Surveyors that do not have experience with the species are required to obtain training on locating and identifying CRF adult, larval and egg stages before survey results are accepted. Training may include attendance at various workshops that have an emphasis on the biology of the California red-legged frog, accompanied by an appropriate level of field identification training; field work with individuals who possess valid 10(a)(1)(A) permits for the CRF; and experience working with ranids and similar taxa.

In some localities more intensive surveys (*e.g*., dip-netting larvae and adults) may be desirable to document the presence of CRF. In order to conduct such focused surveys a valid section 10(a)(1)(A) permit is required (refer to introduction section for information on how to apply for a section 10(a)(1)(A) permit). Applicants will be considered qualified for a section 10(a)(1)(A) permit if they meet the Service’s most current qualification requirements. At a minimum, prospective applicants must:

1) Possess a Baccalaureate degree in biology, ecology, a resource management-related field, or have equivalent relevant experience;
2) Have completed course work in herpetology and study-design/survey-methodology or have equivalent relevant experience;
3) Have verifiable experience in the design and implementation of amphibian surveys or research or have equivalent relevant experience;
4) Have verifiable experience handling and identifying a minimum of 10 CRF, or similar ranid species, comprised of a minimum of 5 adults and a combination of larva and juveniles;
5) Obtain a minimum of 40 hours of field experience through assisting in surveys for the CRF during which positive identification is made;
6) Have familiarity with suitable habitats for the species and be able to identify the major vegetative components of communities in which California red-legged frog surveys or

research may be conducted.

7) Have familiarity with and be able to identify native and non-native amphibians that may co-occur with the listed species.

B. Survey Periods

Surveys may begin anytime during January and should be completed by the end of September. Multiple survey visits conducted throughout the survey-year (January through September) increases the likelihood of detecting the various life stages of the CRF. For example, adult frogs are most likely to be detected at night between January 1 and June 30, somewhere in the vicinity of a breeding location, whereas, sub-adults are most easily detected during the day from July 1 through September 30.

Due to the geographic and yearly variation in egg laying dates, it is not possible to specify a range of dates that is appropriate for egg surveys throughout the range of the CRF. The following table summarizes the best approximated times to survey for CRF egg masses.

Geographic Area	Best Survey Period*
Northern California along the coast and interior to the Coast Range (north of Santa Cruz County)	January 1 and February 28
Southern California along the coast and interior through the Coast Range (south of, and including Santa Cruz County)	February 25 and April 30
Sierra Nevada Mountains and other high-elevation locations	Should not begin before April 15

Site specific conditions may warrant modifications to the timing of survey periods, modifications must be made with the Service's approval prior to conducting the surveys.

Survey Methodology

This Guidance recommends a total of **<u>up to</u>** eight (8) surveys to determine the presence of CRF at or near a project site. Two (2) day surveys and four (4) night surveys are recommended during the breeding season; one (1) day and one (1) night survey is recommended during the non-breeding season. Each survey must take place at least seven (7) days apart. At least one survey must be conducted prior to August 15th. The survey period must be over a minimum period of 6 weeks (*i.e.,* the time between the first and last survey must be at least 6 weeks). Throughout the species' range, the non-breeding season is defined as between July 1 and September 30.

If CRF are identified at any time during the course of surveys, no additional surveys will be conducted in the area, unless the surveying effort is part of a Service-approved project to determine actual numbers of frogs at a site.

The following methodology shall be followed unless otherwise specified, or approved by the appropriate Service Fish and Wildlife Office:

1) Upon arrival at the survey site, surveyors should listen for a few minutes for frogs calling, prior to disturbing the survey site by walking or looking for eye shine using bright lights. If CRF calls are identified, the surveyor should note this information on the survey data sheet and note the approximate location of the call. Once the survey begins, the surveyor should pay special attention to the area where the call originated in an attempt to visually identify the frog.

2) The most common method of surveying for CRF is the visual-encounter survey. This survey is conducted either during daylight hours or at night by walking entirely around the pond or marsh or along the entire length of a creek or stream while repeatedly scanning for frogs. This procedure allows one to scan each section of shore from at least two different angles. Surveyors should begin by first working along the entire shoreline, then by entering the water (if necessary and no egg masses would be crushed or disturbed), and visually scanning all shoreline areas and all aquatic habitats identified in the site assessment. Generally, surveyors shall focus on all open water to at least 2 meters (6.5 feet) up the bank. When wading, surveyors must take maximum care to avoid disturbing sediments, vegetation, or larvae. When walking on the bank, surveyors shall take care to not crush rootballs, overhanging banks, and stream-side vegetation that might provide shelter for frogs. Surveys must cover the entire area, otherwise the remaining survey area must be surveyed the next day/night that weather conditions allow (both visits would constitute one day/night survey).

3) Day surveys may be conducted on the same day as a night survey.

   The main purpose of day surveys during the breeding season is to look for larvae, metamorphs, and egg masses; the main purpose of day surveys during the non-breeding season is to look for metamorphosing sub-adults, and non-breeding adults. Daytime surveys shall be conducted between one hour after sunrise and one hour before sunset.

4) Night surveys

   The main purpose of night surveys is to identify and locate adult and metamorphosed frogs. Conditions and requirements for conducting night surveys are as follows:

   A. Night surveys must commence no earlier than one (1) hour after sunset.
   B. Due to diminished visibility, surveys should not be conducted during heavy rains, fog, or other conditions that impair the surveyor’s ability to accurately locate and identify frogs.
   C. Nighttime surveys shall be conducted with a Service-approved light such as a Wheat Lamp, Nite Light, or sealed-beam light that produces less than 100,000 candle watt. Lights that the Service does not accept for surveys are lights that are either too dim or too bright. For example, Mag-Light-type lights and other

types of flashlights that rely on 2 or 4 AA's/AAA's, 2 C's or 2 D batteries. Lights with 100,000 candle watt or greater are too bright and also would not meet Service requirements.

D. The Service approved light must be held at the surveyor's eye level so that the frog's eye shine is visible to the surveyor.
E. The use of binoculars is a must in order to effectively see the eye shine of the frogs. Surveys conducted without the use of binoculars may call in to question the validity of the survey.

5) Weather conditions.

Weather and visibility conditions must be consistent throughout the duration of the survey; if weather conditions become unsuitable, the survey must be completed at another time when conditions are better suited to positively locating and identifying frogs. Suitable conditions are as follows:

A. Air temperature at the survey site must be at least 10 degrees Celsius (50 degrees Fahrenheit). Frogs are less likely to be active when temperatures are below 10 degrees Celsius (50 degrees Fahrenheit).
B. Wind speed must not exceed 8 kilometers/hour (5 miles/hour) at the survey site. High wind speeds affect temperatures and the surveyor's ability to hear frogs calling.
C. Surveys must be conducted under clear to partly cloudy skies (high clouds are okay) but not under dense fog or during heavy rain, as stated above. Surveys may be conducted during light rains.

Surveyors should carefully consider weather conditions prior to initiating a survey. Ask yourself, "Can I collect accurate, reliable data under the existing weather conditions" prior to proceeding with the survey. Weather conditions will be taken into account when the data is reviewed by the appropriate Service Fish and Wildlife Service Office.

6) Decontamination of equipment

In an effort to minimize the spread of terrestrial and aquatic pathogens, all aquatic survey equipment including chest waders, wet suits, float tubes, kayaks, shall be decontaminated before entering potential CRF habitat using the guidelines in Appendix B. Careful attention shall be taken to remove all dirt from boots, chest waders, wetsuits, float tubes, kayaks, and other equipment before placing equipment into the water.

7) Unidentified larvae, sub-adults, and adults

If the larval life stage is the only life stage detected and the larvae are not identified to species (or similarly, if sub-adult or adult frogs are observed but not identified to species), the surveyor must either return to the habitat to identify the frog in another life stage or obtain the appropriate permit (*e.g.*, section 10(a)(1)(A) permit) authorization allowing the surveyor to handle CRF and larvae. In order for the Service to consider a survey to be complete, all frogs encountered must be accurately identified.

8) Reporting results of the surveys

A species survey report shall be provided to the appropriate Fish and Wildlife Office for review. Reports should include, but are not limited to, the following information:

1. Copies of the data sheets provided at Appendix E;

2. Copies of field notes and all other supporting documentation including:

    A. Photographs of all CRF observed during the survey and of the habitat where each individual was located, if possible without harming or harassing the individual;
    B. A map of the site showing the location of any species detected during the survey. Maps shall be either copies of those portions of the U.S. Geological Service 7.5-minute quadrangle map(s) *or* geographic information system (GIS) data;

Based on the information provided in the site assessment report and the survey results, the Service will provide guidance on how CRF issues should be addressed through the section 7 or section 10 processes.

All information on CRF distribution resulting from field surveys shall be sent to the California Natural Diversity Database (CNDDB). CNDDB forms shall be completed, as appropriate, for each listed species identified during the survey(s) and submitted to the California Department of Fish and Game, Wildlife Habitat Data Analysis Branch, 1807 13th Street, Suite 202, Sacramento, California 95814, with copies submitted to the appropriate Service Fish and Wildlife Office. Each form sent to the CDFG shall have an accompanying 1:24,000 scale USGS map (or an exact scale photocopy of the appropriate portion(s) of the map) -or- Global Information System (GIS) data coverage of the site. Copies of the form can be obtained from the CDFG at the above address (telephone: 916-324-3812) or online at: http://www.dfg.ca.gov/whdab/html/animals.html. Additional information about the CNDDB is available in Appendix C.

The Service may not accept the results of field surveys conducted under this Guidance for any of the following reasons:

A. if the appropriate Service Fish and Wildlife Office was not contacted to review the results of the site assessment prior to field surveys being conducted;
B. if field surveys were conducted in a manner inconsistent with this Guidance or with

survey methods not previously approved by the Service;

C. if field surveys were incomplete;
D. if surveyors were not adequately qualified to conduct the surveys;
E. if the reporting requirements, including submission of CNDDB forms, were not fulfilled.

IV. Service Contacts

There are three Service Fish and Wildlife Offices within the range of the CRF (see Map 1). The appropriate office to contact regarding site assessments or survey authorization depends on the location where the surveys are to be conducted.

For project sites and land use activities in Santa Cruz, Monterey, San Benito, San Luis Obispo, Santa Barbara, and Ventura Counties, portions of Los Angeles and San Bernardino Counties outside of the Los Angeles Basin, and portions of Kern, Inyo and Mono Counties east of the Sierra Crest and south of Conway Summit, contact:

Ventura Fish and Wildlife Office,
2493 Portola Road, Suite B
Ventura, California, 93003
(805/644-1766).

For project sites and land use activities in all other areas of the State south of the Transverse Ranges, contact:

Carlsbad Fish and Wildlife Office
Attn: Recovery Permit Coordinator
6010 Hidden Valley Road
Carlsbad, California, 92009
(760/431-9440).

For project sites and land use activities in all other areas of the State, contact:

Sacramento Fish and Wildlife Office
2800 Cottage Way, Suite W-2605
Sacramento, California 95825
(916/414-6600).
(916/414-6713, fax)

For information on section 10(a)(1)(A) recovery permits, contact:

Regional Office,
Eastside Federal Complex
911 N.E., 11th Avenue
Portland, Oregon 97232-4181
(503/231-6241)

* These are independent offices overlapping with the Sacramento Fish and Wildlife Office. Their work primarily focuses on salmonid restoration, fishery monitoring and Forest Plan Implementation.

Map 1. Map of California showing jurisdictional boundaries of Service Fish and Wildlife Offices.

References

Davidson, C. 1995. Frog and toad calls of the Pacific Coast: Vanishing Voices. Library of Natural Sounds, Cornell Laboratory of Ornithology, Ithaca, New York. 27 pp. +1 cassette.

Stebbins, R.C. 2003. A field guide to western reptiles and amphibians. Third edition. Houghton Mifflin Company, New York, New York. 533 pp.

Wright, A.H. and A.A. Wright. 1949. Handbook of frogs and toads of the United States and Canada. Third Edition. Comstock Publishing Company, Ithaca, New York. xii+640 pp.

Appendix A.
California red-legged frog identification and ecology.

1. <u>Identification</u>

The following information may aid surveyors in the identification of California red-legged frogs and similar species. However, all surveyors are expected to consult field guides (Wright and Wright 1949; Davidson 1995; Stebbins 2003) for further information.

General Description
The California red-legged frog (*Rana aurora draytonii*), is a relatively large aquatic frog ranging from 4 to 13 centimeters (1.5 to 5 inches) from the tip of the snout to the vent. From above, the California red-legged frog can appear brown, gray, olive, red or orange, often with a pattern of dark flecks or spots. The skin usually does not look rough or warty. The back of the California red-legged frog is bordered on either side by an often prominent dorsolateral fold of skin running from the eye to the hip. The hindlegs are well-developed with large webbed feet. A cream, white, or orange stripe usually extends along the upper lip from beneath the eye to the rear of the jaw. The undersides of adult California red-legged frogs are white, usually with patches of bright red or orange on the abdomen and hindlegs. The groin area can show a bold black mottling with a white or yellow background.

Adults
Positive diagnostic marks should be used to accurately distinguish California red-legged frogs from other species of frogs that may be observed. A positive diagnostic mark is an attribute of the animal that will not be found on any other animal likely to be encountered at the same locality. The following features are positive diagnostic marks that, if observed, will distinguish California red-legged frogs from foothill yellow-legged frogs (*Rana boylii)* and bullfrogs *(Rana catesbeiana)*:

a. Prominent dorsolateral folds (thick upraised fold of skin running from eye to hip) on any frog greater than 5 centimeters (2 inches) long from snout to vent. Young yellow-legged frogs can show reddish folds; these usually fade as the frogs mature.

b. Bright red dorsum.

c. Well defined stripe as described above running along upper lip.

Since California red-legged frogs are often confused with bullfrogs, surveyors should note those features that might be found on bullfrogs that will rarely be observed on California red-legged frogs. These features are:

a. Absence of the dorsolateral fold.
b. Bright yellow on throat.
c. Uniform bright green snout.
d. Tympanum (ear disc) distinct and much larger than eye.

Please note that some frogs may lack all of the above characteristics given for both California red-legged frogs and bullfrogs. Surveyors should regard such frogs as unidentified, unless it is clearly identified as another species.

California red-legged frogs are cryptic because their coloration tends to help them blend in with their surroundings, and they can remain immobile for great lengths of time. When an individual California red-legged frog is disturbed, it may jump into the water with a distinct "plop."   The California red-legged frog may do this either when the surveyor is still distant or when a surveyor is very near. Bullfrogs exhibit similar behavior but will often emit a "squawk" as they dive into the water. Because a California red-legged frog is unlikely to make such a sound, a "squawk" from a fleeing frog will be considered sufficient to positively identify the frog as a bullfrog.

Larvae
Tadpoles may be trapped and handled only by those with a valid 10(a)1(A) permit. California red-legged frog larvae range from 14 to 80 millimeters (0.5 to 3.25 inches) in length. They are greenish to generally brownish color with darker marbling and lack distinct black or white spotting or speckling. Large California red-legged frog larvae often have a wash of red coloration on their undersides and a very small single row of evenly spaced whitish or gold flecks along the side where the dorsolateral fold will develop. Other features to look for to identify California red-legged frog larvae include: eyes set well in from the outline of the head (contrasts with treefrogs (*Hyla* spp.)), oral papillae on both the sides of the mouth and the bottom of the mouth (contrasts with *Bufo* spp.), well developed oral papillae on the sides of the mouth (contrasts with other subspecies of red-legged frogs (*Rana aurora* spp.) and spadefoot toads (*Scaphiopus* spp.)), generally mottled body and tail with few or no distinct black spots on tail fins (contrasts with bullfrogs), and two to three tooth rows on the top and bottom (contrasts with foothill yellow-legged frogs).

Eggs
California red-legged frogs breed during the winter and early spring from as early as late November through April and May. Adults engage in courtship behaviors that result in the female depositing from 2,000 to 6,000 eggs, each measuring between 2 and 3 millimeter (0.1 inches). California red-legged frog eggs are typically laid in a mass attached to emergent vegetation near the surface of the water, where they can be easily dislodged. However, egg masses have been detected lying on the bottom of ponds. The egg mass is well defined and

about the size of a softball. Eggs hatch within 6 to 14 days after deposition at which time the newly hatched larvae are delicate and easily injured or killed. California red-legged frog larvae transform into juvenile frogs in 3.5 to 7 months.

During the time that red-legged frog egg surveys are conducted, other amphibian eggs may be found including those of Pacific treefrogs, spadefoot toads, California tiger salamanders, and newts. Bullfrogs and foothill yellow-legged frogs lay their eggs later in the season. Field guides should be consulted for additional information on egg identification.

2. <u>Habitat</u>

California red-legged frogs occur in different habitats depending on their life stage, the season, and weather conditions. Rangewide, and even within local populations, there is much variation in how frogs use their environment; in some cases, they may complete their entire life cycle in a particular habitat (*i.e.*, a pond is suitable for all life stages), and in other cases, they may seek multiple habitat types (U.S. Fish and Wildlife Service 2002).

Breeding habitat
All life history stages are most likely to be encountered in and around breeding sites, which are known to include coastal lagoons, marshes, springs, permanent and semi-permanent natural ponds, ponded and backwater portions of streams, as well as artificial impoundments such as stock ponds, irrigation ponds, and siltation ponds. California red-legged frog eggs are usually found in ponds or in backwater pools in creeks attached to emergent vegetation such as *Typha* and *Scirpus*. However, they have been found in areas completely denuded of vegetation. Creeks and ponds where California red-legged frogs are found most often have dense growths of woody riparian vegetation, especially willows (*Salix* spp.) (Hayes and Jennings 1988). The absence of *Typha*, *Scirpus*, and *Salix* at an aquatic site does not rule out the possibility that the site provides habitat for California red-legged frogs, for example stock ponds often are lacking emergent vegetation yet they provide suitable breeding habitat. California red-legged frog larvae remain in these habitats until metamorphosis in the summer months (Storer 1925; Wright and Wright 1949). Young California red-legged frogs can occur in slow moving, shallow riffle zones in creeks or along the margins of ponds.

Summer habitat
California red-legged frogs often disperse from their breeding habitat to forage and seek summer habitat if water is not available. In the summer, California red-legged frogs are often found close to a pond or a deep pool in a creek where emergent vegetation, undercut banks, or semi-submerged rootballs afford shelter from predators. California red-legged frogs may also take shelter in small mammal burrows and other refugia on the banks up to 100 meters from the water any time of the year and can be encountered in smaller, even ephemeral bodies of water in a variety of upland settings (Jennings and Hayes 1994; U.S. Fish and Wildlife Service 2002).

Upland habitat
California red-legged frogs are frequently encountered in open grasslands occupying seeps and

springs. Such bodies may not be suitable for breeding but may function as foraging habitat or refugia for dispersing frogs. During periods of wet weather, starting with the first rains of fall, some individuals make overland excursions through upland habitats (U.S. Fish and Wildlife Service 2002).

3. Movement

California red-legged frogs may move up to 3 kilometers (1.88 miles) up or down drainages and are known to wander throughout riparian woodlands up to several dozen meters from the water (Rathbun *et al.* 1993). Dispersing frogs have been recorded to cover distances from 0.40 kilometer (0.25 mile) to more than 3.2 kilometers (2 miles) without apparent regard to topography, vegetation type, or riparian corridors (Bulger 1998). California red-legged frogs have been observed to make long-distance movements that are straight-line, point to point migrations rather than using corridors for moving in between habitats. Dispersal distances are considered to be dependent on habitat availability and environmental conditions. On rainy nights California red-legged frogs may roam away from aquatic sites as much as 1.6 kilometers (1 mile). California red-legged frogs will often move away from the water after the first winter rains, causing sites where California red-legged frogs were easily observed in the summer months to appear devoid of this species. Additionally, California red-legged frogs will sometimes disperse in response to receding water which often occurs during the driest time of the year.

References for Appendix A

Bulger, J. 1998. Wet season dispersal and habitat use by juvenile California red-legged frogs (*Rana aurora draytonii*) in forest and rangeland habitats of the Santa Cruz Mountains. Research proposal.

Davidson, C. 1005. Frog and toad calls of the Pacific Coast: Vanishing Voices. Library of Natural Sounds, Cornell Laboratory of Ornithology, Ithaca, New York. 27 pp. +1 cassette.

Hayes, M.P. and M.R. Jennings. 1988. Habitat correlates of distribution of the California red-legged frog. (*Rana aurora draytonii*) and the foothill yellow-legged frog (*Rana boylii*):Implications for management. Pages 144-158 In: R.C. Szaro, K.E. Severson, and D.R. Patton (technical coordinators), Proceedings of the symposium on the management of amphibians, reptiles, and small mammals in North America. United States Department of Agriculture, Forest Service , General Technical Report (RM-166):1-458.

Jennings, M.R. and M.P. Hayes. 1994. Amphibian and reptile species of special concern in California. Final report to the California Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California, under contract (8023). iii+255 pp.

Rathbun, G.B., M.R. Jennings, T.G. Murphy, and N.R. Siepel. 1993. Status and ecology of sensitive aquatic vertebrates in lower San Simeon and Pico Creeks, San Luis Obispo County, California. U.S. Fish and Wildlife Service, National Ecology Research Center, San Simeon, California. Prepared for the California Department of Parks and Recreation. 103 pp.

Stebbins, R.C. 2003. A field guide to western reptiles and amphibians. Third edition. Houghton Mifflin Company, New York, New York. 533 pp.

Storer, T.1925. A synopsis of the Amphibia of California. University of California Publications in Zoology 27:1-342.

U.S. Fish and Wildlife Service. 2002. Recovery plan for the California red-legged frog (*Rana aurora draytonii*). Portland, Oregon. 173 pp.

Wright, A.H. and A.A. Wright. 1949. Handbook of frogs and toads of the United States and Canada. Third Edition. Comstock Publishing Company, Ithaca, New York. xii+640 pp.

Appendix B.
Recommended Equipment Decontamination Procedures

In an effort to minimize the spread of pathogens that may be transferred as result of activities, surveyors should follow the guidance outlined below for disinfecting equipment and clothing after entering a pond and before entering a new pond, unless the wetlands are hydrologically connected to one another:

i. All organic matter should be removed from nets, traps, boots, vehicle tires and all other surfaces that have come into contact with water or potentially contaminated sediments. Cleaned items should be rinsed with clean water before leaving each study site.

ii. Boots, nets, traps, hands, *etc*. should be scrubbed with either a 75% ethanol solution, a bleach solution (0.5 to 1.0 cup per 1.0 gallon of water), Quat-128™ (1:60), or a 6% sodium hypochlorite 3 solution. Equipment should be rinsed clean with water between study sites. Cleaning equipment in the immediate vicinity of a pond or wetland should be avoided (*e.g.*, clean in an area at least 100 feet from aquatic features). Care should be taken so that all traces of the disinfectant are removed before entering the next aquatic habitat.

iii. Used cleaning materials (liquids, *etc*.) should be disposed of safely, and if necessary, taken back to the lab for proper disposal. Used disposable gloves should be retained for safe disposal in sealed bags.

iv. Additionally, the surveyors shall implement the following when working at sites with known or suspected disease problems: disposable gloves should be worn and changed between handling each animal. Gloves should be wetted with water from the site or distilled water prior to handling any amphibians. Gloves should be removed by turning inside out to minimize cross-contamination.

Appendix C.
General instructions for filling out CNDDB field survey forms

The Natural Diversity Data Base (NDDB) is the largest, most comprehensive database of its type in the world. It presently contains more than 33,000 site specific records on California's rarest plants, animals, and natural communities. The majority of the data collection effort for this has been provided by an exceptional assemblage of biologists throughout the state and the west. The backbone of this effort is the field survey form. We are enclosing copies of Natural Diversity Data Base (NDDB) field survey forms for species and natural communities. We would greatly appreciate you recording your field observations of rare, threatened, endangered, or sensitive species and natural communities
(elements) and sending them to us on these forms.

We are interested in receiving forms on elements of concern to us; refer to our free publications: *Special Plants Lis*t, *Special Animals List,* and *Natural Communities List* for lists of which elements these include. Reports on multiple visits to sites that already exist in the NDDB are as important as new site information as it helps us track trends in population/stand size and condition. Naturally, we also want information on new sites. We have enclosed an example of a field survey form that includes the information we like to see. It is especially important to include a xeroxed portion of a USGS topographic quad with the population/stand outlined or marked (see back of enclosed example).

Without the map, your information will be mapped less accurately, as written descriptions of locations are frequently hard to interpret. Do not worry about filling in every box on the form; only fill out what seems most relevant to your site visit. Remember that your name and telephone number are very important in case we have any questions about the form.

If you are concerned about the sensitivity of the site, remember that the NDDB can label your element occurrence "Sensitive" in the computer, thus restricting access to that information. The NDDB is only as good as the information in it, and we depend on people like you as the source of that information. Thank you for your help in improving the NDDB.

Copies of the NDDB form can be obtained from the CDFG at the above address (telephone: 916-324-3812) *or* online at: http://www.dfg.ca.gov/whdab/html/animals.html.

Appendix D.

<u>California Red-legged Frog Habitat Site Assessment Data Sheet</u>

This data sheet is to assist in the data collection of California red-legged frog habitat in the vicinity of projects or other land use activities, following the August 2005, *Revised Guidance on Site Assessment and Field Surveys for California Red-legged Frogs* (Guidance), issued by the U.S. Fish and Wildlife Service. Prior to collecting the data requested on this form, the biologist should be familiar with and understand the Guidance.

The "Site Assessments" section of the Guidance details the data needed to complete a site assessment. When submitting a complete site assessment to the Service (one that has been done following the Guidance), one data sheet should be included for each aquatic habitat identified. If multiple aquatic habitats are identified within the project site, then multiple data sheets should be completed. A narrative description of the aquatic, riparian, and upland habitats should be provided to characterize the breeding habitat within the project site and the breeding and dispersal habitat within 1.6 kilometers (1 mile) of the project site. In addition to completing this data sheet, field notes, photographs, and maps should be provided to the appropriate Fish and Wildlife Service Office, as requested in the "Site Assessments" section of the Guidance.

Appendix D.
California Red-legged Frog Habitat Site Assessment Data Sheet

Site Assessment reviewed by________________________ _________ __________________________________
(FWS Field Office) **(date)** **(biologist)**

Date of Site Assessment: _______________
(mm/dd/yyyy)

Site Assessment Biologists: ____________________________ ____________________________
(Last name) **(first name)** **(Last name)** **(first name)**

____________________________ ____________________________
(Last name) **(first name)** **(Last name)** **(first name)**

Site Location:____
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S).

****ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: ____
Brief description of proposed action:

1) Is this site within the current or historic range of the CRF (circle one)? YES NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? YES NO
If yes, attach a list of all known CRF records with a map showing all locations.

GENERAL AQUATIC HABITAT CHARACTERIZATION

(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)

POND:
Size: ______________________________ Maximum depth: __________________

Vegetation: emergent, overhanging, dominant species: ______________________________
____
____

Substrate: ____
____

Perennial or Ephemeral *(circle one)*. If ephemeral, date it goes dry: __________________________

Appendix D.
California Red-legged Frog Habitat Site Assessment Data Sheet

STREAM:

Bank full width: ________________
Depth at bank full: ______________
Stream gradient: ________________

Are there pools (circle one)? YES NO
If yes,
Size of stream pools: ________________________
Maximum depth of stream pools: ______________

Characterize non-pool habitat: run, riffle, glide, other: ____________________________
____
____
Vegetation: emergent, overhanging, dominant species: ____________________________
____
____
Substrate: ____
____
Bank description: ____
____
____

Perennial or Ephemeral *(circle one)*. If ephemeral, date it goes dry: _______________________

Other aquatic habitat characteristics, species observations, drawings, or comments:

Necessary Attachments:

1. All field notes and other supporting documents
2. Site photographs
3. Maps with important habitat features and species location

Appendix E.
California Red-legged Frog Survey Data Sheet

This data sheet is to assist in the data collection during surveys for California red-legged frogs in areas with potential habitat. This data sheet is intended to assist in the preparation of a final report on the field surveys as detailed in the August 2005, *Revised Guidance on Site Assessment and Field Surveys for California Red-legged Frogs* (Guidance) issued by the U.S. Fish and Wildlife Service (Service). Before completing this data sheet, a site assessment should have been conducted using the Guidance and the Service should have been contacted to determine whether surveys are required. Prior to collecting the data requested on this form, the biologist should be familiar with and understand the Guidance. To avoid and minimize the potential of harassment to California red-legged frogs, all survey activities shall cease once an individual California red-legged frog has been identified in the survey area, unless prior approval has been received from the appropriate Service Fish and Wildlife Office. The Service shall be notified within three (3) working days by the surveyor once a California red-legged frog is detected, at which point the Service will provide further guidance. Surveys should take place in consecutive breeding/non-breeding seasons (*i.e.*, the entire survey period, including breeding and non-breeding surveys should not exceed 9 months). It is important that both the breeding and non-breeding survey be conducted during the time period specified in the Guidance. Site specific conditions may warrant modifications to the timing of survey periods, modifications must be made with the Service's approval. The survey consists of two (2) day and four (4) night surveys during the breeding season and one (1) day and one (1) night surveys during the non-breeding season.

All California red-legged frog life stages should be surveyed for. Surveyors may detect larvae but not be able to identify this life stage to species as handling any life stage of the California red-legged frog necessitates a valid 10(a)(1)(A) permit. If the larval life stage is the only life stage detected and the larvae are not identified to species, the surveyor must either return to the habitat to identify the frog in another life stage or have a valid 10(a)(1)(A) permit allowing the surveyor to handle California red-legged frogs and larvae. In order for the Service to consider a survey to be complete, all frogs encountered must be accurately identified.

Appendix E.
California Red-legged Frog Survey Data Sheet

Survey results reviewed by______________________ ________ ______________________________
(FWS Field Office) (date) (biologist)

Date of Survey: __________ (mm/dd/yyyy)

Survey Biologist: ______________________________ (Last name) (first name)

Survey Biologist: ______________________________ (Last name) (first name)

Site Location:____
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S).

ATTACH A MAP (include habitat types, important features, and species locations)**

Proposed project name: ____
Brief description of proposed action:

Type of Survey (circle one): **DAY NIGHT BREEDING NON-BREEDING**

Survey number (circle one): **1 2 3 4 5 6 7 8**

Begin Time:________________________ **End Time:**________________________

Cloud cover:________________________ **Precipitation:**________________________

Air Temperature:____________________ **Water Temperature:**__________________

Wind Speed:________________________ **Visibility Conditions:**________________

Moon phase:________________________ **Humidity:**__________________________

Description of weather conditions: ____
____

Brand name and model of light used to conduct surveys: ______________________

Were binoculars used for the surveys (circle one)**?** **YES NO**
Brand, model, and power of binoculars: ____

Appendix E.
<u>California Red-legged Frog Survey Data Sheet</u>

AMPHIBIAN OBSERVATIONS

Species	# of indiv.	Observed (O) Heard (H)	Life Stages	Size Class	Certainty of Identification

Describe potential threats to California red-legged frogs observed, including non-native and native predators such as fish, bullfrogs, and raccoons: ______________________________________
____
____
____
____

Other notes, observations, comments, *etc.*

Necessary Attachments:

4. All field notes and other supporting documents
5. Site photographs
6. Maps with important habitat features and species locations

ATTACHMENT B

CALIFORNIA NATIVE SPECIES FIELD SURVEY FORM

Mail to:
California Natural Diversity Database
Department of Fish and Game
1807 13th Street, Suite 202
Sacramento, CA 95811
Fax: (916) 324-0475 *email: CNDDB@dfg.ca.gov*

For Office Use Only

Source Code ____________ Quad Code ____________
Elm Code ____________ Occ. No. ____________
EO Index No. ____________ Map Index No. ____________

Date of Field Work (mm/dd/yyyy): ____________

Reset

California Native Species Field Survey Form

Send Form

Scientific Name:

Common Name:

Species Found? ☐ Yes ☐ No ____________ If not, why?

Total No. Individuals ________ Subsequent Visit? ☐ yes ☐ no

Is this an existing NDDB occurrence? ________ Yes, Occ. # ☐ no ☐ unk.

Collection? If yes: ________ Number ____________ Museum / Herbarium

Reporter: ____________
Address: ____________
____
E-mail Address: ____________
Phone: ____________

Plant Information

Phenology: ______% vegetative ______% flowering ______% fruiting

Animal Information

______ # adults ______ # juveniles ______ # larvae ______ # egg masses ______ # unknown

☐ wintering ☐ breeding ☐ nesting ☐ rookery ☐ burrow site ☐ other

Location Description ***(please attach map AND/OR fill out your choice of coordinates, below)***

County: ____________ Landowner / Mgr.: ____________
Quad Name: ____________ Elevation: ____________
T____ R____ Sec ____, ____ ¼ of ______¼, Meridian: H☐ M☐ S☐ Source of Coordinates (GPS, topo. map & type): ____________
T____ R____ Sec ____, ____ ¼ of ______¼, Meridian: H☐ M☐ S☐ GPS Make & Model ____________
DATUM: **NAD27** ☐ **NAD83** ☐ **WGS84** ☐ Horizontal Accuracy ____________ meters/feet
Coordinate System: UTM Zone 10 ☐ UTM Zone 11 ☐ ***OR*** Geographic (Latitude & Longitude) ☐
Coordinates:

Habitat Description (plants & animals) *plant communities, dominants, associates, substrates/soils, aspects/slope:*
Animal Behavior *(Describe observed behavior, such as territoriality, foraging, singing, calling, copulating, perching, roosting, etc., especially for avifauna):*

Please fill out separate form for other rare taxa seen at this site.

Site Information Overall site/occurrence quality/viability (site + population): ☐ Excellent ☐ Good ☐ Fair ☐ Poor

Immediate AND surrounding land use:

Visible disturbances:

Threats:

Comments:

Determination: *(check one or more, and fill in blanks)*

- ☐ Keyed (cite reference): ____________
- ☐ Compared with specimen housed at: ____________
- ☐ Compared with photo / drawing in: ____________
- ☐ By another person (name): ____________
- ☐ Other: ____________

Photographs: *(check one or more)*

	Slide	Print	Digital
Plant / animal	☐	☐	☐
Habitat	☐	☐	☐
Diagnostic feature	☐	☐	☐

May we obtain duplicates at our expense? yes☐ no☐

STUDY PLAN TR-8

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

ESA-Listed Amphibians - California Tiger Salamander Study Plan

July 2011

Related Study Requests: USFWS-02

1.0 Project Nexus

The Districts' ongoing continued operation and maintenance (O&M) of the Don Pedro Project (Project) has the potential to affect the terrestrial and aquatic habitat of the California tiger salamander (CTS; *Ambystoma californiense*). CTS (Central Valley population) is listed as threatened under the federal Endangered Species Act (ESA) and as threatened under the California Endangered Species Act (CESA). Project O&M activities including ground disturbing-activities, vegetation management, and routine maintenance at Project facilities may disrupt CTS habitat.

2.0 Resource Agency Management Goals

The U.S. Fish and Wildlife Service (USFWS) has jurisdiction as CTS are protected under the ESA. Listed threatened and endangered species are protected from take, defined as direct or indirect harm, unless a Section 10 permit is granted to an entity other than a federal agency or a Biological Opinion with incidental take provisions is rendered to a federal lead agency via ESA Section 7 consultation. Pursuant to the requirements of ESA, an agency reviewing a proposed project within its jurisdiction must determine whether any federally listed species may be present in the study area and determine whether the proposed federal action will jeopardize the continued existence of the species. Under ESA, habitat loss is considered to be an adverse effect to a species. In addition, the action agency is required to determine whether its action is likely to jeopardize the continued existence of any species that is proposed for listing under ESA or to result in the destruction or adverse modification of critical habitat proposed to be designated for such species (16 USC 1536[3], [4]).

The California Department of Fish and Game (CDFG) administers the CESA. The CTS (Central Valley population) is listed as a state-threatened species. On August 2, 2010, the Office of Administrative Law approved the Fish and Game Commission determination that CTS should be listed as a state-threatened species; the regulations became effective on August 19, 2010 (CDFG 2011). CESA prohibits the take (interpreted to mean the direct killing) of listed species under CESA (14 CCR Subsection 670.2, 670.5). Under CESA, state agencies are required to consult with CDFG when preparing California Environmental Quality Act documents. Consultation ensures that proposed projects or actions do not have an adverse effect on state-listed species. During consultation, CDFG determines whether take would occur and identifies "reasonable and prudent alternatives" for the project and conservation of special-status species. CDFG can authorize take of a state-listed species if an incidental take permit is issued by the Secretary of the Interior or Commerce in compliance with the federal ESA, or if the director of CDFG issues a permit under Section 2080 in those cases where it is demonstrated that the impacts are minimized and mitigated. Pursuant to the requirements of CESA, a state or local agency reviewing a proposed project within its jurisdiction must determine whether any state-listed species may be present in the project area and determine whether the proposed project will have a potentially significant impact upon such species. If significant impacts to state listed species are identified, the state lead agency must adopt reasonable and prudent alternatives as specified by CDFG to prevent or mitigate for impacts.

Critical habitat under the ESA for CTS was originally designated on August 23, 2005. On December 14, 2005, a portion of this critical habitat was excluded in order to avoid negative impacts on the finalization and implementation of the Santa Rosa Plains Conservation Strategy. The USFWS is currently re-proposing 74,223 acres of the Santa Rosa Plains as critical habitat and must make its final ruling by July 1, 2011 (USFWS 2009). Recovery criteria or a recovery plan has not yet been drafted for the CTS (Central Valley population).

3.0 Study Goals

The specific objectives of this study are to:

- Identify and map known occurrences of CTS and determine, if appropriate, the closest known breeding locality;
- Evaluate the likelihood that CTS currently exist in the study area using habitat assessments and historical records;
- Compile incidental observations of CTS from other relicensing studies; and
- Provide information that can be used to develop a Biological Assessment and support a Biological Opinion.

4.0 Existing Information and Need for Additional Information

Habitat for CTS consists of open terrain with vacant burrows or other refugia, in proximity to vernal pools or other appropriate ponds for breeding. Adult CTS spend little time at breeding sites and are otherwise terrestrial preferring open, rolling terrain or foothills, particularly in areas with ground squirrel or pocket gopher burrows. Although vacant or mammal-occupied burrows are evidently favored, CTS will also reside in crevices, loose soil, or under surface objects (Brode 2003). Adult CTS have been documented dispersing as far as 1.2 miles, although most individuals are believed to remain within about 2,300 feet of breeding sites (USFWS 2004).

Larvae and eggs are usually found in shallow, turbid, vernal, or semi-permanent pools and ponds that fill during winter rains (Alvarez 2004a). Permanent ponds, stock ponds, and rarely intermittent streams or ditches may be used for breeding sites if fish are not present. CTS eggs are laid between December and February in small clusters or singly on submerged stems and leaves. Larvae usually transform in about four months (Behler and King 1979) as water recedes in late spring or summer, but may metamorphose in as little as 10 weeks (Jennings and Hayes 1994) or overwinter in permanent ponds (Alvarez 2004b).

Several occurrences of CTS are recorded in the California Natural Diversity Database (CNDDB) within the Project area quadrangles (La Grange 7.5-minute U.S. Geological Survey [USGS] quadrangle). These occurrences are recorded in the vicinity of La Grange, the Tuolumne River, and south of the Don Pedro Reservoir. The most recent record is from 2007 and is located along Big Creek, between McNulty Ridge and Bonds Flat Road, south of Don Pedro Reservoir. If suitable habitat for CTS occurs within the Project Boundary, CTS has the potential to occur.

Existing information is not adequate to meet the goal of the study. Information necessary to address the study goal includes a site-specific assessment of habitat suitability for CTS in relation to Project facilities and normal O&M activities that might affect CTS.

5.0 Study Methods

5.1 Study Area

The study area for the CTS habitat assessment consists of suitable aquatic and upland habitats within the existing FERC Project Boundary and extends 1.24 miles from the Project Boundary.

5.2 General Concepts

These general concepts apply to the study:

- Personal safety is the most important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study reports.

5.3 Study Methods

The Districts will perform the following five-step approach to completing the study plan:

Step 1 – Site Assessments and Site Assessment Report. The Districts will review available databases, including museum records, and consult with agencies to determine the nearest known occurrences of CTS to the study area. As required by the Interim Guidance on Site Assessment and Field Surveys for Determining *Presence* or a *Negative* Finding of the California Tiger Salamander (Guidance; USFWS 2003; Attachment A), CTS occurrences within 3.1 miles of the Project Boundary and the closest CTS occurrence to the Project Boundary will be determined. Communications with the CDFG CNDDB and the Endangered Species Office of the USFWS will be documented.

Potential CTS breeding habitats within the Project Boundary and within 1.2 miles of the Project Boundary will be identified, characterized, and mapped based on review of existing aerial photography, National Wetland Inventory maps, and other pertinent resource agency GIS layers as available. Using available information, these aquatic habitat sites will be characterized by habitat type (e.g., natural seasonal pond, stock pond, or creek), surface area, depth, seasonality, topography, and types of associated aquatic or emergent vegetation. Habitat identification and mapping is expected to be at a scale of 1:6,000 (1"=500').

Field visits to verify habitat characterizations and collect additional information described below will be performed at sites selected as follows:

- All potential breeding locations within the Project Boundary.
- Representative potential breeding locations that are publicly accessible (and private lands for which access permission can be obtained) within 1.24 miles of the Project Boundary.

Information to be collected during field visits will include topography; soil type; plant communities; water body presence, location, types, and size; fossorial mammals detected; current land use, and a description of adjacent lands, including uplands. Each site will be photographed to depict habitat and other notable findings. The presence of fish, American bullfrogs (*Lithobates catesbeianus*), and other incidental observations of amphibians will be noted. Upland habitats will be characterized based on description of upland vegetation communities, land uses, and any potential barriers to CTS movement.

<u>Step 2 – Prepare, Format, and Quality Assurance/Quality Control Data.</u> The Districts will develop GIS maps depicting known CTS occurrences, potential habitat, Project facilities and features, and other information collected during the study. Field data will then be subject to quality assurance and quality control (QA/QC) procedures, including spot-checks of transcription and comparison of GIS maps with field notes on locations of any CTS occurrences.

<u>Step 3 – Consult with the Districts' Project Operations Staff.</u> Operations staff will be consulted to identify typical Project O&M activities in areas of potential CTS habitat in the study area and to identify activities with the potential to adversely affect CTS.

<u>Step 4 – Prepare Report.</u> The Districts will prepare a report that includes the following sections: (1) Study Goals, (2) Methods, (3) Results, (4) Discussion, and (5) Conclusions. Confidential information will not be included in the report, but provided to appropriate agencies.

The report will be submitted to USFWS, with separate submittals to BLM for any site assessments that take place on BLM lands. The report will include the following:

- Copies of data sheets
- Copies of field notes
- GPS data for all field visit sites
- List of known occurrences of CTS locations within the study area
- Photographs of the field visit sites including a map of photo locations
- GIS map of potential CTS habitat and locations of field visit sites
- Summaries of site habitat assessments
- Supporting data in Excel spreadsheet and GIS layers, as appropriate

Step 5 – Consult with USFSW. The Districts will consult with USFWS to determine if additional data gathering is needed and to discuss the potential Project effects on CTS.

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC issues its Study Plan Determination by December 31, 2011, and the study is not disputed by a mandatory conditioning agency:

- Site Assessment (Step 1) .... November 2011 – March 2012
- QA/QC (Step 2)...March 2012 – April 2012
- Operations Staff Consultation (Step 3) ....May 2012 – June 2012
- Report Preparation (Step 4).. June 2012 – September 2012
- USFWS Consultation (Step 5) ....September 2012 – January 2013
- Report Issuance .... January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

This study is consistent with the goals, objectives, and methods outlined for recent FERC relicensing efforts in California, and uses data from the USFWS, BLM, and other reliable sources for the analysis.

8.0 Deliverables

In addition to the reports described above, the study results will be displayed in GIS maps and files that show locations of field site visits, habitat potentially suitable for CTS, and known CTS locations. Incidental observations of amphibians, turtles, and reptiles will also be described.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

Alvarez, J.A. 2004(a). Use of artificial egg laying substrate to detect California tiger salamanders (*Ambystoma californiense*). Herpetological Review 35: 45 - 46.

——. 2004(b). Overwintering California tiger salamander (*Ambystoma californiense*) larvae. Herpetological Review 35: 344.

Brode, J.M. 2003. Survey protocol for California tiger salamander (*Ambystoma californiense*). CDFG Inland Fisheries Informational Leaflet (44): 1-7.

Behler, J.L., and F.W. King. 1979. The Audubon Society field guide to North American reptiles and amphibians. Alfred A. Knopf, New York. 719 pp.

California Department of Fish and Game (CDFG). 2011. State and Federally Listed Endangered and Threatened Animals of California. January 2011. Available online at: <http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/ TEAnimals.pdf. www.dfg.ca.gov/ biogeodata/cnddb/pdfs/TEAnimals.pdf>.

Jennings, M.R., and M.P. Hayes. 1994. Amphibian and reptile species of special concern in California. Final report to the California Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, CA, under Contract (8023).

U.S. Department of Interior, Fish and Wildlife Service (USFWS). 2003. Interim Guidance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander. October 2003.

——. 2004. Endangered and Threatened Wildlife and Plants; Proposed Designation of Critical Habitat for the Santa Barbara County Distinct Population Segment of the California Tiger Salamander. Proposed Rule. Federal Register 69(14): 3064-3094.

——. 2009. Sacramento Fish and Wildlife Office Species Account for California Tiger Salamander (*Ambystoma californiense*). Available online at: <http://www.fws.gov/sacramento/es/animal-spp-acct/california_tiger_salamander.rtf>.

ATTACHMENT A

INTERIM GUIDANCE ON SITE ASSESSMENT AND FIELD SURVEYS FOR DETERMINING PRESENCE OR A NEGATIVE FINDING OF THE CALIFORNIA TIGER SALAMANDER

OCTOBER 2003

Interim Guidance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander
October 2003

The Santa Barbara County population of the California tiger salamander (Ambystoma californiense) was federally listed as endangered on September 21, 2000 (65 FR 57242). The Sonoma County Distinct Population Segment (DPS) of the California tiger salamander was listed as endangered on July 22, 2002 (67 FR 47727). The Central California DPS of the California tiger salamander was proposed for listing as threatened on May 23, 2003 (68 FR 28648). The Santa Barbara and Sonoma County DPSs were proposed for reclassification from endangered to threatened, on May 23, 2003 (68 FR 28648). The California Department of Fish and Game (Department) considers the California tiger salamander throughout its entire range to be a species of special concern.
(Special Animals List July 2003 http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/SPAnimals.pdf)

The Service and Department have received numerous requests for guidance in planning for the protection of the California tiger salamander (CTS) at the sites of proposed and existing land use activities. This document provides interim guidance for two procedures to accurately assess the likelihood of CTS presence in the vicinity of a project site, including: (1) an assessment of CTS locality records and potential CTS habitat in and around the project area; and (2) focused field surveys of breeding pools and their associated uplands to determine whether CTS are likely to be present.

Because CTS use aquatic and upland habitats during their life cycle, they may be present in either or both habitats on a given property. For sites with suitable breeding habitat, two consecutive seasons of negative larval surveys and a negative upland drift fence study in the intervening fall/winter are recommended to support a negative finding. For sites with no suitable aquatic breeding habitat, but where suitable upland habitat exists, two consecutive seasons of negative upland drift fence studies are recommended to support a negative finding.

If the following Guidance is followed completely, the results of these site assessments and field surveys will be considered valid by the Service and Department. Results of the site assessments and field surveys should be reported to the appropriate Service's Field Office, if appropriate the Service's Regional Office in Portland, Oregon pursuant to the terms and conditions of the permittee's section 10(a)(1)(A) recovery permit, and to the Department and other agencies or offices as required. Details regarding the recommended content and/or format of reports are provided throughout the remainder of this document.

Surveyors must obtain permission of the landowner before implementing any surveys or research on the CTS. **In locations where the CTS is federally listed surveyors should obtain a Recovery Permit for this species pursuant to section 10(a)(1)(A) of the Endangered Species Act of 1973, as amended, prior to implementing the guidance.** For surveys that may ultimately be used in support of a negative finding, it is recommended that surveyors consult with Service biologists on their study design before beginning work. If surveyors are working in areas with other federally listed species that are likely to be captured incidentally during CTS surveys, surveyors should also possess a valid 10(a)(1)(A) permit for these species (e.g., California red-legged frog, vernal pool tadpole shrimp, etc.). For all locations, the surveyor should hold an active Scientific Collecting Permit from the Department that specifically names CTS surveys as an authorized activity. Authorization Number 9, without explicit permission for handling CTS, is not adequate for CTS surveys.

Site Assessment for the California tiger salamander

Available information about CTS and their habitats in the vicinity of the project should be used to determine the likelihood that CTS may occur there and if field surveys are appropriate. The project proponent should compile and submit to the Service and the Department the following information:

Element 1. Is the project site within the range of the CTS?

The surveyor should review the attached maps or referenced weblink to determine if the project site is within the range of the CTS. For Sonoma County, refer to the attached county map (Sonoma County pdf). For Santa Barbara County, refer to http://www.fws.gov/ventura/es/protocols/ctsfieldsurvey_protocols.pdf . For Monterey, San Benito, and San Luis Obispo counties, contact the Ventura Fish and Wildlife Office at the address provided below. For all other areas, refer to the attached map of California (all of California pdf).

Element 2. What are the known localities of CTS within the project site and within 3.1 miles (5.0 kilometers) (km) of the project boundaries?

This is to place the project site in a regional perspective. The surveyor should consult the California Natural Diversity Data Base (CNDDB) maintained by the Department to determine known localities of the CTS. The Sacramento or Ventura Fish and Wildlife Offices should be contacted for localities within their respective jurisdictions. Other information sources on local occurrences of CTS should be consulted. These sources may include, but are not limited to, biological consultants, local residents, amateur herpetologists, resources managers and biologists from municipal, state, and Federal agencies, environmental groups, and herpetologists at museums and universities. The surveyor should note in their report all known CTS localities within the project site and within 3.1 miles of the project boundaries; if there are no localities within 3.1 miles, the nearest locality should be noted.

Element 3. What are the habitats within the project site and within 1.24 miles (2 km) of the project boundaries?

This distance is based on the observed mobility of the species. Describe the upland and aquatic habitats within the project site and within 1.24 miles of the project boundaries. Characteristics of the site that should be recorded include acreage, elevation, topography, plant communities, presence and types of water bodies, fossorial mammal species and their burrows, current land use, a description of adjacent lands, and an assessment of potential barriers to CTS movement. Use of aerial photographs is necessary to characterize potential breeding habitats that are not part of the project site under consideration. The aquatic habitats should be mapped and characterized (e.g., natural vernal pools, stockponds, drainage ditches, creeks, types of vegetation, surface area, depth, approximate drying date). Suitable upland habitat, including locations of underground refugia, for CTS should be mapped as well, with a focus on areas where small mammal burrows are located or are most dense.

Reporting and interpretation of the site assessment

Site assessments should include, but are not limited to, the following information: (1) photographs of the project site(s); (2) survey dates and times; names of evaluator(s); (3) a description of the site assessment methods used; (4) a list of CTS localities, as requested above; and (5) a map of the site(s) showing habitat as requested above. Maps should be of similar nature to a U.S. Geological Survey (USGS) 7.5-minute (1:24,000) topographic maps -or- Geographic Information System (GIS) data depicting the site(s) and the area within 5 kilometers (3.2 miles) of its boundaries. The report should be provided to the appropriate Service field office and Department regional office prior to initiating field surveys.

After completing items 1-3 of the site assessment (as above), send a report to the appropriate Service field office and Department regional office. Based on the information provided from the site assessment, the Service and Department will provide recommendations as to the appropriateness of field surveys. Surveys should not be initiated until recommended by the Service and Department.

Interim Presence/Negative Finding Survey Guidance for the California Tiger Salamander

Biological field surveys should be conducted for all sites with potential CTS habitat. Due to its unique life history, the CTS can be difficult to detect depending on weather and time of year. Aquatic sampling for larvae during spring months can be the most effective way to determine if CTS are present in a given area. However, especially if environmental conditions are unfavorable, CTS may not breed successfully in a given year. After metamorphosis CTS spend most of each year on land, emerging from refugia only occasionally, usually on rainy nights. CTS have been observed on land 1.24 miles from any potential breeding pool.

At sites that contain both upland habitat and potential breeding habitat (i.e., pools that contain standing water continuously for at least 10 weeks, extending into April), aquatic sampling during two breeding seasons and a drift fence study in the intervening winter should be conducted to support a negative finding. At sites that contain appropriate upland habitat only, but where there is a known or potential breeding site accessible within 1.24 miles, a two-year drift fence study should be conducted.

In years with little rainfall, upland emergence may be reduced and CTS may not breed. Field surveys conducted in years with at least 70% of average rainfall between September 1 and April 1, at the nearest National Oceanic and Atmospheric Administration climate station are most reliable. Data from survey seasons not meeting this criterion will also be considered; surveyors should provide strong justification that their data are reliable including but not limited to local climate (e.g., daily rainfall totals, pond filling date, pond drying date) and biological survey data (e.g., other species captured during each sampling interval).

Aquatic larval sampling

1. Aquatic larval surveys of potential breeding pools should be repeated three times each season. Surveys should be conducted once each in March, April, and May, with at least 10 days between surveys. **If pools are likely to dry prior to the completion of three surveys, the sampling schedule should be shifted accordingly.**

2. Captured CTS should remain in nets for the minimum amount of time necessary, but no longer than 5 minutes. During this time, larvae should not be kept out of water for more than 30 seconds. Photographs should document a representative sample of captured CTS.

3. Disruption to the pond’s bottom should be minimized. Shallow areas where young larvae may occur should be traversed in the most direct and least disturbing manner possible.

4. Sampling should cease once presence has been determined to minimize disturbance of pool flora and fauna. If CTS are detected at a pond, subsequent visits to that pond are not necessary.

5. Ponds should be initially sampled using D-shaped or similar, long-handled dipnets with 1/8th inch (3.2mm) or finer mesh. If CTS larvae are not captured in the first 50 dipnet sweeps, covering representative portions of the pond, seines should be used.

6. If dipnetting has been unsuccessful, seines should be used to sample 100% of the surface area of ponds smaller than 1 acre and at least 30% of the surface area of larger pools, including a representative sample from different water depths and vegetated and non-vegetated areas. One eighth inch (3.2 mm) or finer mesh minnow seines with weights along the bottom and floats along the top edge should be used, with dowling or PVC pipe attached to the end of the seine so the bottom edge can be dragged along the bottom of the pool. Whenever possible, the seine should be pulled from one edge of the pond to the other.

7. Use of minnow traps will be considered on a case-by-case basis. Minnow trapping for CTS larvae should only be conducted in habitats that are too deep to adequately survey with dipnets and seines, or in which dense vegetation impedes normal dipnetting/seining activities. **In these cases the surveyor should submit to the Service a written minnow trap sampling design based on the requirements detailed below.** No minnow trapping should be conducted in ponds known to support state or federally threatened or endangered animals (e.g., California red-legged frogs (Rana aurora draytonii)). In areas where California red-legged frogs may occur, minnow trapping should be preceded by negative surveys following the Service guidelines for this species. To conduct minnow trap sampling in pools known to contain California red-legged frogs, surveyors must possess a valid Recovery Permit for this species pursuant to section 10(a)(1)(A) of the Endangered Species Act of 1973, as amended.

Minnow trapping should be conducted in the following manner:

a. Minnow traps should be monitored for three three-day intervals between March 1 and May 15 (for a total of nine days of trapping per site). Trapping intervals should be separated by at least ten days. Minnow trap surveys should immediately cease if CTS presence is determined.

b. Minnow trapping should be avoided during warm periods when air temperatures reach 80 degrees Fahrenheit or when water temperatures reach 70 degrees Fahrenheit or warmer, to prevent the possibility of mortality due to reduced oxygen availability.

c. Minnow traps should be deployed overnight and checked frequently enough to ensure that larvae are not killed or injured. Traps should be checked at least once per day.

d. A minimum of four traps should be placed in each pond. For larger ponds, traps should be distributed along the shoreline with no more than 75 ft (23 m) between traps. Each trap should be clearly marked with the name, telephone number, and State and Federal permit number of the surveyor. Traps should be anchored to stakes set near the shoreline. Steel braided fishing line or heavy cord works well for this purpose; galvanized wire and stainless steel wire should not be used because these wires may kink and break. If livestock are present, we recommend that the surveyor devise a method to anchor the trap in a manner to prevent entanglement of livestock. Brightly colored flagging should be affixed to each anchor point. For extra security, a float attached to each trap can aid in detection. If a minnow trap is lost, every effort should be made to recover it to avoid the possibility of leaving behind a trap that can kill a variety of species over time.

e. Traps should be deployed to the deepest parts of ponds and in shoreline areas with aquatic vegetation growth.

9. Data regarding the type and quality of each pool sampled should be recorded. At a minimum, these data should include the date and time, location, type of water body (e.g., vernal pool, seasonal wetland, artificial impoundment, etc.), dimension and depth of pond, water temperature, turbidity, presence of aquatic vegetation (submergent and emergent), and dominant invertebrates and all vertebrates observed. Photographs of pools and adjacent upland areas are helpful and copies should be included in the final report.

10. Surveyors should follow guidance below for disinfecting equipment and clothing after surveying a pond and before entering a new pond, unless the two ponds are hydrologically connected to one another. These recommendations are adapted from the Declining Amphibian Population Task Force's Code which can be found in their entirety at: http://www.open.ac.uk/daptf/ .

a. All dirt and debris, including mud, snails, plant material (including fruits and seeds), and algae, should be removed from nets, traps, boots, vehicle tires and all other surfaces that have come into contact with water. Cleaned items should be rinsed with clean water before leaving each study site.

b. Boots, nets, traps, etc., should then be scrubbed with either a 70 % ethanol solution, a bleach solution (0.5 to 1.0 cup of bleach to 1.0 gallon of water), QUAT 128 (quaternary ammonium, use 1:60 dilution), or a 6% sodium hypochlorite 3 solution and rinsed clean with water between study sites. Cleaning equipment in the immediate vicinity of a pond or wetland should be avoided. Care should be taken so that all traces of the disinfectant are removed before entering the next aquatic habitat.

c. When working at sites with known or suspected disease problems, disposable gloves should be worn and changed between handling each animal.

d. Used cleaning materials (liquids, etc.) should be disposed of safely, and if necessary, taken back to the lab for proper disposal. Used disposable gloves should be retained for safe disposal in sealed bags.

Upland Habitat Survey Methods

A drift fence study conducted during fall and winter is the primary method used to study CTS in upland habitats. To support a negative finding, an upland drift fence study should be included. Although less intrusive methods (see below) may also be used to determine presence of the CTS, these methods are less reliable and thus cannot be used to support a negative finding.

Because CTS have been observed to make breeding migrations of at least 0.6 miles (1 km), the project proponent or the Service may assume presence of CTS if a known breeding pond lies within 1 km and no significant barriers exist. Examples of significant physical barriers include high-density residential or urban development and Interstate Highways, while features such as golf courses, disked fields, and most paved roads are not considered barriers.

For sites with at least one accessible potential breeding pool, we recommend that a one-year drift fence study be conducted during the winter between two consecutive seasons of aquatic larval surveys (if presence of CTS was not established during the first season of aquatic sampling). We recommend that a two year drift fence study be conducted if: 1) a site has suitable upland habitat and a potential breeding pool lies within 1.2 miles (2 km); 2) on-site ponds cannot be adequately sampled using aquatic methods (e.g., deep impoundments with known presence of California red-legged frogs); or 3) if non-native predators or poor water quality may preclude detection of CTS during larval sampling (i.e., due to mortality of the larvae).

1. We recommend that a proposal to conduct a drift fence study be submitted in writing to the Service and the Department. The results of studies not approved by the Service and Department may not be accepted in support of a negative finding. The proposal should include an aerial photograph of the study site indicating all potential on- and off-site breeding locations identified in the site assessment and an overlay with the proposed drift fence study design clearly delineated. We recommend that drift fence study designs incorporate the following:

   a. **For sites with at least one suitable breeding pond** (i.e., ponds that contain standing water for at least 10 continuous weeks in most years), the ponds should be surrounded by drift fences installed 10 - 50 ft from the high water line. Sections of drift fence should be spaced regularly around the pond, focusing on areas where salamanders are most likely to be captured. We recommend that each section of fence be at least 30 ft (9.2 m) long, and that the total distance between fence sections be no greater than the total length of installed fence (i.e., >50% of the circumference fenced). There should be no more than 33 ft (10 m) between pitfall traps, and drift fences should be constructed such that during periods when traps are closed, openings at least every 66 ft (20 m) allow animal passage.

   b. **For all sites**, we also recommend upland drift fences. Unless a strong rationale can be presented, drift fence equaling at least 90% of the site perimeter should be installed. The exact placement of fences should be selected to maximize the probability of capturing CTS (e.g., in grassland areas with high densities of mammal burrows; along site boundaries closest to identified potential breeding pools; with pitfalls situated away from areas where flooding is likely). Pitfalls should be spaced less than 33 ft apart. To the extent possible drift fences and pitfalls should be placed to minimize the number of flooded buckets. Each section of fence should be a minimum of 30 ft (9.2 m) long, unless topography, property lines, or other circumstances dictate. Upland drift fences should be constructed such that during periods when traps are closed, openings at least every 66 ft (20 m) allow animal passage.

2. Arrays should be approved and constructed by 15 October. Beginning on or before October 15, pitfall buckets should be opened before sunset if there was any rain during the day or if at 2 PM rain is forecast for the remainder of the day or subsequent night with 70% or greater probability (based on the nearest National Weather Service forecast - available at http://www.wrh.noaa.gov/Sacramento/). Traps should be open each night and checked each morning until no rain has fallen within the preceding 24 hours. Nights of high relative humidity (greater than 75% relative

humidity) should be considered equivalent to rain events once onsite or nearby seasonal wetlands have become inundated with standing water, regardless of its depth, surface area, or duration. The above guidance should be followed until 20 nights of surveying under the proper conditions has been conducted. After 20 nights of surveying is completed, and until March 15, pitfall buckets should be opened before sunset if there was any rain during the day, or if at 2 PM rain is forecast for the remainder of the day or subsequent night with 70% or greater probability. Traps will be checked the next morning, and unless it is still raining or more rain is forecast, the traps can be closed until the next rain event.

3. Drift fences should be constructed from a material that is durable, weather resistant, and **appropriate for the area in which it will be installed; proposals should describe the materials to be used**. Examples include aluminum flashing, silt fencing, untreated wood particle board, shade cloth, window screen, Vexar plastic mesh, etc. Hardware cloth may be useful for short segments of fence that experience heavy overland water flow. Drift fences should be buried at least 3 inches (8 cm) underground and extend at least 1 ft (31 cm) above the ground. All drift fences require regular inspections and maintenance, especially after each significant storm event. If drift fences are installed incorrectly and/or have insufficient maintenance this may call into question the reliability of the data. Unless special authorization is received from the Service and Department to maintain drift fences through non-sampling months, drift fencing should be disassembled by April 1.

4. Pitfall traps should not be placed in a manner that will disturb or destroy rodent burrows or other refugia that could be used by CTS.

5. Excessive pitfall flooding may invalidate a study. To avoid flooding traps should be placed preferentially in slightly elevated locations where flooding is less likely. Pitfalls in locations likely to flood should be free of holes. If ground saturation forces a pitfall out of the soil it can be weighted down with cement, gravel or other suitable materials.

6. All pitfall traps should have a rigid lid that closes securely. When not in use, traps should be closed in a manner that precludes entry by CTS and other animals.

7. Pitfall traps should be cylindrical, non-galvanized, metal or plastic containers. They should be at least 2-gallons in size and 8 in (20 cm) deep.

8. Each pitfall trap should contain noncellulose sponges or other nontoxic absorbent material which should be kept moist at all times.

9. Each pitfall trap should have a rigid cover with legs one to two inches high to provide shade and shed water during extreme rain events.

10. When in use, pitfall traps should be checked as often as necessary, but at a minimum one time a day, with one of these checks occurring between one hour before sunrise and noon. Whenever possible, traps should be opened just before dark and checked and closed the following morning.

11. When not in use, the drift fence and pitfall traps should be inspected weekly to ensure the system has not been disturbed by vandals, wildlife, fallen trees, wind, etc. Repairs to fences should be completed prior to the next night of sampling.

12. Pitfall traps should be placed as far as possible from ant nests. If an ant nest develops within 10 feet of an existing pitfall trap, the pitfall trap should be moved, removed from the field, or closed.

13. Captured CTS should be released as near as possible to the point of capture, in a manner that maximizes their survival. CTS should be released into the mouth of a small mammal burrow or other suitable refugia. CTS should be

watched after release to be sure that they are in a safe location and are not susceptible to increased predation risk.

14. Once a CTS is captured, all traps and drift fences should be emptied and removed within 24 hours, and holes in the ground which contain traps should be filled in.

15. In addition, to minimize mortality of small mammals that may become trapped during surveys, each pitfall trap should also incorporate either jute twine, as described in Karraker (2001; http://www.fs.fed.us/psw/rsl/projects/wild/karraker/karraker4.pdf), a rodent safe-house as described in Padgett-Flohr and Jennings (2001), or other material as approved by the Service and Department.

16. Each pitfall trap should be marked with the name, telephone number, and Department permit number.

Other methods

Other methods, such as visual egg surveys, night driving, nocturnal surveys, fiber optic scoping and cover-boards, may be used to determine presence of the CTS, but these techniques may not be accepted in support of a negative finding. Deviations from this guidance may be approved on a case-by-case basis if a strong rationale can be presented.

Reporting

If one or more CTS are captured or detected a representative sample of the embryo(s), larva(e), or transformed salamander(s) should be photographed. The Service and the Department should be contacted by telephone within 3 working days if CTS are captured. If any mortality of California tiger salamander occurs, specimens should be collected, preserved by freezing, and the Service and the Department contacted by telephone within 1 work day.

For each survey location, a final report detailing the survey results should be submitted to the Service and the Department within one month of the last site visit. The written report should include, but is not be limited to, the following information: names of surveyors and copies of permits and authorizations, a description and map at the appropriate resolution of the type and quality of upland and aquatic habitats and land uses at the site; a map indicating the location of water bodies sampled for larvae; a map indicating the location of drift fences and pitfalls. The survey report also should include survey methods used, the dates and times of surveys, rainfall totals by date, nightly minimum temperatures, number and length of dipnet sweeps made, number of passes with seine, total estimated area seined, records of upland and aquatic animals captured, and pond water temperature, turbidity, and maximum depth at each aquatic sampling. If CTS are detected on the site, the report should include a map indicating the precise location of all CTS observations and captures, the number of CTS egg masses, larvae, sub-adults and adults observed, and photographic verification of CTS from the site. Site photographs may also be helpful in interpreting survey results. For the Department, survey reports should also include CNDDB field locality forms. Locality information should be in the form of UTM or latitude/longitude (degree, minute, second) coordinates.

In the case of a negative finding including a season with 70% of average rainfall, additional information (e.g., pond filling/drying dates, quantity and timing of rainfall during each sampling interval, temperatures) supplied by the surveyor, may assist the Service and the Department in their decision whether or not to accept the data.

Contact Information:

U.S. Fish and Wildlife Service

For an application or guidance on how to obtain a Federal permit or for reporting, please contact:

For areas within the Great Valley hydrobasin:

U.S. Fish and Wildlife Service
Sacramento Fish and Wildlife Office

Attn: Permit Coordinator 2800 Cottage Way, W-2605
Sacramento, California 95825
(916) 414-6547
For hydrobasins south of and including Santa Cruz County:

U.S. Fish and Wildlife Service
Attn: Permit Coordinator
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B Ventura, California 93003
(805) 644-1766

http://www.fws.gov/endangered/permits/

Please refer to http://www.fws.gov/ventura/areas/responsibilities.html or http://www.fws.gov/sacramento/sfwo_jurisdiction.htm for a map showing U.S. Fish and Wildlife Office jurisdictions.

California Department of Fish and Game

For Department reporting or questions regarding land use activity guidance, a map of regional offices and telephone numbers is available at http://www.dfg.ca.gov/regions/regions.html

For State of California Scientific Collecting permit applications and information, please contact:
California Department of Fish and Game
License and Revenue Branch
3211 S Street
Sacramento, California 95816
(916) 227-2271

For additional State permit information, please refer to:

http://www.dfg.ca.gov/hcpb/ceqacesa/ceqacesa.shtml (How to Obtain a Scientific Collecting Permit)

http://www.dfg.ca.gov/hcpb/ceqacesa/rsrchpermit/mou/whenneedmou.shtml (When is the MOU Required?)

http://www.dfg.ca.gov/licensing/pdffiles/fg1476.pdf (Scientific Collecting Regulations)

http://www.dfg.ca.gov/licensing/pdffiles/fg1379e.pdf (Scientific Collecting Permit Attachment)

STUDY PLAN TR-9

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Special-Status Wildlife - Bats Study Plan

July 2011

Related Study Requests: None

1.0 Project Nexus

The ongoing operation and maintenance (O&M) of the Don Pedro Project (Project) may potentially affect special-status[1] bats. Specifically, Project features may provide suitable roosting, breeding or hibernating habitat for identified special-status bat species. Recreation facilities and activities may disturb potential habitat. Project O&M activities such as vegetation management (e.g., hazard tree removal) may disturb current habitats used by special-status bats. Project operations could affect riparian habitats that may be used by bats for roosting. This study focuses on the potential for Project O&M activities and recreation activities to affect special-status bat species.

Table 1.0-1 provides the target list of special-status bats for this study, including the following information for each species: special status, general habitat type, and recorded occurrence within the Project Boundary.

2.0 Resource Agency Management Goals

Agencies with management responsibilities related to bats include the U.S. Department of Interior (USDOI), Fish and Wildlife Service (USFWS), USDOI, Bureau of Land Management (BLM) on federal lands managed by BLM; and the California Department of Fish and Game (CDFG).

[1] Special-status wildlife are considered those wildlife species that are: found on BLM land and formally listed by BLM as a Sensitive Species (BLM-S); listed under the federal Endangered Species Act (ESA) as Proposed or a Candidate for listing as endangered or threatened or proposed for delisting; listed under the California Endangered Species Act (CESA) as Proposed or a Candidate for listing as endangered or threatened or proposed for delisting; formally listed by CDFG as a Species of Special Concern (SSC). Species listed as threatened or endangered under the ESA or CESA are addressed separately and not considered special-status for the purpose of the relicensing proceedings. There are no ESA- or CESA-listed bat species expected to occur within the Project Boundary or in the area surrounding the Project Boundary.

Table 1.0-1 Special-status bat species known to occur or likely to occur within the Project Boundary.

Species	Special Status[1]	Suitable Habitat Type	Occurrence in Project Boundary
Yuma myotis *Myotis yumanensis*	BLM-S	Roosts in buildings, mines, caves, and crevices; feeds over water (0 to 10,800 feet) but uncommon to rare above 8,400 feet.	Two CNDDB[2] occurrences: (1) bridge adjacent to Highway 49; and (2) bridge near intersection of Highway 120 and Jacksonville Road.
Long-eared myotis *Myotis evotis*	BLM-S	Roosts in buildings, crevices, and snags; feeds along habitat edges, in open habitats, and over water (0 to 8,800 feet at least).	Potentially occur within suitable habitat.
Fringed myotis *Myotis thysanodes*	BLM-S	Roosts in buildings, mines, caves, snags, and crevices; feeds in open habitats and over water (4,300 to 7,200 feet).	Potentially occur within suitable habitat.
Western small-footed myotis *Myotis ciliolabrum*	BLM-S	Roosts in caves, buildings, mines, crevices, and under bridges; feeds over streams, ponds, and springs (0 to 8,800 feet).	Potentially occur within suitable habitat.
Western red bat *Lasiurus blossevillii*	SSC	Generally associated with edge habitats adjacent to streams, open fields, orchards and occasionally in urban areas. Roosts in tree foliage, and forages in open areas over land or water (sea level up through mixed conifer forests).	CNDDB occurrence southeast of Moccasin, adjacent to Highway 49.
Spotted bat *Euderma maculatum*	BLM-S, SSC	Arid deserts, grasslands, and mixed conifer forests (0 to 9,800 feet).	CNDDB occurrence 2.2 miles southeast of Standard; intersection of Woodham-Carne Road and Yosemite Road.
Townsend’s big-eared bat *Corynorhinus townsendii*	BLM-S, SSC	Roosts in buildings, mines, tunnels, and caves; feeds along habitat edges (0 to 10,365 feet).	CNDDB occurrence at mine on Quartz Mountain, 2.1 miles south of Jamestown.
Pallid bat *Antrozous pallidus*	BLM-S, SSC	Roosts in caves, crevices, and buildings; feeds in a variety of open habitats (8,000 feet).	Five CNDDB occurrences: (1) west of Sullivan Creek; (2) Jamestown Mine site near Sonora; (3) Tuolumne River 2.5 miles east southeast of Jacksonville; (4) near intersection of Highway 120 and Jacksonville Road; and (5) southeast of Moccasin, adjacent to Highway 49.
Western mastiff bat *Eumops perotis*	BLM-S, SSC	Open areas with abundant roost locations provided by crevices in rock outcrops and buildings at lower elevations, but as high as 8,700 feet.	Six CNDDB occurrences: (1) one mile southwest of Yosemite Junction, south of Highway 120; (2) ¼ mile northeast of Yosemite Junction, (3) ½ mile southeast of New Melones Lake; (4) mapped at Tuolumne (Town)[3]; (5) southeast of Moccasin adjacent to Highway 49; and (6) near intersection of Highway 120 and Jacksonville Road.

1 Status: BLM-S: Bureau of Land Management Sensitive Species
SSC: California Department of Fish and Game Species of Special Concern

2 CNDDB: California Natural Diversity Database.

3 The CNDDB only provided “Tuolumne (Town)” as the location of this occurrence, and indicated that more information was needed.

The BLM's resource management goals regarding special-status species, including special-status bats, are to maintain, improve, or enhance native populations and the ecosystems upon which they depend; ensure that all BLM management activities and authorizations are consistent with the conservation needs of special-status species; manage special-status species habitat to assist in the recovery of listed species; protect and manage significant and sensitive resources on BLM lands; and to maintain and/or improve meadow and wetland habitat and riparian and aquatic habitat for all life stages of special-status species.

3.0 Study Goals

The goal of this study is to identify Project O&M and/or recreation activities that may adversely affect special-status bat species. The criteria to determine a Project effect includes both of the following:

- A special-status bat species is found to occur (more than incidentally) within the Project Boundary.
- A specific Project O&M or recreation activity has a reasonable possibility of having an adverse effect on the special-status bat species found.

4.0 Existing Information and Need for Additional Information

Existing and relevant information regarding known and potentially occurring special-status bats in the Project Boundary is available from the CDFG's California Wildlife Habitat Relationships (CWHR) program and the California Natural Diversity Data Base (CNDDB). Existing information is too general to meet the goal of the study. Additional information needed to address the study goal is to identify specific locations of any special-status bats in relation to Project facilities and normal Project O&M activities that might affect these special-status species.

5.0 Study Methods

5.1 Study Area

The study area consists of the area within the Project Boundary, including road bridges within the Project Boundary.

Specific sampling sites will be selected based on the results of a reconnaissance survey (see Section 5.3, Study Methods), taking into consideration habitat suitability, accessibility, and the overall objective of sampling a broad range of habitat types and localities within the Project Boundary. Specific target sites will be sampled once in late July or early August, which corresponds to the peak of bat activity; and then again in late September or early October which corresponds to fall migration. Sampling during these two periods increases the likelihood of detecting special-status bats that may be present in a given season.

5.2 General Concepts

The following general concepts apply to the study:

- Personal safety is the most important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study reports.

5.3 Study Methods

The study approach will consist of the following four steps:

Step 1 – Initial Reconnaissance. In February 2012, the Districts will evaluate all recreation facilities, bridges, dams, powerhouses, and adits within the study area. At each location, the Districts will visually inspect the exterior and interior of buildings and the underside of associated supports of bridges for active bat roosts and signs of past use including guano and urine staining. Any observed bat activity will be documented with photographs. The location of the occurrences found during the initial reconnaissance will be recorded by GPS, stored in the Project GIS database, and displayed on Project maps. The Districts will use the information collected during the initial reconnaissance to prioritize locations that will be targeted for focused special-status bat surveys described in Step 2.

The following types of bat roosts will be considered during the assessment:

- **Maternity Roosts** - A maternity roost is a feature that provides protection from the elements and predators, and provides the correct thermal environment for reproduction. Maternity roosts tend to be warmer in temperature because breeding females need to maintain a high metabolism to aid in lactation. Juvenile bats need to keep warm to maintain a metabolic rate that allows for rapid growth. According to Tuttle and Taylor (1998), maternity roost thermal requirements are species-dependent but generally remain between 70°F and 90°F; however, Townsend’s big-eared bat nursery roosts have been discovered in sites where ambient temperatures are as low as 60°F. Species that form large colonies can be found raising young in mines with ambient temperatures as low as 56°F, but often prefer 66°F or higher.
- **Day Roosts** - A day roost is a feature where bats are able to spend the non-active period of the day resting or in torpor, depending on weather conditions. Day roosts provide shelter from the elements and safety from predators.
- **Night Roost** - A night roost is a feature used by bats to rest between foraging bouts, to allow digestion of prey, to escape from predators, as shelter from weather, and possibly for social purposes. Night roosts are typically sites or structures that retain heat to aid the bat in maintaining the higher metabolism necessary for digestion.
- **Winter Hibernacula** - Areas used by bats during colder winter months. During this time, bats enter torpor, receiving nourishment from their fat storage gained during summer months. Many species will awaken for brief periods of time to stretch, but will resume torpor. Bats, such as the Townsends big-eared bat, will hibernate for short periods of time and will often resume feeding behavior during warm winter spells (Tuttle and Taylor 1998). According to Tuttle and Taylor (1998), airflow and temperature are key determinants in use of structures, such as tunnels and adits, as hibernacula. Temperatures within these roost sites are generally below 53°F at the onset of hibernation, and remain between 34°F and 50°F by midwinter. Structures that have a varying temperature regime

allow bats to find suitable temperatures during warm or cold winters (Tuttle and Taylor 1998).

Step 2 – Focused Surveys. The Districts will conduct surveys at locations where evidence of bat activity is found and has a reasonable chance of being affected by Project O&M and/or recreation activities. Surveys will include acoustic and mist netting survey methods. Surveys will be conducted near dusk as bats begin to emerge from their roosts. The Districts will obtain the appropriate CDFG permits and approvals prior to beginning the surveys. Each survey location will be sampled twice during the study: once during the peak reproductive period (July-August); and once during the fall migration (late September or early October). Sampling methods are described below.

- **Acoustic Sampling** - Acoustic sampling will be conducted during peak bat activity using an Anabat SD1 bat detector system (Titley Electronics) to identify bat species. The Anabat system detects bat ultrasonic echolocation calls and converts them into sonograms. Analook computer software uses the sonograms to identify bat species (O'Farrell et al. 1999). Acoustic sampling will be performed in conjunction with mist net sampling.

- **Mist Net Sampling** - Mist net surveys will be conducted from sunset to approximately 1:00 AM. Captured bats will be identified to species level. Additional information including sex, age, reproductive status, forearm measurement, and weight will be recorded.

- **Long-Term Acoustic Monitoring (LTAM**) - At two sites, selected in consultation with the appropriate resource agencies, LTAM will be conducted. LTAM will involve the deployment of Anabat SD1 bat detectors for monitoring of bat activity and species identification over time. The Districts will deploy the LTAM equipment in select areas adjacent to Project facilities such as the dam or powerhouse. Deployment of the LTAM equipment will be from early March through October in order to capture spring migration; young rearing; peak bat activity; and fall migration.

  Inspection of the LTAM equipment and retrieval of acoustic data will occur on a monthly basis. However, in order to ensure that all equipment is functioning properly, the Districts will perform an initial inspection of the equipment and download all data recorded no more than two weeks after initial deployment. The second visit will occur four weeks after initial deployment and if no malfunctions have occurred, all remaining visits will be at four week intervals. If at any time a malfunction occurs, it will be immediately corrected by removal of the equipment currently in service and replacement with proper functioning equipment. For all equipment that requires replacement, the Districts will perform inspections and data downloads at week two and four after deployment, and if no malfunctions have occurred, all remaining visits will be at four week intervals.

  The Anabat SD1 bat detectors will be coupled with an external power source (e.g., 12-volt battery) for long-term deployment, and EME Systems Bat-Hats to aid in acoustic data collection. Additionally, a small solar panel will be used to maintain the charge of the battery to prevent frequent visits to the site for battery replacement. Acoustic data will be saved directly to a compact flash memory card. The LTAM equipment will be programmed to collect data from approximately one hour before sunset until sunrise. The unit will remain off during the daytime. If a unit is stolen or vandalized twice, the Districts will not reinstall the unit.

Step 3 – Quality Assurance/Quality Control Review. The Districts will perform a quality assurance/quality control (QA/QC) review of all data, including maps, recordings, identifications, and sightings. To minimize variation in acoustic data between LTAM sites, each Anabat SD1 detector will be calibrated in accordance with Larson and Hayes (2000). A subset of the acoustic sampling data as well as the LTAM data will go through QA/QC review. After acoustic call files have been identified to species or species groups, 10 percent of the identified files will be randomly selected and subject to a QA/QC review to verify accurate identification. QA/QC of the acoustic data will be qualitative (visual check of call shape against calls from a similar species) and quantitative (comparison of maximum and minimum frequencies, characteristic frequencies, and call duration against known parameters for the identified species). The QA/QC procedure will be performed by a qualified biologist who did not participate in the analysis of acoustic call files. The initial reconnaissance data and mist net sampling data will also be reviewed to verify all data fields have been filled in on the data sheets. All map figures that will be used in study reports will go through a QA/QC review as well. This will include a review of mist netting and LTAM site locations in the Project Boundary. The data collected will be analyzed to assess the potential for specific Project activities to impact any special-status bats.

Step 4 – Prepare Report. The Districts will prepare a report that includes the following sections: (1) Study Goals, (2) Study Methods, (3) Results, (4) Discussion, and (5) Conclusions. The Districts will make the report available to Relicensing Participants when completed.

6.0 Schedule

The Districts anticipate the following schedule to complete the study as follows assuming FERC issues its Study Plan Determination by December 31, 2011, and the study is not disputed by a mandatory conditioning agency:

- Planning (Step 1) .... January 2012 − July 2012
- Fieldwork (Step 2) .... March 2012 − October 2012
- QA/QC Review and Data Analyses (Step 3) .... November 2012 − December 2012
- Report Preparation (Step 4) .... January 2013
- Report Issuance .... January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

This study is consistent with the goals, objectives, and methods outlined for recent FERC relicensing efforts in California, and uses well-established methodologies developed in consultation with CDFG on similar projects.

8.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

9.0 References

Larson, J.L. and J.P. Hayes. 2000. Variability in sensitivity of Anabat II bat detectors and a method of calibration. Acta Chiropterologica 2(2): 209-213.

O' Farrell, M., B.W. Miller, and W.L. Gannon. 1999. Qualitative identification of free-flying bats using the Anabat detector. Journal of Mammalogy 80(1): 11-23.

Tuttle, M.D., and D.A.R. Taylor. 1998. Bat and Mines. Bat Conservation International. Resource Publication No. 3, 50pp.

STUDY PLAN W&AR-1

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Water Quality Assessment Study Plan

July 2011

Related Study Requests: Gardner-01, CWA-01, CWA-02, Rosapepe-01

1.0 Project Nexus

The ongoing operation and maintenance (O&M) of the Don Pedro Project (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). This study investigates the potential Project effects to water quality.

For the purpose of this Study Plan, water quality parameters being analyzed are those listed in Table 1.0-1.

Table 1.0-1 Water quality parameters.

Parameter		Method	Target Reporting Limit µg/L (or other)	Hold Time
Basic Water Quality- Field				
Dissolved Oxygen	DO	SM 4500-O	0.1 mg/L	Field
Specific Conductance	-----	SM 2510 A	0.001 µmhos	Field
pH	-----	SM 4500-H	0.1 su	Field
Turbidity	-----	SM 2130 B	0.1 NTU	Field
Oxidation-reduction potential	-----	SM 2130 B	±20 mV	Field
Basic Water Quality - Laboratory				
Total Organic Carbon[1]	TOC	SM 5310	0.2 mg/L	28 d
Dissolved Organic Carbon	DOC	EPA 415.1 D	0.5/0.1	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	2000	14 d
Hardness (measured value)	-----	EPA 2340 B/SM 2340 C	1 mg/L as CaCO3	
Calcium	Ca	EPA 6010 B	30	180 d
Magnesium	Mg	EPA 6010 B	1	
Potassium	K	EPA 6010 B	500	180 d
Sodium	Na	EPA 6010 B	29	180 d
Chloride	Cl	EPA 300.0	20	28 d
Nutrients				
Nitrate-Nitrite	-----	EPA 300.0	2	28 d <pH 2
Total Ammonia as N	-----	EPA 4500-NH3/SM 4500-NH3	0.02	28 d <pH 2

Parameter		Method	Target Reporting Limit µg/L (or other)	Hold Time
Total Kjeldahl Nitrogen as N	TKN	SM 4500 N	100	28 d <pH 2
Total Phosphorous	TP	SM 4500-P	20	28 d <pH 2
Dissolved Orthophosphate	PO_4	EPA 365.1/EPA 300.0	0.01	48 h at 4°C
Metals (Total and Dissolved)				
Arsenic (total and dissolved)	As	EPA 200.8/1632	53/0.004	180 d
Cadmium (total and dissolved)	Cd	EPA 200.8/1638	3.4/0.003	180 d
Copper (total and dissolved)	Cu	EPA 200.8/1638	5.4/0.01	180 d
Iron (total and dissolved)	Fe	EPA 200.8/1638	6.2/2.2	180 d
Lead (total and dissolved)	Pb	EPA 1638	0.005	180 d
Mercury (total)	Hg	EPA 1631	0.0002	28 d
Methylmercury (total and dissolved)	CH3Hg	EPA 1630	0.00005/0.00002	90 d
Selenium (total)	Se	EPA 200.8/1638	75	180 d
Silver (total and dissolved)	Ag	EPA 200.8/1638	7/0.03	180 d
Zinc (total and dissolved)	Zn	EPA 200.8/1638	1.8/0.3	180 d
Herbicides and Pesticides				
Aldrin	----	EPA 8081A	0.05/0.01	7d
Alpha-BHC (=alpha-HCH)	----	EPA 8081A	0.05/0.01	7d
Beta-BHC (=beta-HCH)	----	EPA 8081A	0.05/0.008	7d
Chlordane	----	EPA 8081A	0.5/0.08	7d
Chlorpyrifos	----	EPA 8141A	0.005/0.0024 mg/L	7d
Delta-BHC (=delta-HCH)	----	EPA 8081A	0.05/0.017	7d
Dieldrin	----	EPA 8081A	0.05/0.01	7d
Diazinon	----	EPA 8141A	0.005/0.0029 mg/L	7d
Endosulfan I	----	EPA 8081A	0.05/0.005	7d
Endosulfan II	----	EPA 8081A	0.05/0.01	7d
Endrin	----	EPA 8081A	0.05/0.0118	7d
Gamma-BHC (=gamma-HCH)	----	EPA 8081A	0.05/0.02	7d
Heptachlor	----	EPA 8081A	0.05/0.007	7d
Heptachlor Epoxide	----	EPA 8081A	0.05/0.02	7d
Toxaphene	----	EPA 8081A	2/0.3	7d
Bacteria				
Total Coliform	----	SM 9221	1.1 MPN	24 h
Fecal Coliform	----	SM 9221	1.1 MPN	24 h
Escherichia coli	*E. coli*	SM 9221	1.1 MPN	24 h
Petroleum Hydrocarbons				
Total Petroleum Hydrocarbons (gasoline range)	TPH-g	EPA SW8015B	50	14 d
Oil & Grease	O&G	Visual Observation	----	----

[1] Total organic carbon data may be used in calculations required to assess conformance with water quality objectives.

In addition, this study addresses the following issues identified in Section 6.0 of the Pre-Application Document (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 temperatures downstream of Don Pedro Reservoir are the subject of an ongoing study required by FERC in its July 2009 order. The Districts' study plan for the conduct of this study was approved by FERC in May 2010 and the study results were published in March 2011. This study is entitled: Lower Tuolumne River Water Temperature Model Study (Stillwater 2011).

2.0 Resource Agency Management Goals

SWRCB is the state agency that administers the federal Clean Water Act (CWA) (33 U.S.C. §11251-1357) as applies to California waters with the responsibility to maintain the chemical, physical, and biological integrity of the state's waters and to protect the beneficial uses of stream reaches consistent with Section 401 of the federal CWA, the Regional Water Quality Control Board Basin Plans, State Water Board regulations, California Environmental Quality Act, and any other applicable state law. SWRCB's management goals are set forth in the CVRWQCB's Basin Plan, which was initially adopted in 1998 and most recently revised by the SWRCB in 2009.

The Don Pedro Project and the areas upstream and downstream of the Project fall within three Basin Plan Hydro Units: (1) Hydro Unit 536, which includes the Tuolumne River upstream of the Project; (2) Hydro Unit 536.32, which includes Don Pedro Reservoir; and (3) Hydro Unit 535, which includes the Tuolumne River from Don Pedro Dam to the San Joaquin River. Designated beneficial uses in these three Hydro Units are described in Table 2.0-1.

Table 2.0-1 Beneficial uses of the Tuolumne River in the vicinity of the Don Pedro Project.

Designated Beneficial Use Description from Basin Plan, Section II		Designated Beneficial Use by Hydro Unit (HU) from Basin Plan, Table II-1			
		Use	Source to Don Pedro Reservoir	Don Pedro Reservoir	Don Pedro Dam to San Joaquin River
			HU 536	HU 536.32	HU 535
Municipal and Domestic Supply (MUN)	Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.	MUNICIPAL AND DOMESTIC SUPPLY	Existing	Potential	Potential
Agricultural Supply (AGR)	Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation (including leaching of salts), stock watering, or support of vegetation for range grazing.	IRRIGATION	Existing	-----	Existing
		STOCK WATERING	Existing	-----	Existing
Industrial Process Supply (PRO)	Uses of water for industrial activities that depend primarily on water quality.	PROCESS	-----	-----	-----

Designated Beneficial Use Description from Basin Plan, Section II		Designated Beneficial Use by Hydro Unit (HU) from Basin Plan, Table II-1			
		Use	Source to Don Pedro Reservoir	Don Pedro Reservoir	Don Pedro Dam to San Joaquin River
			HU 536	HU 536.32	HU 535
Industrial Service Supply (IND)	Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressuration.	SERVICE SUPPLY	-----	-----	-----
		POWER	Existing	Existing	-----
Water Contact Recreation (REC-1)	Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.	CONTACT	Existing	Existing	Existing
		CANOEING AND RAFTING[1]	Existing	-----	Existing
Non-Contact Water Recreation (REC-2)	Uses of water for recreational activities involving proximity to water, but where there is generally no body contact with water, nor any likelihood of ingestion of water. These uses include, but are not limited to, picnicking, sunbathing, hiking, beach-combing, camping, boating, tide-pool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.	OTHER NON-CONTACT	Existing	Existing	Existing
Warm Freshwater Habitat (WARM)	Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.	WARM[2]	Existing	Existing	Existing
Cold Freshwater Habitat (COLD)	Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.	COLD[2]	Existing	Existing	Existing

Designated Beneficial Use Description from Basin Plan, Section II		Designated Beneficial Use by Hydro Unit (HU) from Basin Plan, Table II-1			
		Use	Source to Don Pedro Reservoir	Don Pedro Reservoir	Don Pedro Dam to San Joaquin River
			HU 536	HU 536.32	HU 535
Migration of Aquatic Organisms (MGR)	Uses of water that supports habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.	WARM[3]	-----	-----	-----
		COLD[4]	-----	-----	Existing
Spawning (SPWN)	Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.	WARM[3]	-----	-----	Existing
		COLD[4]	-----	-----	Existing
Wildlife Habitat (WILD)	Uses of water that support terrestrial or wetland ecosystems including, but not limited to, preservation or enhancement of terrestrial habitats or wetlands, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, or invertebrates), or wildlife water and food sources.	WILDLIFE HABITAT	Existing	Existing	Existing

1 Shown for streams and rivers only with the implication that certain flows are required for this beneficial use.

2 Resident does not include anadromous. Any hydrologic unit with both WARM and COLD beneficial use designations is considered COLD water bodies by the SWRCB for the application of water quality objectives.

3 Striped bass, sturgeon, and shad.

4 Salmon and steelhead.

In addition, Section 303(d) of the CWA requires that every two years each state submit to the U.S. Environmental Protection Agency (EPA) a list of rivers, lakes, and reservoirs in the state for which pollution control or requirements have failed to meet water quality standards. Based on a review of the SWRCB's 2010 proposed list and its associated TMDL Priority Schedule, Don Pedro Reservoir has been identified as CWA §303(d) state impaired for mercury, and the lower Tuolumne River (Don Pedro Reservoir to San Joaquin River) as state impaired for diazinon, Group A Pesticides, and Unknown Toxicity (SWRCB 2010). Group A Pesticides consist of aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor epoxide, hexachlorocyclohexanes (including lindane), endosulfan, and toxaphene.

Additionally, the CVRWQB has proposed that Sullivan Creek (Phoenix Reservoir to Don Pedro Reservoir) and Woods Creek (north side of Don Pedro Reservoir to San Joaquin River) be listed as state impaired for *Escherichia coli* (*E. coli*). Dry Creek (tributary to lower Tuolumne River at Modesto) has been proposed as state impaired for chlorpyrifos, diazinon, *E. coli*, and unknown toxicity (SWRCB 2010). However, these constituents have not yet been added to the 303(d) list, and therefore, there are no approved TMDL plans for them.

3.0 Study Goals

The goal of this study is to characterize existing water quality conditions in Don Pedro Reservoir and the lower Tuolumne River as measured at the discharge from the Project. The objective of the study is to determine whether or not Project operations cause a Basin Plan Objective to not be met.

4.0 Existing Information and Need for Additional Information

Existing relevant and reasonably available information for the general Project area is documented in Section 5.2.1 of the PAD. Historic information suggests that water quality in Don Pedro Reservoir meets Basin Plan Water Quality Objectives. Water entering Don Pedro Reservoir from the Wild and Scenic Tuolumne River is well-oxygenated, cold water of high quality with few exceptions. As water flows through the reservoir, there are very few sources of potential water quality degradation, these being the minor tributaries (e.g., Woods, Sullivan, and Moccasin creeks) entering the reservoir and the recreation infrastructure at Don Pedro Reservoir (e.g., campsites and fuel stations). Subsequently, water leaving Don Pedro Reservoir remains of high quality and available data indicate that Basin Plan criteria are met.

Seasonal temperature stratification processes can play an important role in lake water quality conditions. Don Pedro Reservoir becomes thermally stratified in late spring and maintains a separation between the warmer waters of the top layer (i.e., epilimnion) and the cold water pool comprising the bottom layer (i.e., hypolimnion) until fall when turnover begins.

Since Don Pedro Dam was completed in 1971, dissolved oxygen levels in the reservoir’s epilimnion have ranged between 7.6 and 8.4 milligrams per liter (mg/L) for August through November 1978 and 1979 (EPA 2010a). In the hypolimnion, dissolved oxygen levels recorded during discrete intermittent sampling ranged between 0.7 and 8.6 mg/L, and temperatures ranged between 2.3 to 14.0°C for the same time period (EPA 2010a).

Existing information provides a recent description of the general water quality of the Tuolumne River upstream and substantially downstream of the Project, while less is known about the water quality within and immediately downstream of the Project. Therefore, additional information regarding water quality in the Project will be gathered during the late summer when reservoir stratification is stable to obtain a data set that is representative of Project conditions and effects.

5.0 Study Methods

Water quality sampling will occur in the Tuolumne River upstream of Don Pedro, Woods Creek, Sullivan Creek, within Don Pedro Reservoir, and in the Tuolumne River immediately downstream of Don Pedro Dam. Bacteria samples will be collected from sites adjacent to recreation areas at Don Pedro Reservoir.

5.1 Study Area

The study area includes the Project Boundary and consists of upstream of Don Pedro Reservoir, within Don Pedro Reservoir, and the Tuolumne River immediately below Don Pedro Dam. Recreation-related facilities and O&M activities that discharge wastewater to the reservoir or the Tuolumne River will also be identified and sampled.

5.2 General Concepts

The following general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study report.

5.3 Study Methods

Study methods are separated into two elements for this Study Plan: Water Chemistry Element and Recreation Activity Element.

5.3.1 Water Chemistry Element

The study approach for the water chemistry element will consist of the following seven steps:

<u>Step 1 – Select Water Quality Sampling Locations.</u> To better understand the dynamics of the water chemistry and physical structure of Don Pedro Reservoir, water quality information will be collected in Woods Creek and Sullivan Creek prior to entering Don Pedro Reservoir; the Tuolumne River upstream of Don Pedro Reservoir; within Don Pedro Reservoir; and in the Tuolumne River immediately below Don Pedro Dam.

Timing of Sampling Events. Water chemistry samples will be collected in the late summer period (late August/Early September).

Sample Locations and Depths. In-reservoir water quality samples will be co-located with reservoir temperature profiles at two sites: one site between Upper and Middle Bays and one near the main dam (Table 5.3-1). At each reservoir location, water chemistry samples will be collected for laboratory analysis at two depths: within one meter above the bottom in the hypolimnion and one meter below the surface in the epilimnion. Field water quality measurements will be made at these same depths with a Hydrolab DataSonde 5 (Hydrolab).[1]

Table 5.3-1 Reservoir and stream reach sample locations.

Reservoir/Stream Reach	Sample Depth	Location
Woods Creek	Just below surface	Just prior to entering Don Pedro Reservoir
Sullivan Creek	Just below surface	Just prior to entering Don Pedro Reservoir
Tuolumne River above Don Pedro Reservoir	Just below surface	Upstream of Wards 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)

[1] Or other similar instrument that has the same precision and accuracy.

Analytical Parameters. All samples associated with the stream and reservoir sampling will be analyzed for the following parameters:

- Basic Water Chemistry - Field
- Basic Water Chemistry - Laboratory
- Inorganic Ions
- Metals
- Nutrients
- Herbicides and Pesticides

The methods associated with each parameter are listed in Table 1.0-1.

<u>Step 2 – Collect Data and Samples.</u> All data will be collected in accordance with standard quality assurance practices.

As water temperature (±0.1°C), dissolved oxygen (±0.2 mg/L), pH (±0.2 standard unit, or su), specific conductance (±0.001 µmhos/cm), and turbidity (±1 NTU) will be measured in the field using a Hydrolab DataSonde 5 or equivalent to meet the reporting limits in Table 1.0-1. Prior to and after each use, the instrument will be calibrated using manufacturer's recommended calibration methods. Any variances will be noted on the field data sheet and final report and recalibration or repair done as necessary. The Districts will note relevant conditions during each sampling event on the field data sheet (i.e., weather, air temperature, flow, description of location, floating material, and evidence of oil and grease). Sampling equipment will be thoroughly cleaned between sampling sites.

Surface samples will be collected using a grab sampling technique. Hypolimnetic samples will be collected using a Kemmerer bottle or equivalent. Each laboratory sample will be collected using laboratory-supplied clean containers, certified to meet the reporting limits in Table 1.0-1. Water samples to be analyzed for metals will be taken using "clean hands-dirty hands" method[2] consistent with the EPA Method 1669 sampling protocol as described in *Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels* (EPA 1996). Samples requiring filtration before analysis will be filtered in accordance with standard protocols in the field.

All sample containers will be labeled with the date and time that the sample is collected, sampling site, or identification label; and handled in a manner consistent with appropriate chain-of-custody protocols. The sample container will be preserved (as appropriate), stored and delivered to a State of California certified water quality laboratory for analyses of the parameters listed in Table 1.0-1 in accordance with maximum holding periods for each parameter. A chain-of-custody record will be maintained with the samples at all times. Each sampling site location will be recorded using a GPS unit and the coordinates will be recorded in a field logbook. Shared sampling equipment will be thoroughly cleaned between sampling sites.

As part of the field quality assurance program, a field blank will be collected every day or every 10 samples, which ever is most frequent; duplicates and equipment rinsates will be collected

[2] One member of a two-person sampling team is designated as "dirty hands"; the second member is designated as "clean hands." All operations involving contact with the sample bottle and transfer of the sample from the sample collection device to the sample bottle are handled by the individual designated as "clean hands." "Dirty hands" is all other activities that do not involve direct contact with the sample.

every 10 samples[3] and submitted to the laboratory for analysis. A field blank is a sample of analyte-free water poured into a container in the field, preserved, and shipped to the laboratory with the samples. A field blank assesses any contamination from field conditions during sampling. A rinsate is a sample of analyte-free water poured over or through decontaminated field sampling equipment prior to the collection of samples. It assesses the adequacy of the decontamination processes. Trip blanks will be collected for every cooler used for transporting volatile organics samples.

<u>Step 3 – Laboratory Analysis of Water Samples</u>. All laboratory analyses will be conducted using EPA Analytical Methods (EPA 2010b) or Standard Methods (APHA et al. 2010), or an equivalent method sufficiently sensitive to detect and report at levels necessary for evaluation against state and federal water quality standards. A California-certified laboratory will prepare and analyze water samples for the following surface water analytical parameters:

- Basic Water Chemistry - Laboratory
- Inorganic Ions
- Metals
- Nutrients
- Herbicides and Pesticides
- Bacteria
- Petroleum Hydrocarbons

The analytes and target reporting limits associated with each parameter are listed in Table 1.0-1.

<u>Step 4 – Compile Data and Perform Quality Assurance/Quality Control.</u> All data will be verified and/or validated as appropriate. In brief, following field and laboratory analyses, which includes the laboratories' own quality assurance/quality control QA/QC (QA/QC) analysis, the Districts will subject all data to QA/QC procedures including, but not limited to: spot-checks of transcription; review of electronic data submissions for completeness; comparison of results to field blank and rinsate results; and, identification of any data that seem inconsistent. If such a datum is found, the Districts will consult with the laboratory to identify any potential sources of error before concluding that the datum is correct.

All verified chemical detections, including data whose results are "J" qualified,[4] will be used for this assessment. Should the laboratory need to re-extract samples and re-run the sample under different calibration conditions, the data identified by the laboratory as the most certain will be used. If field-sampling conditions, as measured by the field blank and the rinsate sample results, indicate that samples have been corrupted, the Districts will qualify the data accordingly.

<u>Step 5 – Determine if Parameters are Consistent with Water Quality Objectives.</u> Table 5.3-2 below shows the benchmark values that will be used to assist with the assessment of sample results and their consistency with the Basin Plan and other water quality objectives. The benchmark values in Table 5.3-2 were taken from the California Toxics Rule (CTR) (EPA 2000); the Basin Plan (CVRWQCB 1998); and bacterial water quality standards for recreational waters from EPA (2003).

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3 Sometimes logistically only one sample is collected a day.

4 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.

Table 5.3-2 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	Marshack 2008	EPA AWQC; 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	----	----
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

Basin Plan Water Quality Objective (Potentially Affected Beneficial Uses)	Symbol or Abbreviation	Benchmark Values	Reference	Notes
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	See Geology and Soil Resources
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	-----	20oC (mean daily), T > 3-5oC (min)	Frost and Brown 1967; Elliott 1981	See Water Temperature Study
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
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 $CaCO_3$

Basin Plan Water Quality Objective (Potentially Affected Beneficial Uses)	Symbol or Abbreviation	Benchmark Values	Reference	Notes
		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 uµg/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”)
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	Ambient Water Quality Criteria
Chlordane	----	0.0043 µg/L	Marshack 2008	Ambient Water Quality Criteria
Chlorpyrifos	----	0.014 µg/L	Marshack 2008	Ambient Water Quality Criteria
Diazinon	----	0.05 µg/L[5]	Marshack 2008	Ambient Water Quality Criteria
Dieldrin	----	0.056 µg/L	Marshack 2008	Ambient Water Quality Criteria
Endosulfan	----	0.056 µg/L	Marshack 2008	Ambient Water Quality Criteria
Endrin	----	0.036 µg/L	Marshack 2008	Ambient Water Quality Criteria
Heptachlor	----	0.0038 µg/L	Marshack 2008	Ambient Water Quality Criteria
Heptachlor epoxide	----	0.0038 µg/L	Marshack 2008	Ambient Water Quality Criteria
alpha-Hexachlorocyclohexane	----	0.08 µg/L	Marshack 2008	Ambient Water Quality Criteria
beta-Hexachlorocyclohexane	----	0.08 µg/L[6]	Marshack 2008	Ambient Water Quality Criteria
delta-Hexachlorocyclohexane	----	0.08 µg/L[6]	Marshack 2008	Ambient Water Quality Criteria
gamma-Hexachlorocyclohexane	----	0.08 µg/L	Marshack 2008	Ambient Water Quality Criteria

Basin Plan Water Quality Objective (Potentially Affected Beneficial Uses)	Symbol or Abbreviation	Benchmark Values	Reference	Notes
Toxaphene	----	0.0002 µg/L	Marshack 2008	Ambient Water Quality Criteria
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.

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,[5] the CTR (EPA 2000) will be evaluated. Section 131.38 of 40 California Code of Regulations (CFR) 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 Concentrations (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 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 5.3-2 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 four of the metals addressed in this study plan (i.e., cadmium, copper, 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 su.

Step 6 – Consult with Project Operations Staff. If a water quality result suggests Basin Plan objectives are not being met, the Districts will consult with Project operations staff to identify

5 Ammonia, nitrate, and trace metals.

Project O&M activities that typically occur in the area with the potential to adversely affect the parameter.

Step 7 – Prepare Report. As stated in Section 3.0, this sampling plan is intended to inform the Districts and relicensing participants on the potential for Project operations to cause a Basin Plan Objective not to be met. The Districts will prepare a report that includes the following sections: (1) Study Goals; (2) Methods; (3) Results; (4) Conclusions; and (5) Description of Variances from the study plan, if any. A complete water quality data set will be provided as appendices to the report including time and location of each sample collected, sample specific performance information, as well as electronic copies of laboratory results. The Districts will make the report available to relicensing participants upon completion.

5.3.2 Recreation Activity Element

The study approach for the recreation activity element will consist of the following seven steps:

Step 1 – Select Sampling Locations for Recreation-related Surveys. The condition of existing recreation facilities and dispersed recreation areas may adversely affect water quality at some near-shore locations adjacent to unmanaged and low-managed recreation facilities.

Timing of Sampling Events. In accordance with bacteria sampling protocols, bacteria samples will be collected on five different days within a 30-day period, including either the Independence Day or Labor Day holiday weekend (CVRWQCB 1998). A single petroleum hydrocarbon sample will be collected at each location during the holiday weekend included in the bacteria sampling.

Sample Locations and Depths. Recreation sample locations are listed in Table 5.3-3. At each near-shore sample location, surface water will be collected from the near surface (bacteria) and/or the surface (petroleum hydrocarbons). Samples will be collected either from shore or from a non-motorized boat.

Table 5.3-3 Recreation sample locations on Don Pedro Reservoir.

Recreation Area	Bacteria 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

Analytical Parameters. Water samples associated with the recreation-related sampling will be analyzed for the recreation suite of surface water analytical parameters:

- Bacteria
- Petroleum Hydrocarbons

Visual observations of oil and grease will be recorded in the field notebook.

Steps 2 through 7. As the remaining Steps 2 through 7 will follow the same steps as described in Section 5.3.1 above.

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC's Study Plan Determination is deemed final on December 31, 2011 and the study is not disputed by a mandatory conditioning agency.

- Planning and Laboratory Contracting..June – July 2012
- Field Work..August – September 2012
- Laboratory Data Received...October – November 2012
- Final Checking and QA/QC Review .... November – December 2012
- Produce Final Report .... January 2013
- Report Issuance.. January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

The methods presented in this study plan also are consistent with those used in recent relicensings in California.

8.0 Deliverables

The Districts plan to prepare an Excel table that will include for each parameter measured the result of all seasons collected, along with sample-specific uncertainty, and sorted by sampling location. The table will be provided on a compact disc (CD) and appended to reports. Data that are greater than the benchmarks provided in Table 5.3-3 will be highlighted.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

American Public Health Association, American Water Works Association, and Water Environment Federation. 2010. Standard Methods for the Examination of Water and Wastewater. 21st edition. Washington, D.C. Available at: http://www.standard methods.org/.

California Department of Public Health (CDPH). 2010. California Code of Regulations, Title 22, Division 4, Chapter 15, Domestic Water Quality and Monitoring Regulations.

Available online at: <http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Lawbook.aspx>.

Central Valley Regional Water Quality Control Board (CVRWQCB). 1998. The Water Quality Control Plan (Basin Plan) for the Sacramento River Basin and the San Joaquin River Basin. 4th ed. California Regional Water Quality Control Board, Central Valley Region. Revised in September 2009 with the Approved Amendments. Available online at: <http://www. waterboards.ca.gov/centralvalley/water_issues/basin_plans/>.

Elliott, J.M. 1981. Some Aspects of Thermal Stress on Freshwater Teleosts, pages 209-245. In A.D. Pickering, editor, Stress and Fish. Academic Press, London.

Frost W.E. and M.E. Brown. 1967. The Trout. New Naturalist Series. Collins, St., James Place, London.

Marshack, J. 2008. A Compilation of Water Quality Goals. California Regional Water Quality Control Board, Central Valley Region, Rancho Cordova, California. Available online at: <http://www.swrcb.ca.gov/centralvalley/water_issues/water_quality_standards_limits/ water_quality_goals/index.html>.

State Water Resources Control Board (SWRCB). 2010. 2010 Integrated Report Clean Water Act Sections 303(d) and 305(b). Approved August 4, 2010. Board Resolution No. 2010-0040. Sacramento, California. Available online at: <http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml>

Stillwater Sciences. 2011. Tuolumne River water temperature modeling study. Final Report. Prepared by Stillwater Sciences, Berkeley, California for Turlock Irrigation District and Modesto Irrigation District. March. Available online at: <http://tuolumnerivertac.com>.

U.S. Environmental Protection Agency (EPA). 1996. Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. EPA 821-R-95-034. U.S. Environmental Protection Agency, Washington, DC. July 1996. Available online at: <http://www.ecy.wa.gov/programs/ wq/wastewater/method_1669.pdf>.

——. 2000. Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California. 40 CFR 131, pages 31682-31711. Federal Register May 18. Available online at: <http://www.epa.gov/fedrgstr/EPA-WATER/2000/May/Day-18/w11106.pdf>.

——. 2003. Bacterial Water Quality Standards for Recreational Waters (Freshwater and Marine Waters). Office of Water Report No. EPA-823-R-03-008. June. Available online at: <http://www.epa.gov/waterscience/beaches/local/sum2.html>.

——. 2010a. STORET database. Available online at: <http://www.epa.gov/storet>.

——. 2010b. Clean Water Act Analytical Methods. Available online at: <http://water.epa.gov/scitech/ swguidance/methods/index.cfm>.

STUDY PLAN W&AR-2

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Project Operations/Water Balance Model Study Plan

July 2011

Related Study Requests: AR-02; Reclamation-02, 04; CDFG-01, LTF-01, NMFS-02, NMFS-04, SWRCB-13

1.0 Project Nexus

Turlock Irrigation District's (TID) and the Modesto Irrigation District's (MID) (collectively, the Districts) continued operation and maintenance (O&M) of the Don Pedro Project (Project) will affect reservoir storage levels in Don Pedro Reservoir, reservoir releases, and stream flow in the Tuolumne River downstream of Don Pedro. This study does not directly address any specific resource issues, but provides a tool for examining water levels and dam releases under potential operational scenarios that may inform development of license requirements.

2.0 Resource Agency Management Goals

Several agencies have resource management goals related to reservoir water levels and reservoir releases. These include the U.S. Army Corps of Engineers (ACOE) for flood management purposes and reserved flood control storage in Don Pedro Reservoir; the U.S. Department of Interior (USDOI), Bureau of Land Management (BLM) for public land administered by BLM; USDOI, Fish and Wildlife Service (USFWS); the State Water Resources Control Board (SWRCB); and the California Department of Fish and Game (CDFG).

3.0 Study Goals

The study goal is to develop a Project operations computer model (Operations Model) that can be used by all Relicensing Participants (RPs) to simulate current and potential future operations of the Project. The objective of the study is to develop an Operations Model that represents the historical plant operations with reasonable accuracy for purposes of relicensing and can be used to simulate potential future operations under a variety of operating scenarios.

Study objectives include developing a model that simulates current Project operations for a period of analysis that covers a range of historical hydrologic conditions. The Operations Model should also be able to simulate basic decisions made during Project operations including the management of flood control reservation, water supply management, dam releases, reservoir levels, and hydropower generation. Objectives also include:

- reproducing observed reservoir levels, reservoir releases, and hydropower generation, within acceptable calibration standards over a range of hydrologic conditions,
- Providing output to inform other studies, analyses, and models,
- Allowing simulation of changes in Project operations to estimate effects on reservoir levels, reservoir releases and hydropower generation, and
- Configuring the model for ease of use by RPs.

4.0 Existing Information and Need for Additional Information

The Districts believe adequate information currently exists to develop the Operations Model that meets the above objectives. These data are provided in the Pre-Application Document (PAD) and includes area-storage-elevation information for the Project reservoir, historical operations data on reservoir water levels, reservoir releases, power generation, and flows downstream of the Project. The Project's Flood Control Manual outlines flood control guidelines and objectives. The existing Federal Energy Regulatory Commission (FERC) license specifies required fishery releases and flows downstream of the Project.

5.0 Study Methods

5.1 Study Area

The study area includes the Tuolumne River from City and County of San Francisco's (CCSF) O'Shaughnessy Dam to U.S. Geological Survey Gage 11290000 – Tuolumne River at Modesto.

5.2 Study Methods

Model development will consist of the following steps:

Step 1 – Model Programming and Data Input for Don Pedro Project Operations Model. The Districts will utilize Microsoft Excel as the platform to develop the Project Operations Model. Microsoft Excel is public domain spreadsheet software for personal computers and is readily available from Microsoft through a variety of sources. There are several advantages to utilizing a spreadsheet platform for the Operations Model. First, spreadsheets allow transparency in calculations allowing users to follow and understand the logic. Second, spreadsheets are highly adaptable, allowing simulation of a wide range of operational criteria, constraints, and conditions. Third, many Relicensing Participants have some existing level of familiarity with spreadsheets which can assist in gaining understanding of the model without learning how to navigate through a new program. Finally, the spreadsheet platform is conducive to allowing simple data input and result review, including easily applied statistical and graphical outputs.

The Operations Model will be constructed in a spreadsheet program, likely to be greater than 50 megabytes in size. Computation time for the Model will be on the order of seconds to minutes, depending on computer memory and processor speed, alleviating any need to run only part of the model or simulation period.

The model will simulate Project Operations for a 40-year period of water years (WY) 1970 through WY 2009 (Period of Record). A water year begins October 1 and ends September 30 of the following year. For example, WY 1970 begins October 1, 1969 and ends September 30,

1970. The period from WY 1970 through 2009 was selected due to the availability of daily data at the Project and most stream gaging locations. The proposed Period of Record includes both the driest (WY 1977) and the wettest (WY 1983) years for the longer period of available monthly data from WY 1922 through WY 2009, based on the total annual inflow to Don Pedro Reservoir. The period also includes three multi-year periods of below average inflow; 1976 through 1977, 1987 through 1992, and 2001 through 2004.

The model output would typically be mean daily flow at or below the Project and selected non-Project facilities, daily power production at the Project powerhouse and end-of-day reservoir elevation. These data can be summarized in a manner most suitable for use in relicensing. For instance, should agencies and other RPs wish to classify hydrologic conditions by water year types, this would occur as part of or subsequent to the completion of the analysis. The model output can be organized by hydrologic conditions or any other proposed grouping.

Table 5.3-1 Model nodes and output for Project and other select locations.

Project Nodes		Nodes Other than Project	
Model Node	**Model Output**	**Model Node**	**Model Output**
Don Pedro Reservoir	Storage and elevation, regulated and unregulated inflow	CCSF Upstream Reservoirs	Total inflow, Total reservoir storage; San Joaquin Pipeline regulated flow, regulated river release
Don Pedro Powerhouse	Generation, release through turbine, and bypass flow	La Grange Dam	TID and MID Main Canal Diversions, and river release
Don Pedro Dam	Regulated river release	Tuolumne River at Modesto (Modesto Gage)	River flow (including upstream accretions and depletions between La Grange Dam and Modesto Gage)

The model will simulate Project operations at all locations on a daily time-step. In addition, the model will simulate operation of CCSF (non-Project) facilities above Don Pedro Reservoir, in aggregate, on a daily time-step. A daily time-step was selected to provide sufficient detail to address most issues and concerns related to Project operations. A daily time step for the model has also been selected due to the unavailability of data on a sub-daily time-step.

The model will use synthesized mean daily unimpaired flow data developed by the Districts and the CCSF. Unimpaired flows will be used as inflow to the CCSF reservoirs and the unregulated portion of inflow to Don Pedro Reservoir in the model. The model will depict the operations of the CCSF upstream facilities under current requirements, including water demands and operational policies and agreements. The model will simulate Project reservoir operations to maintain minimum flow requirements as specified in the existing FERC license.

Logic to simulate Project operations will be consistent with requirements specified in the ACOE document entitled “Don Pedro Dam and Lake, Tuolumne River, California; Reservoir Regulation for Flood Control” dated August 1972 (ACOE 1972). This flood control manual sets flood control limits in Don Pedro Reservoir for rain flood space from September through May, and for conditional snowmelt flood space from February through July.

The model will also depict the Districts' water supply operations through the use of a time series based on a calculation of current demands. As such, these demands will not be meant to replicate historical diversions and operations.

The model will simulate Project Operations subject to the physical constraints of the Project including maximum and minimum reservoir capacities, outlets capacities, powerhouse capacities, and requirements for generation.

Reservoir storage from the previous day will be combined with daily inflows and estimated demands to make releases from Don Pedro Reservoir according to the following priority:

1. Minimum flow requirements in the existing FERC license.
2. Irrigation and M&I water demands within the Districts' service areas.

Additional releases from Don Pedro will be made to maintain required flood control space per the flood control manual.

La Grange Dam will be a model node downstream of the Project. There will be no explicit operation of the dam and its impoundment except water released from the Project is assumed to flow into and out of the dam. Diversions into the Districts' main canals will be simulated based on the estimated demands. The terminal downstream model node will be the Tuolumne River at Modesto (Modesto Gage). Accretions and depletions into and out of the Tuolumne River between La Grange Dam and the Modesto Gage will be estimated for the proposed Period of Record.

Where intermediate flows below Project facilities are of interest to RPs, as a post-modeling process, the Districts will calculate mean daily flows at other locations. These locations would be aligned with locations where the Districts, outside of the Project, may affect flow in the Tuolumne River, or where estimates of flow can be provided. Flow at these locations will be estimated by adding the mean daily flow at the Project facility generated by the model and estimated accretion values calculated at the location.

<u>Step 2 – Develop Water Year Types</u>. Current flow requirements in the FERC license are tied to the California Department of Water Resources (DWR) San Joaquin Valley Water Year Hydrologic Classification Indices (60-20-20 Index). The Districts will develop a set of water year types for use in relicensing, in consultation with RPs. The water year types will be utilized for potential operational decisions and hydrologic data analysis purposes as part of the relicensing. These water year types may be based on historical DWR Bulletin 120 forecasts, 60-20-20 Index, or other readily available precipitation or meteorological data that is consistently available to Project operators at the time operational decisions would be made. The Districts will also include a table presenting the San Joaquin Valley Water Year Hydrologic Classification Indices and the water year classification presented in the study report for each year simulated in the model. If another water year type index is recommended, the Districts will also describe the index or information to be used in determining the different water year type.

<u>Step 3 – Validate the Model</u>. Model validation (i.e., determining that the model is well-founded and fulfills the purpose for which it was constructed) will occur in four tasks. In the first task, the Districts will evaluate the model by comparing the model output to the historical record;

specifically, mean daily flows, daily reservoir elevations, mean daily diversions, and total daily generation over the period from WY 1997 through WY 2009. This period provides a wide range of hydrologic conditions including multiple years of above and below average inflow, years with comparatively short (WY 1997) and long (WY 2006) duration flood control operations, and is most representative of current operations. Significant differences between historical conditions and model runs will be examined, the causes identified and documented. It is expected that some differences will occur since it is not uncommon for change to occur in operating strategy over time, and the model does not predict unplanned outages or operational anomalies that would appear in the historical operation. Where substantial differences cannot be explained, the model logic/input data will be adjusted so that the model output estimates are closer to the historical values).

In the second task, the Districts will verify that the computer model is a reasonable representation of the Project's operating rules. This will be done by making a number of model runs and reviewing the results with the Districts' senior staff that have operated the Project. If the results seem unreasonable, the model logic/input will be examined.

In the third task, the Districts will meet with interested RPs to review the model. This will include a meeting to generally introduce RPs to the model, including a discussion of the Districts' proposed Water Year Types. At that meeting, RPs will be given a CD with an executable version of the model, a Model Development Report that describes all model input and logic including priorities, and the Districts' Draft Model Validation Report. After a reasonable time for review, the Districts will hold a series of workshops with interested RPs to review the model.

In the last task, the Districts will finalize the model and the Model Development and Validation reports, and provide these to RPs. These will also be included in Districts' application for the new license.

Step 4: Develop Base Case. The model will be configured to represent how the Districts and CCSF currently operate their projects, including all physical, regulatory, and contractual constraints. The underlying assumption is that this base case represents the "No Action Alternative." A full description of the Base Case setting will be prepared and distributed. All subsequent model runs will be compared to the Base Case run.

This study will be considered complete when the model has been developed and validated, and the Base Case developed. Separate from the study, the Districts' expert model user will run the model as reasonably requested by Relicensing Participants. Other interested RPs will make model runs as they deem appropriate.

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC issues its Study Plan Determination by December 31, 2011 and the study is not disputed by a mandatory conditioning agency:

Develop Project Operations Model (Step 1) .... January-June 2012
Validate the Model (Steps 2 & 3)

- Task 1 - Calibration/validation and prepare preliminary report ....July 2012
- Task 2 - Review operations with the Districts' senior staff ....August 2012
- Task 3 - Model presentations and public workshops..........October 2012 - December 2012
- Task 4 - Produce final model and report...January 2013

Develop Base Case (Step 4)...March 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

The methods presented in this study plan also are consistent with those used in recent relicensings in California.

8.0 Deliverables

Products from this study will be the above mentioned model and report.

9.0 Level of Effort and Cost

The Districts will provide an estimate of the cost of this study in the Revised Study Plan.

10.0 References

California Department of Water Resources (DWR). 1970-2009. Water Conditions in California: Bulletin 120. Sacramento, California. Published four times annually: February, March, April, May. Available at: http://cdec.water.ca.gov/snow/bulletin120/.

United States Army Corps of Engineers (ACOE). 1972. Don Pedro Lake, Tuolumne River, California; Reservoir Regulation for Flood Control. Sacramento District, Sacramento, CA. August 1972.

STUDY PLAN W&AR-3

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Reservoir Temperature Model Study Plan

July 2011

Related Study Requests: AR-03, 16; CDFG-03; FOT-03; NMFS-06; Reclamation-03

1.0 Project Nexus

Turlock Irrigation District's and Modesto Irrigation District's (Districts) continued operation and maintenance (O&M) of the Don Pedro Project (Project) will affect the temperature regime of waters in the Don Pedro Reservoir. Similarly, flow releases from Don Pedro Reservoir will affect the temperature of waters downstream of Don Pedro Dam and may contribute to the cumulative effects to resources in the lower Tuolumne River.

2.0 Resource Agency Management Goals

The Districts believe that two agencies have resource management goals related to water temperature in Don Pedro Reservoir and in the lower Tuolumne River: (1) the California Department of Fish and Game (CDFG), and (2) the State Water Resources Control Board, Division of Water Rights (SWRCB). Each of these agencies and their management goals, as understood by the Districts at this time, is described below.

CDFG's goal is to preserve and protect the habitats necessary to support native fish, wildlife and plant species.

SWRCB is the state agency that administers the federal Clean Water Act (CWA) (33 U.S.C. §11251-1357) as applies to California waters with the responsibility to maintain the chemical, physical, and biological integrity of the state's waters and to protect the beneficial uses of stream reaches consistent with Section 401 of the federal CWA, the Regional Water Quality Control Board Basin Plans, State Water Board regulations, California Environmental Quality Act, and other applicable state law.

3.0 Study Goals

The reservoir temperature model will accurately simulate and characterize the seasonal water temperature dynamics experienced in Don Pedro Reservoir under current and potential future conditions. The model would:

- simulate reservoir temperatures resulting from current Project operations,
- accurately reproduce observed reservoir temperatures, within acceptable calibration standards, over a range of hydrologic conditions,
- provide output that can inform other studies, analyses, and models, and
- predict potential changes in reservoir thermal conditions under alternative future operating conditions.

4.0 Existing Information and Need for Additional Information

The existing SJR5Q model, which is an application of the HEC-5Q modeling platform, is based on a 1-D representation of the Don Pedro Reservoir and the lower Tuolumne River to its confluence with the San Joaquin River. Temperature regimes in the Don Pedro Reservoir are likely to be an important resource issue in relicensing. The existing 1-D model is not well-suited to accurately represent the thermal dynamics and structure of the Don Pedro reservoir. The Districts will be developing a 3-D model of the Don Pedro Reservoir that will be capable of more accurately representing the thermal structure and dynamics experienced in the reservoir under a wide range of reservoir water levels and meteorological conditions. Section 5.3.1 below provides a detailed explanation of the benefits of a 3-D reservoir temperature model. The 3-D temperature model of the Don Pedro Reservoir will be “linked” in a feed-forward mode to the lower Tuolumne River temperature model. Existing data and ongoing data collection to support the development of the 3-D temperature model of the Don Pedro Reservoir are described below in Section 5.3.3, Data Sources.

5.0 Study Methods

This study will develop a 3-D model characterizing the thermal structure and dynamics of the Don Pedro Reservoir in Tuolumne County, California. This section of the study plan describes the basis for employing a 3-D model in this case, the model selection, and the model development and use.

5.1 Study Area

The study area encompasses the area from the inflows to Don Pedro Reservoir to the outflow from Don Pedro Reservoir. The reservoir temperature model will interface with the Project Operations Model and the existing HEC-5Q model of the lower Tuolumne River extending from below La Grange Dam to the confluence with the San Joaquin River.[1]

5.2 General Concepts and Procedures

The following general concepts apply to any field work associated with this study:

- Personnel safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- The Districts will make a good faith effort to obtain permission in advance of performance of any field work to access private property where needed.

[1] The Districts have agreed to recalibrate the existing HEC-5Q model of the lower Tuolumne River as recommended in the March 2011 report submitted to FERC.

- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study reports.

5.3 Study Methods

The development plan for the 3-D temperature model of the Don Pedro Reservoir is presented in the following sections:

- 5.3.1 Model Selection
- 5.3.2 MIKE3-FM Model Theoretical Principles
- 5.3.3 Data Sources
- 5.3.4 Model Setup
- 5.3.5 Model Calibration and Verification
- 5.3.6 Baseline Conditions

5.3.1 Model Selection

One-dimensional (1-D) and multi-dimensional (2-D/3-D) modeling platforms were identified for potential application to the Don Pedro Reservoir. The four candidate models evaluated were:

- HEC-5Q, 1-D, longitudinally- and laterally-averaged
- CE-QUAL-W2 - 2-D, laterally averaged
- RMA-10 - 3-D
- MIKE3-FM - 3-D

The San Joaquin River Basin Water Temperature Model (SJR5Q) is an application of the HEC-5Q modeling platform that represents the Don Pedro Reservoir as a one-dimensional vertically-segmented reservoir (AD Consultants 2009). The Don Pedro Reservoir portion of the SJR5Q model was subject to limited calibration using temperature profiles taken by CDFG between September 2005 and September 2006. All the data used in comparisons with model results to date were collected at water levels greater than approximately 790 ft. Therefore, no calibration has been able to occur under conditions of substantial drawdown. During relicensing, it is anticipated that reservoir temperatures will be evaluated under a broad set of reservoir conditions, including under substantial drawdown conditions. The lack of model comparisons with temperature profiles at water levels below 790 ft is a significant deficiency in the SJR5Q model. The 1-D reservoir temperature model is empirical in design and reservoir behavior is estimated by equations and algorithms developed from a set of other reservoirs. Don Pedro Reservoir is 24 miles long and has a shape that does not conform to a typical 1-D configuration, that is, either long and narrow (highly longitudinal) or short and wide (highly transverse). In fact the Don Pedro Reservoir is both narrow and wide at different reaches within the reservoir. It is also asymmetrical and dendritic with several arms (e.g., Moccasin, Woods Creek, Hatch Creek, Big Creek and Rogers Creek) extending into local tributaries. A 2-D or 3-D model, which establishes the reservoir thermal regime based on the analysis of the detailed hydrodynamics (i.e., physics) of the reservoir, boundary conditions (inflows and atmospheric/meteorological conditions), and heat exchange factors, does not have the same inherent deficiency as the empically-based SJR5Q model. In addition, the existence of the old Don Pedro Dam poses a longitudinal variation that is difficult to represent accurately in a 1-D vertically-segmented model. Temperature profiles above and below the old Don Pedro Dam showed a 1 ^{o}C difference in temperature below the crest of the old dam (Elevation 607 ft.) in May 2011, when the reservoir level was at approximately 800 ft. Moreover, lower reservoir levels have a greater potential to affect differences in temperature at the old dam and consequently affect release temperatures.

In analyzing the complex Don Pedro system, a 1-D model would generally possess value only if (1) sufficient observed data were available to calibrate the model over the entire range of potential future circumstances it was called on to evaluate, and (2) the 1-D model were actually shown to reliably simulate the observed data throughout the full range of operations. If both of these circumstances exist, then the 1-D model would not have to be extrapolated beyond its zone of calibration. These circumstances do not exist with the 1-D model of the Don Pedro Reservoir.

A 2-D model (CE-QUAL-W2) would require multiple branches to accurately represent the dendritic shape of the Don Pedro Reservoir and result in the loss of detail where branches overlap. Once it is recognized that a multi-dimensional model is needed, then the geometry and complexity of the reservoir becomes a primary determinant in selecting the preferred model. In this case, the Don Pedro Reservoir has a complex structure, not only because of the presence of the old Don Pedro Dam. Lastly, the temperature of water releases from Don Pedro under a full range of reservoir levels is anticipated to be an important factor in the consideration of potential future operating scenarios. A 3-D model was preferred for these reasons. Based on review of the two 3-D modeling platforms, MIKE3-FM was selected for the temperature modeling of the Don Pedro Reservoir because its documentation, graphical user interface, and technical support are superior to RMA-10.

MIKE3 was developed by the Danish Hydraulic Institute as a professional engineering software package for 3-D free-surface flows (DHI 2009a, 2009b, 2009c). It is applicable to simulations of flows, cohesive sediments, water quality, and ecology in rivers, lakes/reservoirs, estuaries, bays, coastal areas and seas. MIKE3 is the result of 20 years of continuous development and is tuned through the experience gained from hundreds of applications worldwide. The 1-D, 2-D, and 3-D versions of MIKE are probably the most used hydrodynamic models in the world. MIKE3 is fully integrated with GIS enabling the user to efficiently set up model geometry given geo-referenced bathymetric data. The Graphical User Interface enables the modeler to efficiently prepare input and graphically present output.

The flexible mesh version of the model (MIKE3-FM) allows variable-spacing of computational grid points to obtain high spatial resolution in areas of prime interest while saving on model run time through a coarse mesh in other areas. The hydrodynamic model in MIKE3-FM is a general numerical modeling system for simulation of flows in estuaries, bays, lakes/reservoirs, and coastal areas as well as in oceans. It simulates unsteady three-dimensional flows taking into account density variations, bathymetry, and external forcing such as meteorology, tidal elevations, currents and other hydrographic conditions.

A free version of the model allows users to view results, look at the model inputs, understand model logic; in fact, do everything except run the model. When the model is already owned/leased by a consulting firm, there is no cost to others involved in its application. HDR owns/leases the MIKE3-FM model and has used it extensively to model hydrodynamics and temperature. The Districts will provide training for Relicensing Participants interested in using the model.

5.3.2 MIKE3-FM Theoretical Principles

The mathematical foundation in MIKE3-FM is the mass conservation equation, the Reynolds-averaged Navier-Stokes equations in three dimensions, including the effects of turbulence and variable density, together with the conservation equations for salinity and temperature (DHI 2009a). MIKE3-FM employs the Boussinesq and hydrostatic approximations. The salinity, temperature, and pressure are related to the density through the UNESCO definitions. Wind-driven transport is simulated as a function of the shear stress at the water surface. Turbulence is modeled using an eddy viscosity concept and allows the user to select one of several vertical turbulence algorithms. The numerical solution employs a cell-centered finite-volume method.

The MIKE3 Advection/Dispersion (AD) module provides the advection/dispersion basis for the computations to simulate the spreading and fate of dissolved or suspended substances when provided with the flow field from the hydrodynamic module. Conservative and non-conservative constituents can be modeled. The AD module is not necessary for modeling temperature because temperature is in the base MIKE3-FM model.

The underpinnings for modeling temperature are based on heat balance principles. The heat exchange with the atmosphere is calculated on the basis of four physical processes: (1) long wave solar radiation, (2) sensible heat flux (convection), (3) short wave solar radiation (which includes a depth-variable absorption relationship), and (4) latent heat flux (evaporation).

5.3.3 Data Sources

The two broad categories of data required by the model are (1) input data and (2) data for model calibration/verification. Input data pertain to the detailed physical characteristics of the reservoir being modeled. The boundary conditions also require input data and include inflows and withdrawals, temperature of inflows and meteorological data (air temperature, wind speed and direction, solar radiation, relative humidity). Mechanistic response parameters such as heat exchange coefficients are also input along with reservoir operation rule data. Data for model calibration/verification are primarily measurements of the metrics that are calculated by the model, which in this case, are temperature measurements in the reservoir (e.g., vertical profiles) and at the hydroelectric station. The Project database has compiled most of the historical flow and temperature data. The specific data required for the MIKE3-FM model are listed in Table 5.3.3-1 under four headings: (1) Physical and Geomorphological, (2) Flow and Operations, (3) Temperature, and (4) Meteorology.

Table 5.3.3-1. Summary of data needed for Don Pedro Reservoir 3-D temperature model.

Required Data	Source	In Project Database
	Physical and Geomorphological	
Bathymetry	Field survey	yes
Outlet (invert elevation)	Design drawings	yes
Outlet (lat/long)	Design drawings	yes
Dam spillway (elevation)	Design drawings	yes
Dam spillway (length, type)	Design drawings	yes

Required Data	Source	In Project Database
Old Don Pedro Dam spillway (elevation)	Design drawings or bathymetric survey	yes
Old Don Pedro Dam spillway (length, type)	Design drawings or bathymetric survey	yes
Old Don Pedro Dam crest (elevation)	Design drawings or bathymetric survey	yes
Old Don Pedro Dam crest (length, type)	Design drawings or bathymetric survey	yes
Old Don Pedro outlet (elevation)	SJR5Q Report	yes
Old Don Pedro outlet (lat/long)	USGS Topographical Map	no
	Flow and Operations	
Tuolumne River upstream of reservoir (regulated)	CCSF, TID	yes
Tuolumne River upstream of reservoir (total)	TID	yes
Storage (daily)	USGS	yes
Withdrawals through powerhouse (daily)	TID	yes
	Temperature	
Tuolumne River upstream of reservoir	HDR (starting October 2010); CCSF (regulated)	no
Profiles at several locations (see Table x)	CDFG	yes
	Meteorology	
Air temperature, wind speed/direction, solar radiation, relative humidity	TID (starting November 2010); unlisted owners of stations	no

CCSF City and County of San Francisco
CDFG California Department of Fish and Game
TID Turlock Irrigation District
USGS U.S. Geological Survey

Physical and Geomorphological

A digital terrain model (DTM) was purchased from the vendor, INTERMAP®, in August 2008. The DTM was derived from remotely sensed data collected with interferometric synthetic aperture radar (IFSAR) and was processed by the vendor to remove vegetation and cultural features. The shoreline of the reservoir will be generated using a GIS contouring tool with the DTM. It will additionally be visually inspected and modified as needed using a horizontally more accurate hi-resolution aerial image acquired from the vendor DigitalGlobe®.

Bathymetry data were collected in accordance with the study plan provided in Attachment A. Any overlap in the topographical elevations of the IFSAR data and elevations covered by the bathymetric survey will be checked to provide a unified set of reservoir bottom points as Cartesian (x, y, z) coordinates.

The dam spillway and outlet elevations and dimensions will be taken from design drawings of the new Don Pedro Reservoir. The old Don Pedro dam and spillway elevations and dimensions will be based on available design drawings, if any, or detailed bathymetry survey data. The elevation and dimensions of the old Don Pedro outlet will be based on design drawings, if available, or otherwise based on the SJR5Q model data.

Flow and Operations

The hydrology of the Don Pedro Reservoir's watershed includes flows regulated by the City and County of San Francisco (CCSF) and unregulated flows. The combined total inflow to the reservoir is back-calculated by the California Department of Water Resources; however, the daily inflows are highly variable (noisy) and would require smoothing for use in the model. TID's inflow dataset for the historical period will be used in the model calibration and verification. The flow withdrawals for the hydroelectric station will be defined on a daily or hourly basis using TID's data.

Temperature

The temperature of the inflows will be estimated using a temperature balance (calculation) in conjunction with the regulated and unregulated flows. As the temperatures of the regulated flows are measured by CCSF, these data will be used in a temperature balance model pre-processor. The temperature station just upstream of the North Fork Tuolumne River confluence (installed in fall 2010) accounts for all of the regulated watershed area and most of the unregulated watershed area. These data will be used to guide the development of the pre-processor as a water temperature balance or an air-water equilibrium temperature balance. The pre-processor will be used to estimate the temperature of all inflows for the calibration period, which precedes the installation of the HDR temperature station. The verification will use the data being collected at the HDR temperature station.

Temperature profiles were measured by CDFG, and continue to be measured, at six stations in Don Pedro Reservoir. These measurements started in August 2004 and were done almost every month since then. In addition, temperature profiles at a station above the old Don Pedro dam and below the same dam were conducted by HDR|DTA in June 2011 and will be continued monthly until the fall 2011. Surface water temperature recorded concurrently with the bathymetric data in May and June 2011 will also be used in the model calibration. The computerized dataset comprises the primary data for comparisons with the model in the calibration and verification. Temperature measurements at the powerhouse (1978 - 1988, 2010 - 2011) will also be used for the model calibration/verification.

Meteorology

Air temperature, wind speed and direction, solar radiation, and relative humidity are required for the model. A weather station was installed near the dam on November 30, 2010 by the Districts to collect site-specific data, which will be used for the model verification. Data from existing weather stations near Don Pedro Reservoir will be used for the model calibration.

5.3.4 Model Set-up

A flexible mesh of control volumes that define the computational points in the model will be constructed using bathymetry and shoreline data described in Section 5.3.3. The mesh will be unstructured in the horizontal domain and a structured mesh will be used in the vertical domain. A finer mesh will be used in parts of the reservoir where a high degree of spatial resolution is warranted, such as near the intake structure and the old dam. The overall mesh will be developed to balance the competing needs for high spatial resolution and low model run time. Examples of recent MIKE3-FM meshes are shown in Figures 5.3.4-1 and 5.3.4-2.

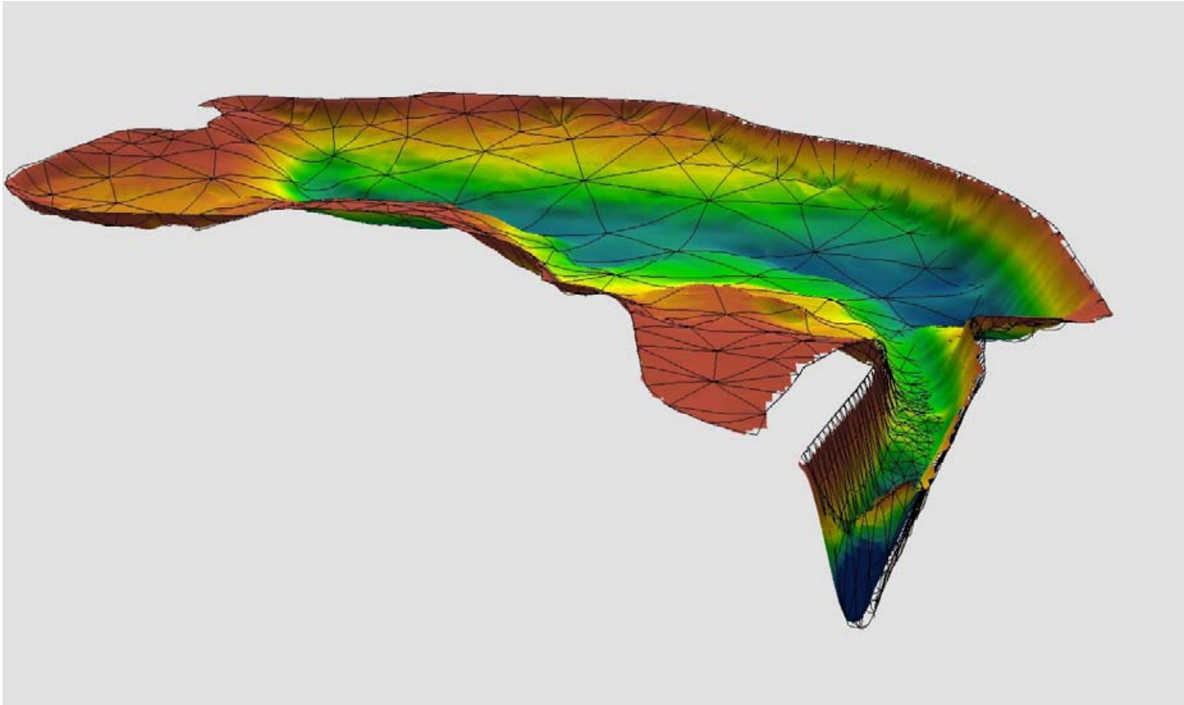

Figure 5.3.4-1 MIKE3-FM 3D model of Northfield Reservoir, MA.

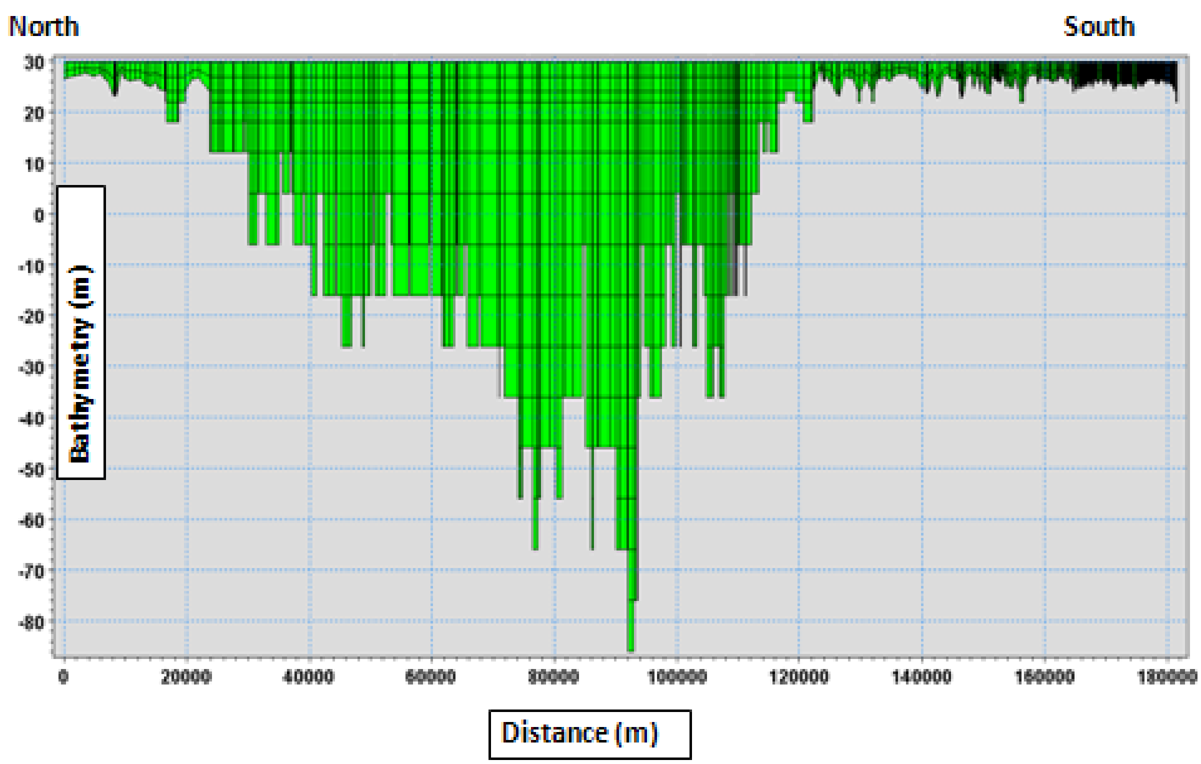

Figure 5.3.4-2 MIKE3-FM 3D model's vertical mesh scheme for Lake Champlain, VT.

Inflow boundaries will be defined to represent the mainstem Tuolumne River and key tributaries that account for the greatest portion of the local reservoir watershed flow. The tributary boundaries will be coincident with two or three arms of the reservoir (e.g., Woods Creek, Rogers Creek, and Hatch Creek). The flow from the unregulated portion of the watershed will be apportioned on the basis of drainage area and the associated temperature will be estimated as described in Section 5.3.3.

5.3.5 Model Calibration and Verification

The general procedure is to calibrate a model (i.e., adjust model parameters within acceptable ranges) using sampling data collected during a certain period, and then verify the model (i.e., compare model and observations without any further adjustment of model parameters) using data collected during different hydrological conditions. Generally, the same types of data are available for both the calibration and verification periods. However, inflow temperature and meteorological data collections for the Don Pedro Reservoir were recently added in the fall of 2010 to provide a more complete set of data for the modeling than the dataset previously available. Several months of these new data will be available for model verification. The model calibration will therefore be done primarily with the data collected prior to the fall of 2010 and the approaches for defining the boundary conditions that were described in Sections 5.3.2 through 5.3.4. Note that the bathymetry survey data are essential for calibrating the model. We assume that reservoir depths have not changed in the last few years so that the same bathymetry data will be used for the model calibration and verification.

The seasonal progression of temperature stratification in the spring and early summer, followed by destratification in late summer and fall, is an important phenomenon for the 3-D temperature model to simulate. The existing temperature profiles indicate that most of the stratification occurs during April through September, and most of the de-stratification takes place October through November. Hence, the model calibration should span at least from April through November. (The temperature is relatively constant over depth during the winter.) In addition, the water surface of the reservoir generally varies due to hydrological conditions and the Districts' operations for flood control and water supply. Existing water surface data show a minimum elevation of approximately 732 feet in October, November, and December 2008. As one of the key issues is the effect of reservoir drawdown on temperature, January through December 2008 is proposed as one of the model calibration periods. Monthly temperature profiles are available for this period.

An additional period may be used to calibrate the model depending on the results of the 2008 comparisons and model run time. There is apparently a gap in the temperature profile sampling data between May 22, 2009 and March 3, 2010, so 2009 would not be appropriate. However, 2007 appears to have monthly profiles and may be used for model calibration, if necessary.

The model verification period would cover the period with the added inflow temperature and meteorological data collections, presumably December 2010 through the early fall of 2011. Model-computed temperature profiles and measured temperatures at the six reservoir profile stations will be shown graphically. Temperature just below the water surface measured during the bathymetry survey along with temperature profiles done at the six CDFG stations and two stations near the old dam during the survey will also be compared to the model as part of the verification. Available powerhouse temperature data will also be compared with model output as time series graphs. Model and measured temperatures at each station will be statistically analyzed to determine how well the model compares with the data. These statistics will be presented in graphical and/or tabular form.

The Districts will conduct a QA/QC review of the modeling following the calibration and verification to confirm its validity for evaluating future conditions. Following this review, the Districts will meet with the Relicensing Participants, per Section 6.0.

5.3.6 Baseline Conditions

The 3-D model will initially be configured to represent how the Districts currently operate the Project, including all physical, regulatory, and contractual constraints. This case represents the "No Action Alternative." A full description of these baseline conditions will be prepared and distributed. All subsequent model runs will be compared to the baseline conditions.

5.4. Documentation and Reporting

A report will be developed that documents all methods and results. Maps showing coverage of the depth sounding points will also be included. In addition to the maps, a table showing area and storage volume for each foot of elevation will be developed and included in the report. Storage volume will be plotted against elevation and compared graphically to the existing reservoir capacity curve presented in the PAD. Vertical temperature profiles and surface temperature plots that show model output and observed data will also be provided.

A description of the model, sources of data, model parameters, assumptions, and calibration and verification will also be provided. In addition, model input files for the calibration, verification, and projections will be provided with annotated documentation of the sources of the data so the files can be traced to the backup upon which they were based.

6.0 Study-Specific Consultation

The Districts will meet with interested Relicensing Participants to review the model's key features and demonstrate the model's primary results following the QA/QC review of the model calibration/verification. Relicensing Participants will be given a description of the model's theoretical principles, model mesh of the reservoir, summary of input data and modeling assumptions, and a draft of the model's validation documentation.

The model will be reviewed by RPs after the calibration/verification to provide the agencies with an opportunity to ask questions and comment on technical aspects of the modeling. The 3-D Modeling Team will conduct a workshop meeting with the reviewers to discuss any issues raised during the review. Model adjustments, if any, will be made in finalizing the calibrated and verified model. The review comments and responses will be documented in a technical memo that will be included as an appendix to the modeling report. The QA/QC review at this juncture of the study will render the 3-D temperature model as suitable for the simulation of existing and baseline conditions during this study as well as future reservoir operating scenarios. The Districts will provide training on the use of the model to interested RPs.

7.0 Schedule

The Districts schedule to complete the study proposal assumes FERC's Study Plan Determination is deemed final on December 31, 2011. Data compilation and model set-up will occur January and February 2012. Model calibration and verification will then take place during March through July 2012. Consultation with Relicensing Participants will occur during April, June and August 2012 and a final report will be produced by November 30, 2012.

8.0 Consistency of Methodology with Generally Accepted Scientific Practices

Three-dimensional hydrodynamic modeling and temperature modeling have been extensively used for complex systems and are generally accepted scientific practices. The 3-D temperature modeling of the Don Pedro Reservoir is consistent with these generally accepted scientific practices.

9.0 Deliverables

In addition to the model itself, the Districts will prepare a report, which will document the methodology and model calibration/verification and model projections.

10.0 Budget

The cost of development of the model for the Don Pedro Reservoir will be provided in the Revised Study Plan.

11.0 References

AD Consultants, Resources Manaagement Assocoiates, Inc., Watercourse Engineering, Inc. San Joaquin River Basin Water Temperature Modeling and Analysis, Prepared for CALFED ERP-06D-S20, October 2009

Danish Hydraulic Institute 2009a. MIKE21 & MIKE3 Flow Model FM, Hydrodynamic and Flow Transport Model, Scientific Documentation, January 2009

Danish Hydraulic Institute 2009b. MIKE21 & MIKE3 Flow Model FM, Hydrodynamic and Flow Transport Model, Step by step training guide, January 2009

Danish Hydraulic Institute 2009c. MIKE3 Flow Model FM, Hydrodynamic Model, User's Guide, January 2009

ATTACHMENT A

BATHYMETRIC AND SURFACE TEMPERATURE DATA COLLECTION

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Bathymetric and Surface Temperature Data Collection

July 2011

1.0 Project Nexus

Turlock Irrigation District and Modesto Irrigation District's (TID and MID or Districts) continued operation and maintenance (O&M) of the Don Pedro Hydroelectric Project (Project) has a potential to affect water temperature. In particular, stratification of the reservoir affects the amount of cold water stored in Don Pedro Reservoir.

The Districts plan to develop a 3-D water temperature model that requires bathymetry information as input. Bathymetric data will also provide a better understanding of the elevation-reservoir storage relationship of the reservoir.

2.0 Resource Management Goals of Agencies with Responsibility for the Resource to be Studied

The Districts believe that two agencies have jurisdiction over water temperature in the reservoir: (1) the California Department of Fish and Game (CDFG), and (2) the State Water Resources Control Board, Division of Water Rights (SWRCB). Each of these agencies and their jurisdiction and management direction, as understood by the Districts at this time, is described below.

CDFG's goal is to preserve; to protect; and, as needed, to restore habitat necessary to support native fish, wildlife and plant species.

SWRCB has authority under the federal Clean Water Act (CWA) (33 U.S.C. §11251-1357) to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. Throughout the relicensing process, the SWRCB maintains independent regulatory authority to condition the operation of the Project to protect water quality and the beneficial uses of stream reaches consistent with Section 401 of the federal CWA, the Regional Water Quality Control Board Basin Plans, State Water Board regulations, California Environmental Quality Act, and any other applicable state law.

3.0 Study Goals and Objectives

This study is needed as input for the proposed 3-D water temperature model and to update the historical reservoir elevation-storage curve. Though monthly profiles collected by CDFG since 2004 will be the predominant dataset used for the 3-D model's calibration and verification, water temperature data collected concurrently with the bathymetric data will also support the effort.

4.0 Existing Information and Need for Additional Information

Previous detailed bathymetric data are not available for the Don Pedro Reservoir. It appears that the only data available to define the original reservoir bathymetry is U.S. Geological Survey (USGS) 15-minute quadrangle maps developed prior to the construction of the new Don Pedro Project. These are not of sufficient detail to define the current bathymetric characteristics of the reservoir.

CDFG has collected monthly water temperature profiles from six locations in Don Pedro Reservoir for several years and profiles collected by CDFG, from 2004 through and including the present, effectively characterize Don Pedro Reservoir's vertical thermal trends. A seventh profile location, upstream of the old Don Pedro Dam, would provide insight into temperature dynamics at this location. Profiles collected during the bathymetry fieldwork will provide a temperature-related link between the bathymetry data and CDFG's long term data-set.

5.0 Study Methods and Analysis

Bathymetry data collected with the reservoir water surface at approximately elevation 790 feet (ft) will be combined with interferometric synthetic aperture radar (IFSAR) topographic mapping, obtained by the Districts when the water surface elevation was at approximately 760 ft, to develop a full description of the reservoir geometry and depth-area-storage relationships.

5.1 Study Area

This study will take place at Don Pedro Reservoir in Tuolumne County, California. The study area consists of Don Pedro Reservoir below the Project Boundary at an elevation of approximately 860 ft, as depicted in Figure 5.1-1.

5.2 General Concepts

The following general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- The Districts will make a good faith effort to obtain permission in advance of performance of the study to access private property where needed. Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study reports.

5.3 Study Methods

The plan for developing the bathymetric model of Don Pedro Reservoir is presented below in five subsections: (1) preparation, (2) field data collection, (3) data processing, (4) quality assurance/quality control, and (5) documentation and reporting.

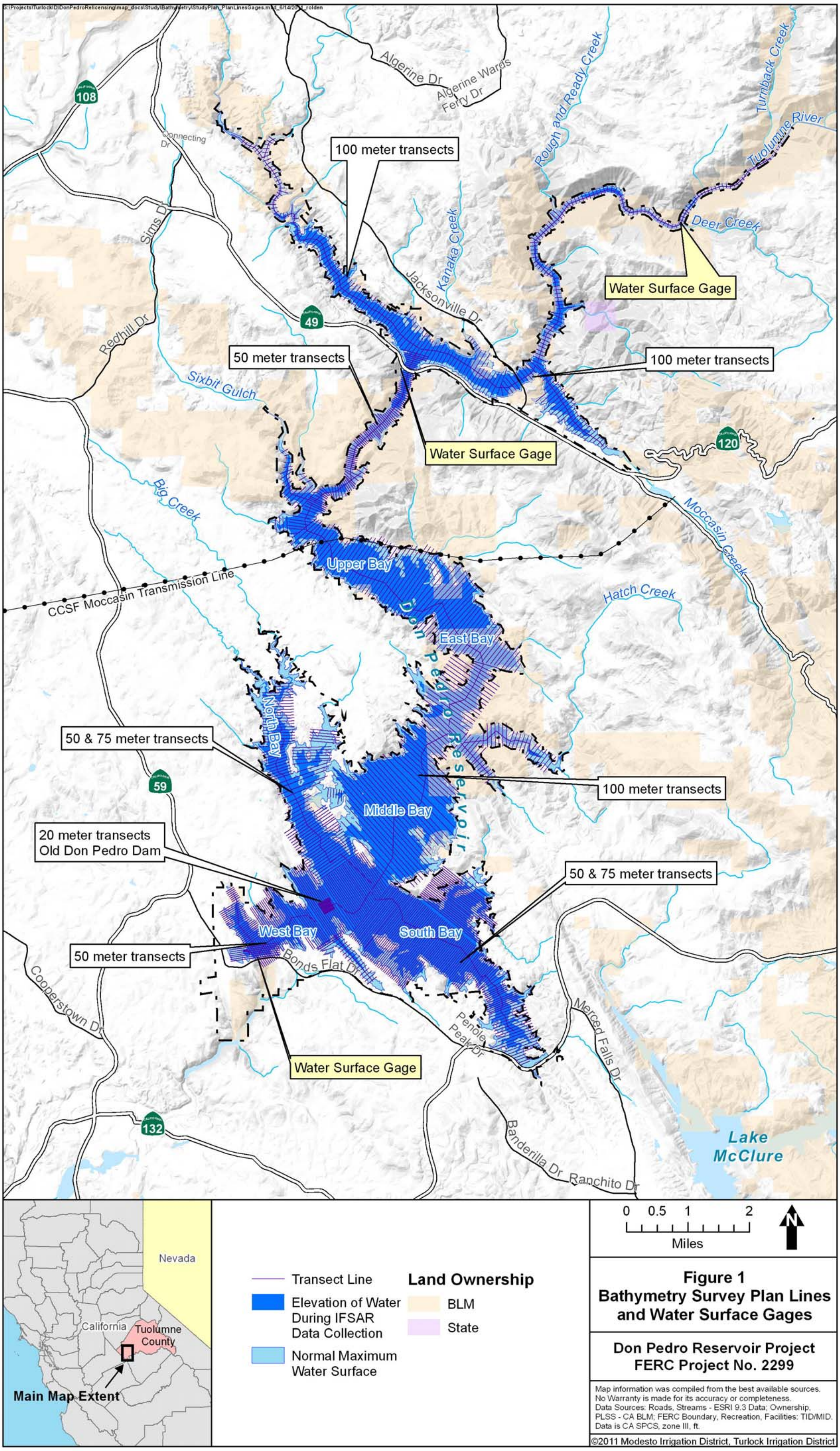

Figure 5.1-1 Bathymetry survey plan lines and water surface gages.

5.3.1 Preparation

Before data collection begins, transects spaced at 50, 75, and 100 meter intervals oriented approximately perpendicular to the longitudinal axis of the reservoir will be established using the bathymetric data collection software, Hypack. In addition to the standard transects, at least one perpendicular "tie line", oriented approximately parallel to the longitudinal axis of the reservoir will be established to ensure inter-transect data consistency. Transects will cover the entire reservoir at the water elevations observed during the time of the field data collection.

The location of the Old Don Pedro Dam, inundated by the construction of the new dam, has been estimated using historical USGS topographic maps. A 20-meter transect spacing will be developed in the area of the Old Don Pedro Dam to establish the geometry and location of the old dam.

5.3.2 Field Data Collection

5.3.2.1 Bathymetric Data

The technique that will be used for data collection employs precision depth sounder and navigation systems aboard an outboard powered 19-ft Johnboat, in conjunction with vertical control to determine the elevation of the water surface at the time of the survey. Vertical control and water surface elevation data will be taken from the gages at the Don Pedro Dam, the Highway 120/49 Bridge, and the Wards Ferry Bridge. The gages at the two bridges will be used to establish vertical control in the upstream portion of the Don Pedro Reservoir. Temporal and spatial variations in water surface elevation throughout the bathymetric survey will be taken into account in the data processing as explained below.

Water depth will be measured using an Airmar B258 1-kilowatt dual frequency transducer and a Foruno FCV-585 digital depth sounder (or equivalent), with a vertical resolution of 0.1 ft. The depth sounder will be deployed aboard the Johnboat that will navigate along predetermined transects. Transect locations may be adjusted in the field to accommodate shallow water, in-water structures, marinas, and/or recreational activities.

Soundings will be taken at approximately 1 second intervals and the boat speed will be set to ensure that bottom features will be appropriately sampled (typically, at least 1 sounding is taken for every 2 linear meters along the vessel track). The boat will be navigated using a differential Global Positioning System (DGPS), and the position of each sounding will be determined using the DGPS system. The DGPS will provide better than 1 meter circular positioning accuracy. All depth and horizontal positioning data will be recorded digitally in the field as a series of points with x-y-z coordinates, using a rugged field notebook PC running Hypack Hydrographic Survey software (or equivalent).

5.3.2.2 Reservoir Temperature Data

CDFG continues to collect monthly temperature profiles in Don Pedro Reservoir and these data will be used as the primary dataset for the 3-D model's calibration and verification. As part of this study, reservoir temperature data will be collected concurrently with the bathymetric data to provide additional data for the 3-D model's verification.

Surface water temperature will be measured concurrently with the bathymetric data and recorded digitally using the Hypack software. Temperature data will be collected using a Falmouth Scientific Ocean Temperature Module (FSI OTM). The accuracy FSI OTM is -± 0.005 degree Celsius temperature. Surface water data provide information about the variation in the reservoir's temperature through the horizontal plane. Vertical temperature profiles will be collected at least one-time each at the six CDFG profile stations and one additional location just upstream of old Don Pedro Dam, to capture any influence of the old dam on reservoir temperature. During each week of surveying, water temperature profiles (along with dissolved oxygen) will be taken at the nearest CDFG profile location or nearby locations.

5.3.2.3 Water Surface Elevation Data

Reservoir water level elevations will be measured throughout the study. Water surface elevations near the dam of the reservoir are routinely measured and recorded by TID. Water surface elevation gages will be installed at two other locations, where benchmarks provide vertical control for combining all elevation data to a common datum: (1) Highway 120/49 Bridge, and (2) Wards Ferry Bridge. All vertical control will be converted to match the vertical datum of the gage at Don Pedro Dam, which is NGVD 29. The three water surface gages will provide continuous data during the bathymetry survey for data processing.

5.3.3 Data Processing

5.3.3.1 Bathymetric Surface Development

The data will be processed using the Hypack software and exported to a table that can be imported into Geographic Information System (GIS). Elevation values for each point will be calculated in a spreadsheet by first correcting the depth of the reading to include the known submergence value of the transducer and then subtracting the depth of the sounding from the water surface elevation of the reservoir according to the nearest gage reading from the same day and time.

Remotely sensed data will be used to supplement the bathymetric data collected in the field. Previously obtained Digital Terrain Model (DTM) data will be integrated with the bathymetric model. These data were collected in August 2004 by the vendor Intermap using IFSAR. The water surface of the reservoir at the time the DTM data were collected was 760 ft and the DTM data extend upwards to well above the Project Boundary elevation. The DTM will assist with defining the reservoir geometry at water levels above that obtained by the bathymetric survey. In the instances of overlap in the topographical elevations of the DTM and elevations covered by the bathymetric survey, the DTM will provide information that may assist in the interpolation of the surface in between the transect points collected in the field.

A contour line at maximum water level will be generated using a GIS contouring tool with the DTM. It will be visually checked and modified as needed using a horizontally more accurate high-resolution aerial image. The field collected points, the DTM surface data below the high water contour, and the maximum water contour will then be used to interpolate a reservoir geometry model in GIS.

The bathymetric survey elevation data will be developed by using the Environmental Science Research Institute (ESRI) geoprocessing tool "Topo to Raster". Contours will be developed from the surface using ESRI contouring tools and displayed at an appropriate resolution for the maps that will be included in the final report.

5.3.3.2 Temperature Data Processing

Surface water temperature data and temperature profiles will be used to assist in the 3-D temperature model verification. In addition, surface water temperature data will be plotted and contoured using Surfer (by Golden Software). Temperature data collected during time intervals of two to four hours will be mapped separately to constrain the diurnal temperature variation and provide a "snapshot" of surface temperature. The resulting temperature contours will be shown on a series of maps of the reservoir.

Vertical temperature profiles will also be plotted and a map showing the location of the vertical profiles will also be produced.

5.3.4 Quality Assurance/Quality Control

Data quality will be assured through following manufacture's instructions and periodically verifying data values through an alternative measurement. Throughout the survey, the depth measured by the sounder will be periodically compared to the actual depth. The actual depth will be measured by either lowering a "bar" beneath the sounder or by direct measurement of the bottom with a lead line or pole. Measurement of the "draft" or the depth from the water surface to the face of the transducer will also be recorded. All measurements will be recorded in the field notebook.

Quality Assurance will be performed by an independent reviewer. A three-step approach will be used for quality assurance of the bathymetric survey data. The first step is a review of the field methods and materials. The second step is checking the edited raw data. Finally, the methods used in the production of the final deliverable will be checked.

Review of field methods will include a check of any "bar checks" performed in the field. A bar check compares the depth measured by the sounder to the actual depth, measured physically. The specifications of the sounder and GPS used in the survey will be reviewed to confirm the accuracy of the data as reported. The water surface elevation data at the three gages will be checked for consistency.

The next step is to check the processing of the raw data. Any data with GPS errors or sounding errors that were flagged accordingly and deleted prior to contour plotting will be checked to confirm that the deletion was appropriate. Soundings will be spot checked for consistency. The crossing of transects and tie-lines will be reviewed to ensure that the sounder recorded similar depths at the intersection of survey lines. If any sharp differences in depth at adjacent points are present, they will be identified as either an error or a real feature.

The last step is a check of the final deliverable. Once the field methods and raw data have been reviewed, the production of contours or a bathymetric surface relative to a know datum will be checked. Calculation of the bottom elevation from sounding depths will be reviewed to ensure corrections for the draft and water surface elevation were properly accounted for. The method of interpolation and setting used to in the interpolation will be reviewed to ensure that reasonable contours are generated. Contours created using interpolation will be checked against actual soundings to verify that the interpolated surface is reasonable. Finally, contours will be checked against any previous studies for consistency.

5.3.5 Documentation and Reporting

A report will be developed that documents all methods and results. Contours derived from the use of the bathymetric and IFSAR data will be displayed in maps of appropriate scale. Maps showing coverage of the depth sounding points will also be included. In addition to the maps, a table showing area and storage volume for each two feet of reservoir elevation will be developed and included in the report. Storage volume will be plotted against elevation and compared graphically to the reservoir area-capacity curve presented in the Pre-Application Document. Vertical temperature profiles and sample surface temperature plots will also be provided.

6.0 Schedule

Surveys are planned to be completed during the months of May and June 2011. IFSAR data has been obtained. Data compilation and mapping will occur from June through September, 2011. Final checking and review will occur in October and November, 2011 and final maps produced by the end of 2011.

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

The methods presented in this study plan are consistent with those used in recent relicensings in California including most recently for the Merced Irrigation District's Lake McClure and McSwain Reservoir. Additional surveys with similar methodology include the Yuba-Bear/Drum-Spaulding Project's Lake Spaulding, Rollins Reservoir, Bowman Lake, Jackson Meadows Reservoir, Fordyce Lake, and Lake Valley Reservoir.

8.0 Deliverables

The Districts will make the draft report available to relicensing participants following internal quality assurance review. The final report will be provided along with the elevation and temperature data in GIS files. These GIS files will be used in developing the 3-D Temperature Model.

9.0 References

Environmental Science Research Institute ArcGIS 10. Available online at: <http://help.arcgis.com/en/ arcgisdesktop/10.0/help/index.html>.

Golden Software. Surfer. Available online at: <http://www.goldensoftware.com/products/ surfer/surfer.shtml>

Intermap. Available online at: <http://www.intermap.com/>.

STUDY PLAN W&AR 4

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Spawning Gravel Study Plan

July 2011

Related Study Requests: AR-14, NMFS-05, SWRCB-07

1.0 Project Nexus

The continued operation and maintenance (O&M) of the Don Pedro Project (Project) may contribute to cumulative effects on the supply and recruitment of spawning-sized gravels downstream of La Grange Dam which may potentially affect spawning gravel availability and use by Chinook salmon (*Oncorhynchus tshawytscha*) and *O. mykiss*.

2.0 Resource Agency Management Goals

Turlock Irrigation District (TID) and Modesto Irrigation District (MID) (collectively, the Districts) believe that four agencies have resource management goals related to salmonid species and/or their habitat: (1) U.S. Department of Interior, Fish and Wildlife Service (USFWS); (2) U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS); (3) California Department of Fish and Game (CDFG); and (4) State Water Resources Control Board, Division of Water Rights (SWRCB).

A goal of the USFWS (2001) Anadromous Fish Restoration Program, as stated in Section 3406(b)(1) of the Central Valley Project Improvement Act, is to double the long-term production of anadromous fish in California's Central Valley rivers and streams. Objectives in meeting this long-term goal include: (1) improve habitat for all life stages of anadromous fish through provision of flows of suitable quality, quantity, and timing, and improved physical habitat; (2) improve survival rates by reducing or eliminating entrainment of juveniles at diversions; (3) improve the opportunity for adult fish to reach spawning habitats in a timely manner; (4) collect fish population, health, and habitat data to facilitate evaluation of restoration actions; (5) integrate habitat restoration efforts with harvest and hatchery management; and (6) involve partners in the implementation and evaluation of restoration actions.

NMFS has developed Resource Management Goals and Objectives for species listed under the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §1801 et seq.) and the Endangered Species Act (ESA) (16 U.S.C. §1531 et seq.), as well as anadromous species that are not currently listed but may require listing in the future. NMFS' (2009) Public Draft Recovery Plan for Sacramento River Winter-run Chinook salmon, Central Valley Spring-run Chinook salmon, and Central Valley steelhead outlines the framework for the recovery of ESA-listed species and populations in California's Central Valley. For Central Valley steelhead, the relevant recovery actions identified for the Tuolumne River are to: (1) conduct habitat evaluations; and (2) manage cold water pools behind La Grange and Don Pedro dams to provide suitable water temperatures for all downstream life stages. For Central Valley Fall/late Fall-run Chinook, the relevant goals are to enhance the Essential Fish Habitat downstream of the Project and achieve a viable population of Central Valley fall/late fall-run Chinook salmon in the Tuolumne River.

CDFG's mission is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. CDFG's resource management goals, as summarized in restoration planning documents such as "Restoring Central Valley Streams: A Plan for Action" (Reynolds et al. 1993), are to restore and protect California's aquatic ecosystems that support fish and wildlife, and to protect threatened and endangered species under California Fish and Game Code (Sections 6920-6924).

SWRCB has responsibility under the federal Clean Water Act (33 U.S.C. §11251-1357) to preserve and maintain the chemical, physical and biological integrity of the State's waters and to protect the beneficial uses of stream reaches consistent with Section 401 of the federal Clean Water Act, the Regional Water Quality Control Board Basin Plans, State Water Board regulations, the California Environmental Quality Act, and any other applicable state law.

3.0 Study Goals

The spawning gravel study will examine gravel availability and spawning utilization as a means of determining the current spawning capacity and spawner/recruit relationships for Chinook salmon and *O. mykiss* in the Tuolumne River. Specific information obtained by this study will update information from prior studies in order to:

- characterize the current area, distribution, and use of spawning riffles in the lower Tuolumne River, and
- provide estimates of maximum spawning run sizes supported by the spawning riffles under current conditions.

4.0 Existing Information and Need for Additional Information

As discussed in the PAD, the availability, distribution, and quality of spawning gravel for spawning by Chinook salmon in the lower Tuolumne River was previously assessed through a series of studies conducted by the Districts from 1986 to 1992. Between September 1999 and February 2001, spawning habitat in a 16-mile reach of the lower Tuolumne River from La Grange Dam (River Mile [RM] 52.0) to the Santa Fe Aggregates haul road bridge (RM 36.3) was resurveyed to document changes in riffle area since 1988 (including the effects of the 1997 flood) and showed an approximate loss of 17 percent of riffle area mapped in 1988 (McBain & Trush 2004). Nearly 80 percent of gravel areas upstream of Old La Grange Bridge were not present in the recent surveys (McBain & Trush 2004). At the same time, spawner preferences have shifted upstream. In earlier studies (TID/MID 1992a), spawner use showed a nearly linear trend of spawning preferences decreasing from upstream to downstream. Most recently, spawning use documented by CDFG shows that the uppermost reaches account for over half of the spawning activity.

Channel bed mobilization due to recent high flow events occurring in 2005, 2006 and 2011 may have resulted in changes to the spawning habitat maps surveyed during 1999–2001 by McBain & Trush (2004).

5.0 Study Methods

The spawning gravel study will examine existing spawning gravel mapping and spawner count data in conjunction with updates to previous mapping efforts, followed by quantitative analysis of spawning use of the available areas to determine Chinook salmon spawning capacity in the lower Tuolumne River.

5.1 Study Area

The study area includes the Tuolumne River from the La Grange Dam (RM 52) downstream to RM 29, which captures the majority of spawning activity documented in recent surveys.

5.2 General Concepts

The following general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study report.

5.3 Study Methods

The study will be conducted using the following steps.

Step 1 – Compile Data from Previously Conducted Studies. Information from previously conducted spawning gravel mapping (e.g., TID/MID 1992a, McBain & Trush 2004), spawning gravel quality assessments (e.g., TID/MID 1992b, TID/MID 1997b, TID/MID 2000), and CDFG spawner surveys (e.g., TID/MID 1997a, CDFG 2009) will be summarized to provide a comprehensive, spatially explicit inventory and to identify data gaps in documentation of existing conditions. Base maps of the most recent riffle habitat areas will be compiled within GIS or digitized from existing aerial photographs.

Step 2 – Collect New Data. The amount of suitable spawning gravel habitat will be assessed by direct mapping of potential habitat areas using existing habitat criteria (depth, velocity, and particle size) developed as part of the ongoing Instream Flow Incremental Methodology study of the lower Tuolumne River. On-the-ground foot surveys will be used to delineate the areal extent of polygons potentially suitable for Chinook salmon and *O. mykiss* spawning. Typical redd dimensions for Chinook salmon and anadromous *O. mykiss* from the literature will be used to determine the minimum patch size for inclusion in the overall area estimates.

Depth and velocity measurements will be collected using a standard velocity meter (Marsh-McBirney Flo-Mate) and a depth-setting wading rod on either a point or transect basis, depending upon the gravel patch size at available spawning flows under the current FERC Flow schedule (e.g., 150, 175, 180, or 300 cfs). To provide an indication of gravel quality, visual texture estimates will be collected at 5–10 locations within each delineated patch or riffle habitat unit, depending on size, using a half-phi gravelometer. Average substrate size (D50) will be validated at a subset of sites by Wolman (1954) pebble counts following the methods developed by Bunt and Abt (2001). Qualitative visual assessment of gravel sorting, angularity, and embeddedness, will also be recorded to indicate spawning suitability of mapped gravel patches.

Step 3 – Analysis and Modeling. Using data collected in Steps 1 and 2, the amount of suitable spawning habitat area for Chinook salmon and *O. mykiss* will be summarized by riffle and reach within the Study Area. Typical redd dimensions documented in previous surveys (TID/MID 1992) will be used to develop estimates of current spawning capacity. Historical redd count information will be used to weight spawner preferences and to develop current estimates of maximum spawning run sizes (carrying capacity) supported by the spawning riffles under current conditions. A stock production curve for the Tuolumne River will be developed using an individual-based model, *escape4*, originally developed to assess density dependent mortality effects on the Tuolumne River Chinook salmon due to redd superimposition (TID/MID 1997 b).

Step 4 – Prepare Report. The Districts will prepare a report that includes the following sections: (1) Study Goals and Objectives; (2) Methods and Analysis; (3) Results; (4) Discussion; and (5) Conclusions. The report will contain relevant summary data, tables and graphs as well as GIS-based maps of available spawning areas.

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC issues its Study Plan Determination by December 31, 2011 and the study is not disputed by a mandatory conditioning agency.

- Planning/Pre-field Arrangements (Step 1) ....January–February 2012
- Field Work (Step 2) ....February 2012 – March 2012
- Data Entry, QA/QC, and Analysis (Step 3) ....April 2012 – June 2012
- Report Preparation (Step 4) ....June 2012 – September 2012
- Report Issuance ....January 2013

The field work for this study may be delayed to winter/spring 2013 depending upon field crew safety considerations at flows encountered in 2012.

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

Spawning gravel inventories and geomorphic studies are common to FERC relicensing projects to determine spawning conditions.

8.0 Deliverables

In addition to GIS-based maps of spawning gravel areas, the Districts will prepare a report, which will document the methodology and results of the study.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

Bunte, K. and Abt, S.R. 2001. Sampling surface and subsurface particle-size distributions in wadable gravel-and cobble-bed streams for analyses in sediment transport, hydraulics, and streambed monitoring. Gen. Tech. Rep. RMRS-GTR-74. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 428 p.

California Department of Fish and Game (CDFG). 2009. Tuolumne River Chinook Salmon Spawning Escapement Survey. Report 2005-2 *In* 2010 Report of Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 39 of the License for the Don Pedro Project, No. 2299. Prepared by California Department of Fish and Game, La Grange, California.

McBain & Trush. 2004. Coarse sediment management plan for the lower Tuolumne River. Revised Final Report. Prepared by McBain & Trust, Arcata, California for Tuolumne River Technical Advisory Committee, Turluck and Modesto Irrigation Districts, USFWS Anadromous Fish Restoration Program, and California Bay-Delta Authority.

National Marine Fisheries Service (NMFS). 2009. Public Draft Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook salmon and Central Valley Spring-Run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead. Available online at: http://swr.nmfs.noaa.gov/recovery/centralvalleyplan.htm

Reynolds, F. L., T. J. Mills, R. Benthin, and A. Low. 1993. Restoring Central Valley streams: a plan for action. Inland Fisheries Div., Calif. Dept. of Fish and Game. Sacramento CA. 184 p.

Turlock Irrigation District and Modesto Irrigation District (TID/MID). 1992a. Lower Tuolumne River spawning gravel availability and superimposition Report, Appendix 6. *In* Report of Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 39 of the License for the Don Pedro Project, No. 2299 Vol. VIII. Prepared by EA Engineering, Science, and Technology, Lafayette, California.

_____. 1992b. Lower Tuolumne River spawning gravel studies report. Appendix 8 to Don Pedro Project Fisheries Studies Report (FERC Article 39, Project No. 2299). *In* Report of Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 39 of the License for the Don Pedro Project, No. 2299. Vol. IV. Prepared by EA Engineering, Science, and Technology, Lafayette, California.

_____. 1997a. Gravel Studies Report: 1987-1989. Report 1996-8 *In* 1996 Report of Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 39 of the License for the Don Pedro Project, No. 2299. Prepared by EA Engineering, Science, and Technology, Lafayette, California.

_____. 1997b. Tuolumne River Salmon Spawning Summary. Report 1996-1 *In* 1996 Report of Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 39 of the License for the Don Pedro Project, No. 2299. Prepared by EA Engineering, Science, and Technology, Lafayette, California.

_____. 2000. Tuolumne River Substrate Permeability Assessment and Monitoring Program, Report 2000-7. In Report of Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 39 of the License for the Don Pedro Project, No. 2299. Vol. II. Prepared by Stillwater Sciences, Berkeley, California.

Wolman, M.G. 1954. A method of sampling coarse river-bed material. Transactions of American Geophysical Union 35: 951-956.

STUDY PLAN W&AR-5

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Salmonid Population Information Integration and Synthesis Study Plan

July 2011

Related Study Requests: Acterra-01, Beam-03, CCSF-02, FOT-02, Gardner-02, Rosapepe-01, USFWS-12

1.0 Project Nexus

The continued operation and maintenance (O&M) of the Don Pedro Project (Project) may contribute to cumulative effects on habitat availability and production of in-river life stages of Central Valley Fall run Chinook salmon (*Oncorhynchus tshawytscha*) and *O. mykiss* in the lower Tuolumne River.

2.0 Resource Agency Management Goals

The Districts believe that four agencies have resource management goals related to Chinook salmon and/or their habitat: (1) U.S. Department of Interior, Fish and Wildlife Service (USFWS); (2) United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS); (3) California Department of Fish and Game (CDFG); and 4) State Water Resources Control Board, Division of Water Rights (SWRCB).

A goal of the USFWS (2001) Anadromous Fish Restoration Program (AFRP), as stated in Section 3406(b)(1) of the Central Valley Project Improvement Act, is to double the long-term production of anadromous fish in California's Central Valley rivers and streams. Objectives in meeting this long-term goal include: (1) improve habitat for all life stages of anadromous fish through provision of flows of suitable quality, quantity, and timing, and improved physical habitat; (2) improve survival rates by reducing or eliminating entrainment of juveniles at diversions; (3) improve the opportunity for adult fish to reach spawning habitats in a timely manner; (4) collect fish population, health, and habitat data to facilitate evaluation of restoration actions; (5) integrate habitat restoration efforts with harvest and hatchery management; and (6) involve partners in the implementation and evaluation of restoration actions.

NMFS has developed Resource Management Goals and Objectives for species listed under the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §1801 et seq.) and the Endangered Species Act (ESA) (16 U.S.C. §1531 et seq.), as well as anadromous species that are not currently listed but may require listing in the future. NMFS' (2009) Public Draft Recovery Plan for Sacramento River Winter-run Chinook salmon, Central Valley Spring-run Chinook salmon, and Central Valley steelhead (Draft Recovery Plan) outlines the framework for the recovery of ESA-listed species and populations in California's Central Valley. For Central Valley steelhead, the relevant recovery actions identified for the Tuolumne River are to: (1) Conduct habitat evaluations, and (2) manage cold water pools behind La Grange and Don Pedro dams to provide suitable water temperatures for all downstream life stages. For Chinook salmon, the relevant goals are to enhance the Essential Fish Habitat downstream of the Project and achieve a viable population of Central Valley fall/late fall-run Chinook salmon in the Tuolumne River.

CDFG's mission is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. CDFG's resource management goals, as summarized in restoration planning documents such as "Restoring Central Valley Streams: A Plan for Action" (Reynolds et al. 1993), are to restore and protect California's aquatic ecosystems that support fish and wildlife, and to protect threatened and endangered species under California Fish and Game Code (Sections 6920–6924).

SWRCB has responsibility under the federal Clean Water Act (33 U.S.C. §11251–1357) to preserve and maintain the chemical, physical and biological integrity of the State's waters and to protect water quality and the beneficial uses of stream reaches consistent with Section 401 of the federal Clean Water Act, the Regional Water Quality Control Board Basin Plans, State Water Board regulations, the California Environmental Quality Act, and any other applicable state law.

3.0 Study Goals

The goal of this study is to summarize relevant available information regarding in-river and out-of-basin factors affecting Chinook salmon and *O. mykiss* production in the Tuolumne River. This synthesis will update conceptual model(s) of Chinook salmon and *O. mykiss* life history in the lower Tuolumne River to reflect the results of post-1995 FERC Settlement Agreement ("FSA") monitoring and other Tuolumne River studies, changes in Tuolumne River conditions since 1995 (e.g., from the 1997 flood), as well as recent advances in the understanding of Central Valley salmonid populations (e.g., genetic structure, hatchery influences, ocean conditions, etc.). Objectives in meeting this goal include:

- collect and summarize available existing data on Chinook salmon and *O. mykiss* to characterize the watershed, Project operations and issues affecting salmonid populations,
- develop hypotheses to understand potential impacts of contributing factors affecting salmonid populations, and
- inform and contribute to development/revision and parameterization of numerical in-river salmon population models.

Specific data compiled from this study will be used in the development of conceptual and quantitative population models as part of interrelated relicensing studies, including the *Tuolumne River Chinook Salmon Population Model* (Study Plan W&AR-6) and the *O. mykiss Population Study* (Study Plan W&AR-10). Results from these interrelated studies would also inform this study.

4.0 Existing Information and Need for Additional Information

Chinook salmon life history has been extensively studied under Article 37 of the original (1964) FERC license of the Don Pedro Project (P-2299), subsequent amendments to Article 37, as well as a 10-year monitoring program developed under Article 58 of the current (1996) license for the Project. Review of Chinook salmon run estimates since 1960 and the decades following completion of the New Don Pedro Project in 1971 indicates that similar cyclical patterns of high and low spawning returns have occurred in the lower Tuolumne River and the other San Joaquin Basin tributaries both before and after 1971. This pattern has been shown to be correlated with large variations in San Joaquin Basin outflow corresponding to drier and wetter water year types (TID/MID 2005; Mesick et al. 2008). However, estimates of Chinook salmon spawning escapement in the Tuolumne River since implementation of the 1996 Article 37 flow schedule have been variable with both high and low escapements following high flow years, so other factors are known to have significant effects on the salmon population. As an example, the Pacific salmon fishery collapse during the past decade has been attributed to deterioration in ocean conditions (NMFS 2008) and highlights the importance of understanding out-of-basin habitat conditions and contributing factors unrelated to Project operations.

As summarized in the Pre-Application Document (PAD), observations of *O. mykiss* have been recorded in the Tuolumne River since 1981 in various river monitoring programs. In-river conditions potentially affecting juvenile rearing and outmigrant life stages include flow-related effects on available habitat area (e.g., TID/MID 1992, Appendices 4 and 5; USFWS 1995) and water temperature (TID/MID 1992, Appendix 19; RMA 2008). The Districts are currently conducting updated Instream Flow Incremental Methodology studies to evaluate suitable steelhead/*O. mykiss* habitat area as a function of flow.

The Districts, as well as state and federal resource agencies, have identified several factors that may affect Chinook salmon and *O. mykiss* production and survival in the Tuolumne River. However, compilation of the findings of prior assessments into a comprehensive synthesis and integration of existing information, as proposed in this study plan, has not been performed.

5.0 Study Methods

Because of the large amount of information available from previously conducted studies and ongoing data collection and monitoring activities, additional field-based data collection is not needed as part of this study.

5.1 Study Area

The study area includes the Tuolumne River from the La Grange Dam (River Mile 52) downstream to the confluence with the San Joaquin River (River Mile 0).

5.2 General Concepts

The following general concepts apply to the study:

- The goal of this review is to help readers make sense of a wide and complex set of studies through a focused examination of the available literature.

- The review synthesizes *findings* specific to the study area or topic.
- Primary sources are preferred and secondary sources are rarely cited. If a secondary or tertiary source is cited, it is clearly identified as such.

5.3 Study Methods

Step 1 – Compile Data from Previously Conducted Studies. Although a large body of existing information has been previously summarized in the PAD, specific information needed to inform quantitative assessments as well as to inform future Project license requirements will be synthesized as part of this study. Information from previously conducted monitoring of Chinook salmon populations in the lower Tuolumne River will be supplemented with compilations of other relevant biologic, hydrologic, physical habitat, and water quality data information..

Step 2 – Perform Analysis. The proposed study will use existing information that is suitable to develop life-history-based conceptual models of linkages between land and water use, watershed processes, aquatic and riparian habitat in the Tuolumne River and Delta, ocean conditions, and population responses of Chinook salmon and *O. mykiss*. For example, a large body of information from previous FERC studies has been summarized in the PAD, including the geomorphic process-based Tuolumne River Restoration Plan (McBain & Trush 2000). The *AFRP/CALFED Adaptive Management Forum: Tuolumne River Restoration Summary Report* (Stillwater Sciences 2001) summarizes much of this information collected through the year 2000 and proposes a number of conceptual models of factors affecting Chinook salmon life history. An example of an overall life-history model of Chinook salmon adapted from this report is presented in Figure 5.3-1 below.

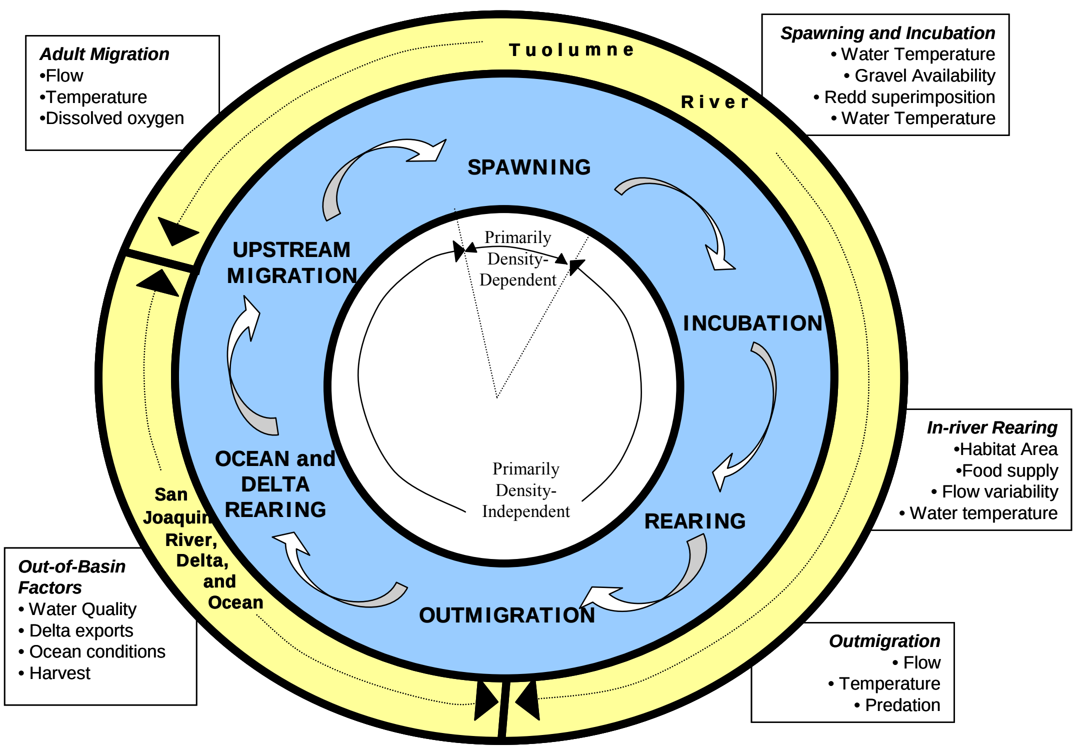

Figure 5.3-1. Example of model of factors affecting Chinook salmon population abundance in the Tuolumne River (adapted from Stillwater Sciences 2001).

Hypotheses about those in-river factors thought to be of greatest importance to salmonid population levels in the basin will be evaluated with existing data and literature and to provide the foundation for quantitative models. Review and synthesis of available data will provide the context for rejecting, accepting, or refining hypotheses and will improve understanding of key uncertainties affecting any conclusions drawn from this study.

This study will determine and document the most appropriate data to be used to parameterize any habitat based, individual based, or multi-stage population dynamics models that may be employed as part of interrelated studies of salmon population dynamics, including the *Tuolumne River Chinook Salmon Population Model* (Study Plan W&AR-6) and the *O. mykiss Population Study* (Study Plan W&AR-10).

Step 3 – Prepare Report. The Districts will prepare a report that includes the following sections: (1) Study Goals and Objectives; (2) Methods and Analysis; (3) Results; (4) Discussion; and (5) Conclusions. The report for this study will be a synthesis of previous and ongoing data collection. The study products will include a list of key hypotheses, a summary of the data supporting or refuting each hypothesis, the relative importance of various factors potentially limiting salmonid populations, and an indication of the level of uncertainty associated with these conclusions.

6.0 Schedule

The Districts anticipate the schedule to complete the study proposal as follows assuming FERC issues its Study Plan Determination by December 31, 2011 and the study is not disputed by a mandatory conditioning agency:

- Existing Data Compilation (Step 1)..January – March 2012
- Analysis and Synthesis (Step 2) ....March – August 2012
- Report Preparation (Step 3) ....August – December 2012
- Report Issuance ....January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

The methods presented in this study plan are consistent with other generally accepted scientific study methods concerning anadromous salmonid population assessments, including those conducted by the state and federal resource agencies.

8.0 Deliverables

The Districts will prepare a report, which will document the methodology and results of the study.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

McBain & Trush. 2000. Habitat Restoration Plan for the lower Tuolumne River Corridor. Final report. Prepared for Tuolumne River Technical Advisory Committee (Don Pedro Project, FERC License No. 2299) by McBain and Trush, Arcata, California.

Mesick, C., J. McLain, D. Marston, and T. Heyne. 2008. Draft paper. Limiting Factor Analyses & Recommended Studies for Fall- run Chinook Salmon and Rainbow Trout in the Tuolumne River. Anadromous Fishery Restoration Program. August 13. 96 pages.

National Marine Fisheries Service (NMFS). 2008. Written testimony of Rodney R. McInnis, Southwest Regional Administrator, NMFS, National Oceanic and Atmospheric Administration, U.S. Dept. of Commerce, Hearing Before the Subcomm. On Fisheries, Wildlife, and Oceans, of the H. Comm. On Natural Resources, at 2 (May 15, 2008), Available online at: <http://republicans.resourcescommittee.house.gov/ pdf/Testimony_ 5-15-08_McInnis.pdf>.

_____. 2009. Public Draft Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook salmon and Central Valley Spring-Run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead. Available online at: <http://swr.nmfs.noaa.gov/recovery/centralvalleyplan.htm>.

Reynolds, F. L., Mills, T. J., Benthin, R., and A. Low. 1993. Restoring Central Valley streams: a plan for action. Inland Fisheries Div., Calif. Dept. of Fish and Game. Sacramento CA. 184 p.

Resource Management Associates, Inc. (RMA). 2008. SJR Basin-Wide Water Temperature Model. Downloaded August 21, 2009. Available online at: <http://www.rmanet.com/ CalFed_Nov2008/>.

Stillwater Sciences. 2001. AFRP/CALFED Adaptive Management Forum: Tuolumne River Restoration Program Summary Report. Prepared for the Adaptive Management Forum Scientific and Technical Panel by Stillwater Sciences, Berkeley CA.

Turlock Irrigation District and Modesto Irrigation District (TID/MID). 1992. Report of Turlock Irrigation District and Modesto Irrigation District pursuant to Article 39 of the license for the Don Pedro Project. Turlock, California.

_____. 2005. 2005 Ten Year Summary Report. Pursuant to Paragraph (G) of the 1996 FERC Order issued July 31, 1996. Don Pedro Project, No. 2299. April.

U.S. Department of Interior, Fish and Wildlife Service (USFWS). 1995. The relationship between instream flow and physical habitat availability for Chinook salmon in the lower Tuolumne River, California. Prepared by USFWS, Ecological Services Division, Sacramento, California for Turlock Irrigation District and Modesto Irrigation District, California

_____. 2001. Final restoration plan for the Anadromous Fish Restoration Program. A Plan to increase Natural Production of Anadromous Fish in the Central Valley of California. Report of the Anadromous Fish Restoration Program Core Group, Central Valley Project Improvement Act to the Secretary of the Interior. Stockton, CA.

STUDY PLAN W&AR-6

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Tuolumne River Chinook Salmon Population Model Study Plan

July 2011

Related Study Requests: NMFS-08

1.0 Project Nexus

The continued operation and maintenance of the Don Pedro Project (Project) may contribute to cumulative effects on habitat availability and production of in-river life stages of Chinook salmon (*Oncorhynchus tshawytscha*) in the lower Tuolumne River.

2.0 Resource Agency Management Goals

The Districts believe that four agencies have resource management goals related to Chinook salmon and/or their habitat: (1) U.S. Department of Interior (USDOI), Fish and Wildlife Service (USFWS); (2) U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS); (3) California Department of Fish and Game (CDFG); and (4) State Water Resources Control Board, Division of Water Rights (SWRCB).

A goal of the USFWS (2001) Anadromous Fish Restoration Program, as stated in Section 3406(b)(1) of the Central Valley Project Improvement Act, is to double the long-term production of anadromous fish in California's Central Valley rivers and streams. Objectives in meeting this long-term goal include: (1) improve habitat for all life stages of anadromous fish through provision of flows of suitable quality, quantity, and timing, and improved physical habitat; (2) improve survival rates by reducing or eliminating entrainment of juveniles at diversions; (3) improve the opportunity for adult fish to reach spawning habitats in a timely manner; (4) collect fish population, health, and habitat data to facilitate evaluation of restoration actions; (5) integrate habitat restoration efforts with harvest and hatchery management; and (6) involve partners in the implementation and evaluation of restoration actions.

NMFS has developed Resource Management Goals and Objectives for species listed under the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §1801 et seq.) and the Endangered Species Act (ESA) (16 U.S.C. §1531 et seq.), as well as anadromous species that are not currently listed but may require listing in the future. NMFS' (2009) Public Draft Recovery Plan for Sacramento River Winter-run Chinook salmon, Central Valley Spring-run Chinook salmon, and Central Valley steelhead (Draft Recovery Plan) outlines the framework for the recovery of ESA-listed species and populations in California's Central Valley. For the Tuolumne River, the relevant goals are to enhance the Essential Fish Habitat downstream of the Project and achieve a viable population of Central Valley fall/late fall-run Chinook salmon.

CDFG's mission is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. CDFG's resource management goals, as summarized in restoration planning documents such as "Restoring Central Valley Streams: A Plan for Action" (Reynolds et al. 1993), are to restore and protect California's aquatic ecosystems that support fish and wildlife, and to protect threatened and endangered species under California Fish and Game Code (Sections 6920–6924).

SWRCB has responsibility under the federal Clean Water Act (33 U.S.C. §11251–1357) to preserve and maintain the chemical, physical and biological integrity of the State's waters and to protect water quality and the beneficial uses of stream reaches consistent with Section 401 of the federal Clean Water Act, the Regional Water Quality Control Board Basin Plans, State Water Board regulations, the California Environmental Quality Act, and any other applicable state law.

3.0 Study Goals

The Chinook salmon population model developed through this study will be used to examine the relative influences of various factors on the life-stage specific production of Chinook salmon in the Tuolumne River, identify critical life-stages that may represent a life-history "bottleneck", and compare relative changes in population size between alternative management scenarios. Specific information obtained by this study will be used to assess the extent to which the abundance of the Chinook salmon populations in the Tuolumne River is affected by in-river factors.

4.0 Existing Information and Need For Additional Information

A number of attempts have been made in the past two decades to assess the relative importance of factors influencing the Chinook salmon population abundance in the Tuolumne River and larger San Joaquin River basin. Four separate population models have been developed to provide a framework for investigating the relative influences of various factors on various Chinook salmon life stages, to identify critical life-stages that may be limiting overall population sizes, and to compare relative changes in population size between alternative management scenarios.

- The EACH population model (TID/MID 1992b, Appendix 1) is a compartment-based deterministic simulation model, with a time-step of one week, that represents the dynamics of populations from each of the three salmon-bearing tributaries to the San Joaquin River using a set of finite difference equations that describe changes in the numbers of Chinook salmon at various geographical locations and developmental stages as functions of these numbers and environmental parameters (represented by flows in the Tuolumne River and Delta exports). The model was recently updated to reflect hydrology from 1973–2007, but the model parameters have not been refitted using recent data. As with the Stock-Recruit Model, use of the EACH model would require refitting of several model parameters and appropriate scaling of input variables to represent changes in Tuolumne River flow or habitat availability.

- The Oak Ridge Chinook Salmon model (ORCM) (Jager et al. 1997, Jager 2000, Jager and Rose 2003, Jager and Sale 2006) is also a compartment-based model originally developed in the 1990s by staff at the Oak Ridge National Laboratory (ORNL) and most aspects of the model have remained unchanged since the model was first documented by Jaeger et al. (1997). The ORCM model is spatially and temporally explicit (at a scale of one-mile river reaches and one-day time steps) and simulates the in-river life history of Chinook salmon by tracking growth, development, migration, and survival of individual fish. Jager and Sale (2006) validated the model outputs by comparisons of the magnitude and timing of juvenile outmigration, as estimated from recent rotary screw trap (RST) data, with those predicted by the ORCM model. Overall, the model predicts outmigration timing very well, but large differences between modeled and observed smolt productivity were apparent in some years. Re-examination of the underlying habitat (i.e., weighted usable area) relationships for individual life stages may improve the model performance, and the mechanistic basis of the ORCM allows the model to be used to exploring management alternatives not closely related to flow, such as changes in habitat area from gravel augmentation, floodplain re-contouring, etc.
- The Stock-Recruit model (TID/MID 1992a, Appendix 2; TID/MID 1997, Report 96-5) uses statistical analysis of the time-series of historical Chinook salmon escapements to the San Joaquin basin in relation to Vernalis flow and Delta exports. The model attempts to capture how density-independent mortality, as influenced by basin-wide spring outflow, combines with density-dependent mortality to affect the rate and magnitude of changes in the San Joaquin system's Chinook salmon population. The model parameters were recently recalibrated for escapement and hydrology data through 2006, and validation testing showed divergence in the modeled and observed escapements during 2005–2006, possibly attributable to changes in ocean conditions during this period (NMFS 2008). These discrepancies suggest some model assumptions regarding stable conditions for adult salmon vary from year to year as a result of ocean conditions. Use of this model would require the refitting of several model parameters and appropriate scaling of input variables to represent changes in Tuolumne River flow or habitat availability.
- CDFG's San Joaquin River Salmon Population Model (CDFG 2005) is a deterministic model comprising linear-regression based relationships between escapement (spawner abundance) and springtime Vernalis flow to predict future smolt and adult production. Although CDFG's model (2005, revised 2009) has been cited in Agency comments on the Don Pedro Project and other proceedings regarding San Joaquin River basin salmon populations, Pyper et al. (2006) and CALFED peer reviewers identified substantial flaws in the initial model and provided several modification recommendations. In response, CDFG issued a revised version (CDFG 2009) that only contains partial revisions and has not yet been peer reviewed. Based on an assessment by Lorden and Bartroff (2010), the current model revisions remain inadequate to address many of the original problems that were identified. Therefore, this model is not functional and is not considered further in this document.

It is apparent based upon the performance of the functional models above that: (1) variations in escapements are not well captured by existing models in all years, (2) a number of out-of-basin factors affect salmon populations in the Tuolumne River, and (3) the effects of Project operations are not easily separable from other factors affecting Chinook salmon in the Tuolumne River. As a result, there is a need for an up-to-date population model that evaluates factors affecting life-stage production and overall population levels. The models described above represent a variety of population modeling paradigms, from compartment based models such as ORCM and EACH that require a great deal of information regarding specific mechanisms to almost purely statistical models such as the Stock-Recruit model) that describes how individuals are distributed across times and locations at a particular life-stage. Spatial scales vary from one-mile reaches of the Tuolumne River (ORCM), to major habitat divisions such as the ocean, bay, delta, and primary river systems (EACH), to a single amorphous unit (the Stock Recruit model). The EACH and ORCM models are constructed with explicit time steps (7 days and a day, respectively), whereas the other two are primarily of stock-production form, stepping directly from life-stage to life-stage. In this study plan, we propose to develop a new population model using a stock-production approach, as described below.

5.0 Study Methods

The Tuolumne River Chinook salmon population modeling study will rely upon existing literature and information, including previously conducted Tuolumne River studies, as well as interrelated relicensing studies in the development of both conceptual and quantitative population models to examine the relative importance of in-river factors affecting Chinook salmon production.

5.1 Study Area

The study area includes the Tuolumne River from the La Grange Dam (River Mile [RM] 52) downstream to the location of the rotary screw trap at Grayson River Ranch (RM 5) near the San Joaquin River confluence.

5.2 General Concepts

The following general concepts apply to the study:

- Cumulative effects are difficult to assess individually unless cause-effect relationships can be parsed out.
- The model focuses on variables that can be influenced by both Project and non-Project influences on the resource(s).
- Project-specific and resource-specific data will be used to calibrate and validate the model whenever possible.
- Model outputs consist of representation of the modeled response variable under an existing baseline or initial condition, as well as predictions under one or more scenarios.
- Although model uncertainties will be identified as part of this study, modeling predictions may show statistically significant differences from baseline conditions that do not display an ecologically or biologically significant difference. Should this occur, the criteria and rationale for biological significance will be documented along with the results.

5.3 Study Methods

Step 1 – Develop Conceptual Model from Previously Conducted Studies. Information from previously conducted studies, as well as the concurrent *Salmonid Populations Integration and Synthesis study* (Study Plan W&AR-5), will be summarized. Using this information, conceptual models of the potential density-dependent and density-independent factors affecting each life-stage of Chinook salmon in the Tuolumne River will be developed and refined. Although review of out-of-basin factors may be included, detailed modeling of historical escapements resulting from variations in these factors (e.g., variations in Delta barrier and export facility operations, ocean productivity, ocean and inland harvest, etc.) is not anticipated.

Step 2 – Develop Quantitative Population Model. Using conceptual models developed in Step 1, a quantitative population model will be developed to provide a framework to examine the relative influences of in-river factors upon life-stage production or population levels of Chinook salmon. The proposed approach is a multi-stage stock production model (Baker 2009) in which starting numbers of a particular life-stage (stock) are mathematically modeled to predict how the numbers change as the cohort goes through subsequent life stages. Individual life stage to life stage steps will be modeled using independent submodels, which can be implemented with methodologies ranging from common stock production forms (e.g., Beverton-Holt). This approach allows model structure to be initially developed without detailed consideration of the underlying mechanisms, but also allows the introduction of one or more mechanisms affecting life-stage to life-stage survival. A redd superimposition model may be used for the step from female spawners to deposited eggs if spawning gravel availability or actual redd superimposition observations suggest this is occurring. A linear model may be used to reflect density-independent mortality (e.g., the step from eggs to emergent fry, in which mortality is not affected by density). Lastly, the Beverton-Holt (1957) and "hockey stick" models (Barrowman and Myers 2000) are typically used for density-dependent[1] interactions (e.g., the life-step from fry to juvenile in circumstances when available habitat limits the population). More elaborate compartment or individual-based models may be introduced as sub-models to reflect variations in habitat conditions due to seasonal shifts in river flow, water temperature, predation, or other factors.

The modeled life-stage structure, the factors selected and default values for parameters and stock production forms will be determined from Tuolumne River data and previously conducted studies, literature values, and agency consultation. For example, a carrying capacity (K) is generally specified for all density-dependent stock production relationships. Information from prior Tuolumne River Chinook salmon seine and snorkeling studies will be used to provide current estimates of rearing densities by habitat type (e.g., riffle, pool head, run, etc.) and literature review will be used to establish maximum densities. To determine carrying capacity, maximum densities within particular habitat types will be combined with up-to-date estimates of habitat availability developed from the ongoing *Tuolumne River Instream Flow Study*[2] as well as the following interrelated studies being conducted as part of relicensing:

[1] Density-dependence in stock-production relationships occurs whenever food or space limitations cause the life-stage specific survival or growth to be related to the numbers of individuals present.

[2] The Tuolumne River Instream Flow Study is currently being conducted in accordance with the May 12, 2010 FERC Order Modifying and Approving Instream Flow and Water Temperature Model Study Plans for the Don Pedro Project (Project No. 2299-072), as modified by Ordering Paragraph (A) of the July 21, 2010 FERC Order.

- Spawning Gravel Study (Study Plan W&AR-4)
- Salmonid Redd Mapping Study (Study Plan W&AR-8)
- Chinook Salmon Fry Study (Study Plan W&AR-9)
- Predation Study (Study Plan W&AR-7)
- Temperature Criteria Assessment (Study Plan W&AR-14).

In order to parameterize the model, estimates of life-stage specific survival (*r*) will also be made from studies and long-term monitoring summarized as part of the *Salmonid Populations Information Integration and Synthesis Study* (Study Plan W&AR-5 as well as literature values. For example, prior studies of egg survival-to-emergence, predation, and outmigrant survival summarized in the Pre-Application Document provide life history parameter estimates specific to the Tuolumne River. Model parameterization will also be compared to literature values and validation will be carried out by comparisons of modeling results of fry and/or smolt production with annual production estimates available from season-long RST sampling conducted since 1998 near Waterford (RM 30) and the Grayson River Ranch (RM 5) (e.g., TID/MID 2011).

Step 3 – Evaluation of Factors Affecting Chinook Salmon Production. To determine the life-stages and model parameters that most affect Chinook salmon production, a sensitivity analysis will be conducted of the parameters and values in the model. The sensitivity analysis will evaluate the equilibrium juvenile and smolt production using initial parameter values established in Step 2, followed by varying the initial parameter values by:

- Decreasing initial value by 50%
- Decreasing initial value by 25%
- Increasing initial value by 33%
- Increasing initial value by 100%

For each change in value, the model will be used to calculate the equilibrium population size, holding all other values constant. For sensitive parameters, additional scrutiny will be focused upon the source of data, and the potential for the Project to influence those parameters. It should be noted, however, that sensitivity analyses of this type cannot explore the potential interactions of multiple input values that are simultaneously increased or decreased.

Step 4 – Evaluation of Salmon Production under Current Project Operations. An evaluation of Chinook salmon production under the current FERC flow schedule will be developed to represent the magnitude and timing of Tuolumne River flows under the current FERC flow schedules across representative water year types.

Step 5 – Prepare Report. The Districts will prepare a report that includes the following sections: (1) Study Goals, (2) Methods and Analysis, (3) Results, (4) Discussion, and (5) Conclusions.

6.0 Schedule

The Districts anticipate the schedule to complete the study proposal as follows assuming FERC issues its Study Plan Determination by December 31, 2011 and the study is not disputed by a mandatory conditioning agency:

- Conceptual Model Development (Step 1) ....January 2012 – March 2012
- Population Model Development (Step 2) ....March 2012 – September 2012
- Modeling Workshop (Step 2) .... May 2012
- Modeling Sensitivity and Evaluation (Steps 2, 3, and 4) .... June 2012 – September 2012
- Report Preparation ....September 2012–December 2012
- Report Issuance .... January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

Population modeling is supported by a large body of literature spanning several decades (e.g., Paulik 1973, Moussalli and Hilborn 1986, Sharma et al. 2005). Population models are commonly employed in hydroelectric relicensing projects to predict relative changes in salmonids population levels in response to changing variables.

8.0 Deliverables

In addition to the completed model, the Districts will prepare a report, which will document the methodology and results of the study.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

Baker, P. 2009. Generalizing the multi-stage stock-production paradigm: a flexible architecture for population modeling. *In* Knudsen EE, Michael H (Eds.). Pacific salmon environmental and life history models: advancing science for sustainable salmon in the future. American Fisheries Society Symposium 71. Bethesda, Maryland.

Barrowman, N.J. and R.A. Myer. 2000. Still more spawner-recruitment curves: The hockey stick and its generalizations. Canadian Journal of Fisheries and Aquatic Sciences 57: 665-676.

Beverton, R.J.H., and S.J. Holt. 1957. On the dynamics of exploited fish populations. Ministry Agriculture, Fisheries and Food, Fisheries Investigation Series 2, No. 19. London, England.

California Department of Fish and Game (CDFG). 2005. San Joaquin River fall-run Chinook salmon population model.

CDFG. 2009. San Joaquin River Fall-run Chinook salmon population model version 1.6. Report to the State Water Resources Control Board. http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/comments040609/comments040609/dfg051509.pdf

Jager, H.I., H.E. Cardwell, M.J. Sale, M.S. Bevelhimer, C.C. Coutant, and W. VanWinkle. 1997. Modeling the linkages between flow management and salmon recruitment in streams. Ecological Modeling 103:171–191.

Jager, H.I. 2000. Predicting the viability of fish populations in a modified riverine environment. Doctoral dissertation. University of Tennessee, Knoxville.

Jager, H.I. and K. Rose. 2003. Designing optimal flow patterns for Fall Chinook salmon in a Central Valley, California, River. North American Journal of Fisheries Management 23:1–21.

Jager, H.I. and M.J. Sale. 2006. Functional comparison between predictions of a Chinook salmon model and monitoring data in the Tuolumne River, California. California Energy Commission, PIER Energy-Related Environmental Research. CEC-500-2006-098.

Lorden, G. and J. Bartroff. 2010. Report on flow vs. escapement model and environmental data: Lordenstats, December 1, 2010. Report provided in Appendix 1 of this document.

Moussalli, E., and R. Hilborn. 1986. Optimal stock size and harvest rate in multistage life history models. Canadian Journal of Fisheries and Aquatic Sciences 43:135-141.

Newman, K.B., and D.G. Hankin. 2004. Statistical procedures for detecting the CVPIA natural Chinook salmon production doubling goal and determining sustainability of production increases. Prepared for CH2M Hill, Corvallis, Oregon.

Paulik, G.J. 1973. Studies of the possible form of the stock-recruitment curve. Rapports et Proces-Verbaux des Reunions, Conseil International pour L'Exploration de la Mer 164: 302-315.

Pyper, B., S. Cramer, and M. Simpson. 2006. Technical memorandum: Review of the California Department of Fish and Game's "San Joaquin River Fall-run Chinook Salmon Population Model." Prepared for O'Laughlin and Paris, Chico, CA.

Reynolds, F.L., T.J. Mills, R, Benthin, and A. Low. 1993. Restoring Central Valley streams: a plan for action. Inland Fisheries Div., Calif. Dept. of Fish and Game. Sacramento CA. 184 p.

Sharma, R., A.B. Cooper, and R. Hilborn. 2005. A quantitative framework for the analysis of habitat and hatchery practices on Pacific salmon. Ecological Modelling 183: 231-250.

S.P. Cramer. 2006. Review of the California Department of Fish and Game's "San Joaquin River Fall-run Chinook Salmon Population Model." Technical Memorandum prepared for the San Joaquin River Group Authority by S.P. Cramer Associates, Gresham, OR.

Turlock Irrigation District and Modesto Irrigation District (TID). 1992a. Stock recruitment analysis of the population dynamics of San Joaquin River system Chinook salmon. Appendix 2 to Don Pedro Project Fisheries Studies Report (FERC Article 39, Project No.

2299). *In* Report of Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 39 of the License for the Don Pedro Project, No. 2299. Vol. III.

_____. 1992b. Population model documentation. Appendix 1 to Don Pedro Project Fisheries Studies Report (FERC Article 39, Project No. 2299). *In* Report of Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 39 of the License for the Don Pedro Project, No. 2299. Vol. III.

_____. 1997. Stock-recruitment analysis report (Report 96-5). Supplement to 1992 FERC Report Appendix 2. In Report of Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 39 of the License for the Don Pedro Project, No. 2299. Vol. VI.

_____. 2011. 2010 Rotary Screw Trap Report. Report 2010-4 *In* Report of Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 39 of the License for the Don Pedro Project, No. 2299. Prepared by FISHBIO Environmental, LLC, Oakdale, CA.

U.S. Department of Commerce, National Marine Fisheries Service (NMFS). 2008. Written testimony of Rodney R. McInnis, Southwest Regional Administrator, NMFS, National Oceanic and Atmospheric Administration, U.S. Dept. of Commerce, Hearing Before the Subcomm. On Fisheries, Wildlife, and Oceans, of the H. Comm. On Natural Resources, at 2 (May 15, 2008). Available online at: <http://republicans.resourcescommittee.house.gov/pdf/Testimony_5-15-08_McInnis.pdf>.

_____. 2009. Public Draft Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook salmon and Central Valley Spring-Run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead. Available online at: <http://swr.nmfs.noaa.gov/recovery/centralvalleyplan.htm>.

U.S. Department of Interior, Fish and Wildlife Service (USFWS). 2001. Final restoration plan for the Anadromous Fish Restoration Program. A Plan to increase Natural Production of Anadromous Fish in the Central Valley of California. Report of the Anadromous Fish Restoration Program Core Group, Central Valley Project Improvement Act to the Secretary of the Interior. Stockton, CA.

STUDY PLAN W&AR-7

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Predation Study Plan

July 2011

Related Study Requests: AR-13, 14; USFWS-11

1.0 Project Nexus

The continued operation and maintenance (O&M) of the Don Pedro Project (Project) may contribute to cumulative effects on the timing and magnitude of stream flow in the lower Tuolumne River. Stream flows, in turn, potentially may contribute to cumulative effects on Chinook salmon (*Oncorhynchus tshawytscha*) outmigrant survival by contributing to changes in velocities, turbidity, and water temperatures that affect the timing and use of in-channel and floodplain habitats by salmon and predatory fish species.

2.0 Resource Agency Management Goals

The Districts believe that four agencies have resource management goals related to Chinook salmon and/or their habitat: (1) U.S. Department of Interior (USDOI), Fish and Wildlife Service (USFWS); (2) U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS); (3) California Department of Fish and Game (CDFG); and (4) State Water Resources Control Board, Division of Water Rights (SWRCB).

A goal of the USFWS (2001) Anadromous Fish Restoration Program (AFRP), as stated in Section 3406(b)(1) of the Central Valley Project Improvement Act, is to double the long-term production of anadromous fish in California's Central Valley rivers and streams. Objectives in meeting this long-term goal include: (1) improve habitat for all life stages of anadromous fish through provision of flows of suitable quality, quantity, and timing, and improved physical habitat; (2) improve survival rates by reducing or eliminating entrainment of juveniles at diversions; (3) improve the opportunity for adult fish to reach spawning habitats in a timely manner; (4) collect fish population, health, and habitat data to facilitate evaluation of restoration actions; (5) integrate habitat restoration efforts with harvest and hatchery management; and (6) involve partners in the implementation and evaluation of restoration actions.

NMFS has developed Resource Management Goals and Objectives for species listed under the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §1801 et seq.) and the Endangered Species Act (ESA) (16 U.S.C. §1531 et seq.), as well as anadromous species that are not currently listed but may require listing in the future. NMFS' (2009) Public Draft Recovery

Plan for Sacramento River Winter-run Chinook salmon, Central Valley Spring-run Chinook salmon, and Central Valley steelhead (Draft Recovery Plan) outlines the framework for the recovery of ESA-listed species and populations in California's Central Valley. For Central Valley steelhead, the relevant recovery actions identified for the Tuolumne River are to: (1) Conduct habitat evaluations, and (2) Manage cold water pools behind LaGrange and Don Pedro dams to provide suitable water temperatures for all downstream life stages. For Central Valley fall/late fall-run Chinook, the relevant goals are to enhance the Essential Fish Habitat downstream of the Project and achieve a viable population of Central Valley fall/late fall-run Chinook salmon in the Tuolumne River.

CDFG's mission is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. CDFG's resource management goals, as summarized in restoration planning documents such as "Restoring Central Valley Streams: A Plan for Action" (Reynolds et al. 1993), are to restore and protect California's aquatic ecosystems that support fish and wildlife, and to protect threatened and endangered species under California Fish and Game Code (Sections 6920-6924).

3.0 Study Goals

The predation study will provide information to increase understanding of the current effects of predation on rearing and outmigrating juvenile Chinook salmon and *O. mykiss* in the lower Tuolumne River. Specific information obtained by this study will update and supplement information from prior studies in order to:

- estimate relative abundance of in-channel habitats used by predator species such as largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), Sacramento pikeminnow (*Ptychocheilus grandis*), and striped bass (*Morone saxitalius*),
- update estimates of predation rate from previous surveys (e.g., TID/MID 1992), and
- determine relative habitat use by juvenile Chinook salmon and predator species at typical flows encountered during the juvenile salmonid outmigration period.

4.0 Existing Information and Need for Additional Information

Interannual variations in seasonal river flow and temperature affect the composition and distribution of the native and non-native fish assemblage, including predators of juvenile salmonids (Baltz and Moyle 1993; Brown and Moyle 1997; Brown 2000; Marchetti and Moyle 2001, Brown and Ford 2002). Surveys of predator species distribution and abundance have been carried out by CDFG and the Districts, and demonstrate increasing predator density downstream of the primary spawning reach of the lower Tuolumne River as well as changes in abundance and habitat use in various water year types (McBain & Trush and Stillwater Sciences 2006). The earliest predation study was conducted in 1987 by CDFG and included the release of 90,000 coded-wire-tagged (CWT) juvenile Chinook salmon from below La Grange Dam (River Mile [RM] 52). Recapture rates of CWT fish indicated only 30 percent of the released fish reached the San Joaquin River confluence (RM 0). Because the most plausible explanation for this observation was mortality by predation, additional predation investigations were undertaken by the Districts.

During 1989, the Districts conducted a follow-up predation study at nine sites in the lower Tuolumne River (TID/MID 1992, App. 22). Although this water year was relatively dry, the main objectives of the study were to obtain preliminary data on (1) the piscivorous predator population (species, abundance), (2) the rates of predation, and (3) the variability inherent in sites, timing of surveys, and numbers of fish examined. Twelve potential Chinook salmon predator species (two of which are native species) were captured during the pilot study. Of these 12 species, only two, one smallmouth and one largemouth bass, were found to contain Chinook juveniles in their stomach content. The estimated rate of predation for smallmouth bass, 0.44 fish per day, was over twice as high as that estimated for largemouth bass, 0.20 fish per day.

Habitat-specific predator abundance was estimated before and after the restoration of special run-pool (SRP) 9 by McBain & Trush and Stillwater Sciences (2006). Monitoring data from September–October 2003 showed that largemouth and smallmouth bass were the most abundant potential salmon predators at all project (SRP 9 and SRP 10) and control (Charles Road) sites. Two other potential salmon predators, Sacramento pikeminnow and striped bass, occurred at very low numbers in the sites sampled. Although no information on predation rate was collected for these species, due to the lower relative abundance of smallmouth bass, predation on Chinook salmon by smallmouth bass was considered to be less important than largemouth bass at that time. However, because relative abundance was shown to be variable between pre- and post-project monitoring assessments of the study sites, there is a need to update this information.

To examine whether water velocity and temperature influence predator and juvenile salmon habitat use at the completed SRP-9 Project discussed above, Stillwater Sciences and McBain & Trush (2006) conducted a predator tracking pilot study of three largemouth bass and one smallmouth bass at the same three sites. Prior habitat suitability modeling conducted at SRP 9 for pre- and post-project conditions using the River 2D model (Steffler and Blackburn 2002) indicated that channel restoration should alter water flows and velocities to provide a "safe-velocity corridor" for outmigrant salmon during relatively low flow conditions. However, juvenile Chinook salmon and piscivore-sized bass captured during the surveys were all found on inundated floodplains or in nearshore areas, and analysis of stomach contents indicated no predation on juvenile salmon and very low feeding rates by all predators examined. The small sample size and non-continuous (weekly) mobile-tracking surveys precluded conclusions regarding habitat use by predators or the relationship between predator location and river flow. Study recommendations included targeting lower flows than occurred during this study (< 7,000 cubic feet per second [cfs]) when mid-channel areas can be more effectively surveyed and higher water temperatures facilitate increased predator feeding rates, and the use of additional observation methods such as electrofishing.

Based upon the predation studies reviewed above, predation of juvenile salmonids by introduced species such as striped bass, smallmouth bass, and largemouth bass can be a significant factor affecting Chinook salmon smolt survival in certain years. In order to update information from previous predation studies to reflect the predator species composition and distribution in response to current conditions, the proposed predation study will include three primary tasks, each using unique methods:

- estimation of relative predator abundance by habitat type (e.g., riffle, run, pool),
- estimation of predation rate by stomach content sampling during the Chinook salmon outmigration period, and

- tracking of relative habitat use by juvenile Chinook salmon and predators in response to changes in river flows and flow-related parameters (e.g., velocity, depth, temperature, turbidity).

5.0 Study Methods

This study consists of evaluating three components related to salmonid predation by native and non-native species in the lower Tuolumne River:

- predator abundance,
- predation rates, and
- predator behavior

5.1 Study Area

The study area includes the Tuolumne River from the La Grange Dam (RM 52) downstream to the confluence with the San Joaquin River (RM 0). Study sites will be selected in habitat units or river reaches that provide suitable habitat for predators and where predators have been documented in prior studies (TID/MID 1992, Ford and Brown 2001, Stillwater Sciences and McBain & Trush 2006, McBain & Trush and Stillwater Sciences 2006). As the majority of predators in the lower Tuolumne River are non-native and are most abundant downstream of approximately RM 31 (Ford and Brown 2001), predation study sites may be concentrated in this downstream reach.

5.2 General Concepts and Procedures

The following general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner; areas considered unsafe in the judgment of field teams will not be surveyed.
- The Districts will make a good faith effort to obtain permission in advance of performance of the study to access private property where needed. Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study reports.

5.3 Study Methods

Predators will be captured in the lower Tuolumne River in multiple habitat types using a variety of methods to determine the relative abundance of each predator species in each type of habitat.

5.3.1 Predator Abundance

Step 1 – Study Design and Permitting. The Predator Abundance study task is designed to collect data on relative predator abundance in specific habitat types using the most feasible and effective methods available. Approximately three habitat types will be sampled from approximately July–September: (1) slow-water (pools and “special run pools” or “SRPs”), (2) fast-water (riffles and runs), and (3) run-pools (in the sand-bedded reach downstream of RM 25). As a means of protecting Chinook salmon and listed Central Valley steelhead from potential harm during sampling, study sites and timing will be selected at downstream locations during summer, a time period when Chinook salmon are absent from the river and any *O. mykiss* are restricted to in cooler upstream locations. Although the preferred sampling methods will be electrofishing, other methods (e.g., gill netting, or direct observation by snorkeling) will be chosen based on site-specific conditions and the typical habitat use of predator species in the lower Tuolumne River documented in prior studies (TID/MID 1992, McBain & Trush and Stillwater Sciences 2006, Stillwater Sciences and McBain & Trush 2006). For example, mark-recapture and snorkeling techniques were previously found to be ineffective in deeper pool habitats (McBain & Trush and Stillwater Sciences 1999).

Because completion of the study as described in this study plan is contingent upon permit approval by CDFG and/or NMFS, the feasibility of the study as well as the accuracy, precision and comparability of the resulting abundance estimates will depend upon which methods are allowed. Permit inquiries and requests will be made well in advance of the proposed study task to allow permit processing and approval. In the event permits are not granted, the Districts will make a good faith effort to modify study designs, if possible, to comply with permit requirements and proceed with the study.

<u>Step 2 – Data Collection</u>. Sampling will take place in pre-selected habitat units mapped onto high-resolution aerial photographs within a GIS. Delineation of habitat units will take place in the field during the Study Design and Permitting Process (Step 1) prior to initiating the sampling. Locations surveyed in each habitat unit will be recorded in the field using Global Positioning System (GPS) receivers to provide the locations of all areas sampled. GPS data will be collected in a manner that meets or exceeds the federal government's "National Map Accuracy Standards" for published maps and stored in Environmental Science Research Institute (ESRI) Shapefile format.

Predators will be captured in three general habitat types described in Step 1 above (i.e., pools/SRPs, riffles/runs, and run-pools). Methods appropriate to each habitat type will be selected as part of the Study Design and Permitting process (Step 1) and may include boat electrofishing, gill netting, and direct observation by snorkeling. Boat electrofishing and gill netting will be used preferentially in SRPs and downstream run-pools where observation success is typically low due to instream cover, deep water, and poor visibility. Multiple pass electrofishing in slow-water habitats such as SRPs will be conducted at night when catch per unit effort is typically highest. Electrofishing will be performed in accordance with the *Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act* (NMFS 2000) and would be used to target territorial species such as largemouth and smallmouth bass that do not range far from their home territory. Predators captured using electrofishing will be identified to species, measured (total length) and weighed, then released near the location of capture.

If electrofishing is not feasible or not allowed by the permitting agencies (CDFG, NMFS), gill netting or snorkeling methods will be evaluated instead. Gill netting is most effective at capturing highly mobile species such as striped bass, whereas snorkeling will typically be restricted to more sedentary bass species in smaller pool habitats where water depth and the amount of instream cover are low enough to permit effective observation. Gill netting will generally be conducted according to methods described by Pope et al. (2009) and all predators captured will be identified to species, measured (total length) and weighed, then released near the location of capture. Although prior Tuolumne River studies have documented the inefficacy of snorkeling in deeper pool habitats (McBain & Trush and Stillwater Sciences 1999; Stillwater Sciences 2009), if selected, snorkeling will be conducted during the day using established observation methods (Dolloff et al. 1996). Predators observed during snorkeling will be identified to species and total length will be estimated to the nearest 10 millimeters (mm).

Step 3 – Analysis. Data collected in Step 2 using each method or combination of methods will be used to estimate relative abundance of each predator species at each site and for each habitat type. Absolute predator abundance in electrofished units will be estimated using the multiple-pass electrofishing depletion method (Moran 1951, Zippin 1956). From the abundance estimates, two population densities can be computed for each site: (1) a linear density based on the bank length of the site sampled and (2) an areal density based on the total area of the sample site (including any pelagic areas not sampled). In the absence of electrofishing, abundance estimates in slow-water habitats will be limited to relative abundance based on data from gill netting and direct snorkel observation. Comparisons of density and relative abundance estimates with results from prior studies will illustrate changes in predator populations and the current potential for effects on juvenile salmonid populations in the lower Tuolumne River. A discussion of the comparability of the resulting estimates from differing observational/sampling methods will be included as necessary as well as a discussion of inter-annual variability documented in previous restoration project monitoring (e.g., McBain & Trush and Stillwater Sciences 2006, Appendix A for SRP 9 monitoring conducted in 1998, 1999, and 2003).

Step 4 – Prepare Report. The Districts will prepare a study task report that includes the following sections: (1) Study Goals, (2) Methods and Analysis, (3) Results, (4) Discussion, and (5) Conclusions. The report will contain relevant summary data, tables and graphs as well as GIS-based maps of sampled habitats.

5.3.2 Predation Rate

Step 1 – Study Design and Permitting. The study task is designed to collect data on predation rate by fish within specific habitat types during the Chinook salmon rearing and outmigration period and stomach contents examined to determine the rate of predation on juvenile salmon. Approximately twelve study sites will be selected from slow-water habitat locations (pools, SRPs) and fast-water habitats (primarily runs), which provide preferred habitat for largemouth bass and smallmouth bass, respectively (TID/MID 1992, McBain & Trush and Stillwater Sciences 2006). Two survey events will be conducted, approximately one-month apart during the Chinook salmon outmigration period (Feb–May) with the goal of documenting the magnitude of predation on juvenile Chinook salmon.

Because completion of the study task as described in this Proposal is contingent upon permit approval by CDFG and inquiries will be made well in advance of the proposed studies for approval. In the event permits are not granted, the Districts will make a good faith effort to modify study designs, if possible, to comply with permit conditions and proceed with the study.

Step 2 – Data Collection. Predator sampling will take place when sufficient numbers of Chinook salmon juveniles are likely to be present, but when water temperature is warm enough to facilitate active feeding by predators. Water temperature data will be obtained by deployment of a continuously recording thermograph at each study site, whereas turbidity will be recorded at the time of sampling at each study site. Salmon catch data from the ongoing rotary screw trap and seine surveys will be used to provide an index of the size of the potential prey population (i.e., outmigrant salmon) during the predation study period. The exact timing of the study will be adjusted in response to river flow, turbidity, and other environmental conditions to maximize the efficiency of predator capture as well as to avoid flood flow conditions.

Hook and line sampling (angling) will be used to capture predators in each habitat type. Sampling will be conducted by three crews, each composed of a local fishing guide or local experienced angler and one biologist. The three crews will sample approximately one-day at each study site, including crepuscular (low light) periods around dawn and dusk, when feeding activity is generally at its peak (Moyle 2002). The sampling goal for each study site will be to capture 5–10 individuals of each species present for stomach content analysis. Although 180 mm total length [TL] has been previously identified as the lower size limit for likely salmon predators (TID/MID 1992), using a lower size limit of 150 mm will serve as a validation of these results.

Field crews will mark the location of each predator caught on orthorectified color aerial photographs and record the position of each catch using a handheld GPS unit to help determine spatial distribution and habitat use (i.e., thalweg, channel margin, floodplain). Stomach lavage or, if necessary, removal of the stomach, will be used to recover stomach contents from all predators >150 mm TL. Stomach contents will be preserved in 70% ethanol, marked with predator species, predator length, capture location, and date/time, and transported to the laboratory for examination.

Step 3 – Analysis. In the laboratory, all identifiable prey items found in predator stomachs will be classified (i.e., fish, insect, crustacean, etc.) and enumerated. Fish found in predator stomachs will be identified to species when possible, and intact fish will be measured. The number of Chinook salmon consumed will be used together with water temperature data and published information on gastric evacuation rate to calculate a predation rate (e.g., number of salmon consumed per day) for each predator. The resulting data will be used to identify differences in predation rates among predator species and habitat types, and in relation to river flow, turbidity, and other environmental conditions.

Predation rates will be compared to observed juvenile salmon monitoring data (e.g., rotary screw-trap and seine data) as well as in comparison to rates from prior Tuolumne River studies (e.g., TID/MID 1992). Comparison of results with data from prior Tuolumne River studies will provide a basis to evaluate the magnitude of current vs. prior predation effects on juvenile salmonid populations in the lower Tuolumne River.

Step 4 – Prepare Report. The Districts will prepare a study task report that includes the following sections: (1) Study Goals, (2) Methods and Analysis, (3) Results, (4) Discussion, and (5) Conclusions. The report will contain relevant summary data, tables and graphs as well as GIS-based maps.

5.3.3 Predator Movement Tracking

Step 1 – Study Design and Permitting. The study is designed to collect data on predator habitat use and movement in response to water velocities and water temperatures occurring at available study flows. The study will identify locations of predators in the channel and, if possible the floodplain, to indicate the effectiveness of high flows in separating salmonid smolts and their predators. Two pool and two riffle sites will be selected based upon the presence and habitat use by predators during the Chinook salmon outmigration period (late March to early May). Both fixed station and mobile tracking of acoustic tagged predators and juvenile Chinook salmon will be carried out at flows intended to facilitate differential habitat use in these, as described below.

Based upon 2D hydraulic modeling conducted as part of the SRP 9 Project (Stillwater Sciences and McBain & Trush 2006), differential habitat use between Chinook salmon and predator fish was estimated to occur at flows in the vicinity of 300 cfs for riffle habitats and 2,000 cfs at in-channel mining pits. In this study, monitoring of riffle habitat locations will target two flow ranges: 1) < 300 cfs will correspond to velocities allowing unrestricted predator movement, and 2) tracking at flows > 300 cfs will correspond to mid-channel velocities greater than those preferred by primary predator species such as largemouth and smallmouth bass. Monitoring of unrestored mining pit (SRP) habitats will target flows in the range of 300 cfs (low velocity) and higher flows (> 2,000 cfs) to examine predator habitat use in pool habitats. Study flows will be provided for up to 5 consecutive calendar days at each flow. The high flow will be provided in conjunction with Vernalis Adaptive Management Program study flows and/or flood management flows, as available through spring 2013.

Because completion of the study as described in this Proposal is contingent upon permit approval by CDFG, permit inquiries and requests will be made well in advance of the proposed studies to allow permit processing and approval. In the event permits are not granted, the Districts will make a good faith effort to modify study designs, if possible, to comply with permit conditions and proceed with the study.

Step 2 – Data Collection. Hook and line sampling will be used to capture up to ten piscivore-sized predators (> 150 mm Fork Length [FL]) at each of the study sites, with five predator fish selected for tagging with acoustic transmitters for subsequent assessment of velocity-driven and temperature-driven spatial distribution and habitat use. The crew will consist of a local fishing guide and one biologist. The fishing guide will be consulted to determine the most effective tackle and methods for catching predators in the Tuolumne River. If feasible, a lure that mimics a juvenile Chinook salmon will be used for hook and line sampling. Each predator fish captured will be tagged using an externally fitted transmitter with an expected battery life >60 day and will be held for up to 24 hours and monitored to ensure proper recovery and tag operation before being released in the same habitat unit where they were captured. In addition to predator fish, up to 60 hatchery reared Chinook salmon will be fitted with acoustic tags, with three release groups of 20 fish planned to examine habitat use at each of the identified study flows.

Following release of study fish at each flow, a combination of fixed and mobile receivers will be used to document juvenile Chinook salmon and predator movement patterns. Fixed receivers will be established at locations upstream and downstream of the selected study riffles to document fish passage and any movement occurring due to changes in river flows or water temperature. In pool habitats, fixed arrays will be established to allow 2D tracking of fish movement. Mobile tracking will be used within riffle habitats and inundated floodplain habitat depending upon flows and access. Locations of individual fish or fish tracks will be established by triangulation techniques for mapping in GIS. Water depth and velocity will be developed through a combination of standard methods using a Marsh-McBirney Flo-Mate (Hach Corporation, Frederick, MD) with top-setting rod, and by use of acoustic Doppler current profiler (ADCP) in deeper habitats.

Water temperature during sampling will be recorded with continuous recording thermographs installed at each site. Tidbits (Onset Corp., Bourne, MA) will be secured to the river bed or bank at each site one day prior to sampling to provide ambient temperature data necessary for determination of gastric evacuation rate. If feasible, thermographs will be installed at near-shore (i.e., floodplain) and mid-channel locations at each site to record potential differences in water temperature between these habitat types. Thermographs will be removed when sampling is completed and returned to the laboratory for data download and analysis.

Step 3 – Analysis. To relate habitat use of predators to river flow and water temperature, habitat use and movement patterns of predator fish will be assessed and comparisons made between varying flow levels and water temperatures in each habitat type sampled. River flow data from the U.S. Geological Survey stream gage near La Grange (upstream of the study area) will be used to calculate minimum, maximum, and mean daily flow for the study period. Predator tracking results will also be compared with sampling and tracking data from prior Tuolumne River studies (McBain & Trush and Stillwater Sciences 1999, 2006; Stillwater Sciences and McBain & Trush 2006) as well as predator and salmon habitat suitability information from literature sources.

Step 4 – Prepare Report. The Districts will prepare a task report that includes the following sections: (1) Study Goals, (2) Methods and Analysis, (3) Results, (4) Discussion, and (5) Conclusions. The report will contain relevant summary data, tables and graphs as well as GIS-based maps.

6.0 Schedule

The Districts anticipate the schedule to complete the study proposal as follows assuming FERC issues its Study Plan Determination by December 31, 2011 and the study is not disputed by a mandatory conditioning agency:

- Study Design and Permitting ....January – February 2012
- Field Data Collection (Predator Abundance) ....July 2012 – September 2012
- Field Data Collection (Predation Rate) ....March 2012 – May 2012
- Field Data Collection (Predator Tracking) ....March 2012 – May 2012
- Data Entry, QA/QC, & Analysis ....June 2012 – September 2012
- Report Preparation ....September – December 2012
- Report Issuance ....January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

Sampling methods proposed for the Predation study tasks are generally accepted and commonly used methods for scientific sampling as noted in sections above for electrofishing (e.g., Reynolds 1996; NMFS 2000), gill netting (e.g., Pope et al. 2009) and snorkeling (Dolloff et al. 1996).

8.0 Deliverables

In addition to GIS-based maps, the Districts will prepare a report, which will document the methodology and results of the study tasks.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

Baltz, D.M., and P.B. Moyle. 1993. Invasion resistance to introduced species by a native assemblage of California stream fishes. Ecological Applications 3(2):246-255.

Brown, L.R. 2000. Fish communities and their associations with environmental variables, lower San Joaquin River drainage, California. Environmental Biology of Fishes 57:251-269.

Brown, L.R., and T. Ford. 2002. Effects of flow on the fish communities of a regulated California river: implications for managing native fishes. River Research and Applications 18:331-342.

Brown, L.R., and P.B. Moyle. 1997. Invading species in the Eel River, California: successes, failures, and relationships with resident species. Environmental Biology of Fishes 49: 271-291.

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

Marchetti, M.P., and P.B. Moyle. 2001. Effects of flow regime on fish assemblages in a regulated California stream. Ecological Applications 11:530-539.

McBain & Trush and Stillwater Sciences. 1999. Tuolumne River restoration project monitoring: Special Run Pools 9/10 and gravel mining reach 7/11 phase, Prepared for Tuolumne River Technical Advisory Committee, U. S. Fish and Wildlife Service Anadromous Fish Restoration Program, and CALFED Ecosystem Restoration Program, by McBain & Trush, Arcata and Stillwater Sciences, Berkeley, CA.

McBain & Trush and Stillwater Sciences. 2006. Special Run Pool 9 and 7/11 Reach: post-project monitoring synthesis report. Prepared for the Tuolumne River Technical Advisory Committee, Turlock and Modesto Irrigation Districts, USFWS Anadromous Fish

Restoration Program, and California Bay-Delta Authority, by McBain & Trush, Arcata and Stillwater Sciences, Berkeley, CA.

Moran, P.A.P. 1951. A mathematical theory of animal trapping. Biometrika 74: 307-311.

Moyle, P.B. (ed.). 2002. Inland Fishes of California. Berkeley, CA: University of California Press.

Pope, K.L., R.M. Neumann, and S.D. Bryan. 2009. Warmwater fish in small standing waters. Pages 13-27 in S.A. Bonar, W.A. Hubert, and D.W. Willis, editors. Standard methods for sampling North American freshwater fishes. American Fisheries Society, Bethesda, Maryland

Reynolds, J.B. 1996. Electrofishing. Pages 83-120 in B.R. Murphy and D.W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Reynolds, F.L., Mills, T.J., Benthin, R., and A. Low. 1993. Restoring Central Valley streams: a plan for action. Inland Fisheries Div., Calif. Dept. of Fish and Game. Sacramento CA. 184 p.

Stillwater Sciences. 2009. March and July 2009 population size estimates of *Oncorhynchus mykiss* in the lower Tuolumne River. Prepared by Stillwater Sciences, Berkeley, California for Turlock Irrigation District and Modesto Irrigation District.

Stillwater Sciences and McBain & Trush. 2006. Lower Tuolumne River Predation Assessment Final Report. Prepared for the Tuolumne River Technical Advisory Committee, Turlock and Modesto Irrigation Districts, USFWS Anadromous Fish Restoration Program, and California Bay-Delta Authority, by Stillwater Sciences, Berkeley, CA and McBain & Trush, Arcata, CA.

Turlock Irrigation District and Modesto Irrigation District (TID/MID). 1992. Lower Tuolumne River Predation Study Report. Appendix 22 to Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 39 of the License for the Don Pedro Project, No. 2299 Vol. VII. Prepared by T. Ford, Turlock and Modesto Irrigation Districts and EA Engineering, Science, and Technology, Lafayette, California.

U.S. Department of Commerce, National Marine Fisheries Service (NMFS). 2000. Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act. National Marine Fisheries Service. June. Available online at: <http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/4d-Rules/upload/electro2000.pdf>.

_____. 2009. Public Draft Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook salmon and Central Valley Spring-Run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead. Available online at: <http://swr.nmfs.noaa.gov/recovery/centralvalleyplan.htm>.

U.S. Department of Interior, Fish and Wildlife Service (USFWS). 2001. Final restoration plan for the Anadromous Fish Restoration Program. A Plan to increase Natural Production of Anadromous Fish in the Central Valley of California. Report of the Anadromous Fish Restoration Program Core Group, Central Valley Project Improvement Act to the Secretary of the Interior. Stockton, CA.

Zippin, C. 1956. An evaluation of the removal method of estimating animal populations. Biometrics 12: 163-189.

STUDY PLAN W&AR-8

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Salmonid Redd Mapping Study Plan

July 2011

Related Study Requests: CCSF-02, CDFG-05, SWRCB-02

1.0 Project Nexus

The continued operation and maintenance (O&M) of the Don Pedro Project (Project) may contribute to cumulative effects on the supply and recruitment of spawning-sized gravels downstream of La Grange Dam which may potentially effect spawning gravel availability and redd distribution of Chinook salmon (*Oncorhynchus tshawytscha*) and *O. mykiss*.

2.0 Resource Agency Management Goals

The Districts believe that four agencies have resource management goals related to Chinook salmon and/or their habitat: (1) U.S. Department of Interior, Fish and Wildlife Service (USFWS); (2) U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS); (3) California Department of Fish and Game (CDFG); and (4) State Water Resources Control Board, Division of Water Rights (SWRCB).

A goal of the USFWS (2001) Anadromous Fish Restoration Program, as stated in Section 3406(b)(1) of the Central Valley Project Improvement Act, is to double the long-term production of anadromous fish in California's Central Valley rivers and streams. Objectives in meeting this long-term goal include: (1) improve habitat for all life stages of anadromous fish through provision of flows of suitable quality, quantity, and timing, and improved physical habitat; (2) improve survival rates by reducing or eliminating entrainment of juveniles at diversions; (3) improve the opportunity for adult fish to reach spawning habitats in a timely manner; (4) collect fish population, health, and habitat data to facilitate evaluation of restoration actions; (5) integrate habitat restoration efforts with harvest and hatchery management; and (6) involve partners in the implementation and evaluation of restoration actions.

NMFS has developed Resource Management Goals and Objectives for species listed under the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §1801 et seq.) and the Endangered Species Act (ESA) (16 U.S.C. §1531 et seq.), as well as anadromous species that are not currently listed but may require listing in the future. NMFS' (2009) Public Draft Recovery Plan for Sacramento River Winter-run Chinook salmon, Central Valley Spring-run Chinook salmon, and Central Valley steelhead outlines the framework for the recovery of ESA-listed species and populations in California's Central Valley. For Central Valley steelhead, the relevant recovery actions identified for the Tuolumne River are to: (1) conduct habitat evaluations; and (2) manage cold water pools behind La Grange and Don Pedro dams to provide suitable water temperatures for all downstream life stages. For Central Valley fall/late fall-run Chinook, the relevant goals are to enhance the Essential Fish Habitat downstream of the Project and achieve a viable population of Central Valley fall/late fall-run Chinook salmon in the Tuolumne River.

CDFG's mission is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. CDFG's resource management goals, as summarized in restoration planning documents such as "Restoring Central Valley Streams: A Plan for Action" (Reynolds et al. 1993), are to restore and protect California's aquatic ecosystems that support fish and wildlife, and to protect threatened and endangered species under California Fish and Game Code (Sections 6920–6924).

SWRCB has responsibility under the federal Clean Water Act (33 U.S.C. §11251–1357) to preserve and maintain the chemical, physical and biological integrity of the State's waters and to protect water quality and the beneficial uses of stream reaches consistent with Section 401 of the federal Clean Water Act, the Regional Water Quality Control Board Basin Plans, State Water Board regulations, the California Environmental Quality Act, and any other applicable state law.

3.0 Study Goals

The salmonid redd mapping study will document the spatial distribution of Chinook salmon and *O. mykiss* redds and redd superimposition as a means of quantifying the current spawning capacity and redd/recruit relationships of the Tuolumne River. Specific information obtained by this study will:

- Identify locations of Chinook salmon and *O. mykiss* spawning redds.
- Document whether salmon production is limited by redd superimposition at current spawning population levels, and
- Document locations and characteristics of *O. mykiss* redds.

4.0 Existing Information and Need For Additional Information

Fall-run Chinook salmon spawning surveys have been conducted on the Tuolumne River by CDFG since 1971 as required under the terms of the Don Pedro Project license. Up to 26 river miles (RM) below the La Grange Dam (RM 52) were surveyed annually in weekly float surveys, typically in the October–December period. Weekly live salmon and redd counts were recorded by riffles or riffle reaches and summarized by river reaches. These redd counts show the spawning activity was usually concentrated in the upper 5 river miles, upstream of Basso Bridge (RM 47.5), with redd superimposition by later arriving spawners reported to occur at higher Chinook salmon escapement levels (TID/MID 1992). The Districts conducted a study of redd superimposition and its effects on the salmon population in the Tuolumne River in the late 1980s/early 1990s (TID/MID 1992). The Districts conducted a study to evaluate the availability of spawning habitat and distribution of redds from aerial photographs, studied five riffles intensively to determine the location and timing of redd construction and superimposition, and developed a model of spawning gravel utilization to estimate egg loss as a function of the number of spawners and the amount of available gravel (TID/MID 1992). The model predicts increases in production that would occur if superimposition were prevented. The study suggested that redd superimposition had the potential to increase egg mortality during years of high escapement when there is increased competition for spawning habitat (TID/MID 2005). The apparent changes in spawner preferences for upstream riffles documented in the decade since the 1997 floods (TID/MID 2005) may have increased the potential for redd superimposition to occur at lower escapement levels.

Although CDFG conducted on-the-ground redd mapping surveys in 1998 and 1999 (TID/MID 2005) and recent redd mapping has been conducted during 2009 and 2010 in conjunction with counting weir operations (FISHBIO, *unpublished data*), there is a need for an up-to-date assessment of actual spawning habitat use by Chinook salmon and potential superimposition that may be occurring at current escapement levels. In addition, no detailed surveys of *O. mykiss* spawning have been conducted on the Tuolumne River to date. This proposed study plan updates prior redd mapping with current surveys to improve estimates of suitable spawning areas as part of interrelated relicensing studies.: CDFG did conduct an intensive on-the-ground redd count study in 1998 and 1999 to calibrate redd counts recorded during the regular spawning surveys conducted by boat. Calibration counts were conducted during three weeks of the spawning season in a stratified random sample of spawning riffles. Intensive redd counts were conducted by walking the areas and mapping the individual redd locations. In heavily used riffles, the calibration counts were often over three times higher than the regular counts taken from the weekly boat surveys (TID/MID 2005), suggesting the need for additional on-the-ground surveys.

5.0 Study Methods

The salmonid redd mapping study will update prior Chinook salmon redd mapping data with current redd mapping to document Chinook salmon and *O. mykiss* redd construction distribution patterns and also to document any redd superimposition that may be occurring. The study approach will be based on actual field observation.

5.1 Study Area

The study area includes the Tuolumne River from the La Grange Dam (RM 52) downstream to RM 29, which captures Chinook salmon spawning activity in riffles documented in recent annual spawner surveys conducted by CDFG.

5.2 General Concepts

The following general concepts apply to the conduct of field work:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study report.

5.3 Study Methods

The study will be developed in the following steps.

Step 1 – Compile Data from Previously Conducted Studies. Information from previously conducted redd count surveys (e.g., CDFG 2009) and prior redd mapping will be summarized to provide a comprehensive, spatially explicit inventory and to identify data gaps in documentation of existing conditions. Base maps of spawning gravel areas will be compiled within GIS from recent areal photography as well as the concurrent *Spawning gravel study*. Depending upon data availability, mapped redd locations in previous surveys will be included as layers on the base maps (e.g., 1998, 1999, 2009, and 2010) to provide a basis for additional data collection (Step 2) and analysis (Step 3).

Step 2 – Collect New Data. Study reach extent and survey riffles will be determined using recent CDFG survey results. In the riffles where CDFG documented redd construction, intensive field surveys will be conducted. If during the surveys additional riffles with redds beyond those identified by CDFG are located, these will be added to the survey. Surveys will generally follow Gallagher et al. (2009) and will be conducted monthly from November through March. All redds will be identified for species use, measured, and geo-referenced. Whether redds were constructed by Chinook salmon or *O. mykiss* will be determined by:

- Redd construction timing: Chinook salmon typically construct redds between November–January, while anadromous *O. mykiss* typically spawn in January–March.
- Redd location: Chinook salmon usually construct redds in the middle of a riffle, while *O. mykiss* redds are usually nearer cover such as cut banks and overhanging trees).
- Redd protection: Chinook salmon generally defend their redds for 1-2 weeks after being built, while *O. mykiss* do not. Monitoring frequency may not allow reliable species association to be determination by this observation.
- Gravel size: Chinook salmon construct redds in larger gravel sizes than *O. mykiss*.
- Redd size: Chinook salmon redds are larger than *O. mykiss* redds.

During redd count surveys, individual redds will be counted, marked, and uniquely labeled on data forms and in the field to avoid double counting and to allow estimation of observer efficiency (Gallagher et al. 2009). The date each redd was first observed, fish species, unique identifier number, and location will be recorded on the data form. Redds will be marked in the field using painted rocks, with the location determined by GPS and mapped on georeferenced aerial photographs for reference during future surveys. Redds under construction will be noted as such and reexamined on consecutive surveys and classified appropriately based on their apparent completion.

For every marked redd, a set of measurements will be made to establish its overall size, identify the area most likely to contain egg pockets, and characterize the hydrological conditions associated with it. The upstream and downstream edges of the redd will be defined as the place where the gravel is no longer visibly worked or where it conforms to the surrounding substrate. Three separate length measurements, a width measurement, and the depth and velocity of the water at the leading edge of the pit will be recorded. Lastly, the median grain-size of each redd will be estimated and any evidence of superimposition since the previous survey will be documented.

Step 3 – Analysis and Modeling. Using data collected in Steps 1 and 2, the number of Chinook salmon and *O. mykiss* redds will be calculated and mapped by riffle and reach within the Study Area. Summary statistics of Chinook salmon and *O. mykiss* redd characteristics will be calculated (e.g., dimensions and grain-size). Differences in Chinook salmon and *O. mykiss* redd distribution patterns will be described and mapped. Evidence and the degree of redd superimposition will be documented to estimate potential recruitment impact of the observed red superimposition for use in the interrelated *Tuolumne River Chinook Salmon Population Model* (Study Plan W&AR-6) and *O. mykiss Population Study* (Study Plan W&AR-10). Additionally, microhabitat conditions at the redd sites will be compared to habitat suitability criteria being used for the related lower *Tuolumne River Instream Flow Study*[1].

Step 4 – Prepare Report. The Districts will prepare a report that includes the following sections: (1) Study Goals, (2) Methods and Analysis, (3) Results, (4) Discussion, and (5) Conclusions. The report will contain relevant summary data, tables and graphs as well as GIS-based maps of redds.

6.0 Schedule

The Districts anticipate the schedule to complete the study proposal as follows assuming FERC issues its Study Plan Determination by December 31, 2011, and the study is not disputed by a mandatory conditioning agency.

- Planning/Pre-field Arrangements (Step 1)..January 2012
- Field Work (Step 2) ....November 2012 – March 2013
- Data Entry, QA/QC, and Analysis (Step 3) ....April – May 2013
- Report Preparation (Step 4) ....June – September 2013
- Report Issuance (Step 4)..January 2014

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

Salmonid redd surveys are common to FERC relicensing projects to determine spawning conditions.

8.0 Deliverables

In addition to GIS-based maps of spawning redd locations documented as part of this study, the Districts will prepare a report, which will document the methodology and results of the study.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

[1] The Tuolumne River Instream Flow Study is currently being conducted in accordance with the May 12, 2010 FERC Order Modifying and Approving Instream Flow and Water Temperature Model Study Plans for the Don Pedro Project (Project No. 2299-072), as modified by Ordering Paragraph (A) of the July 21, 2010 FERC Order.

10.0 References

California Department of Fish and Game (CDFG). 2009. Tuolumne River Chinook Salmon Spawning Escapement Survey. Report 2005-2 *In* 2010 Report of Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 39 of the License for the Don Pedro Project, No. 2299. Prepared by California Department of Fish and Game, La Grange, California.

Gallagher, S.P., P.K.J. Hahn, and D.H. Johnson. 2009. Redd counts. American Fisheries Society Protocols 1953: 197-234.

Reynolds, F.L., T.J. Mills, R. Benthin, and A. Low. 1993. Restoring Central Valley streams: a plan for action. Inland Fisheries Div., Calif. Dept. of Fish and Game. Sacramento CA. 184 p.

Turlock Irrigation District and Modesto Irrigation District (TID/MID). 1992. Lower Tuolumne River spawning gravel availability and superimposition Report, Appendix 6. In Report of Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 39 of the License for the Don Pedro Project, No. 2299 Vol. VIII. Prepared by EA Engineering, Science, and Technology, Lafayette, California.

_____. 2005. 2005 Ten Year Summary Report pursuant to Paragraph (G) of the 1996 FERC Order issued July 31, 1996. Report to Federal Energy Regulatory Commission for FERC Project No. 2299-024.

U.S. Department of Commerce, National Marine Fisheries Service (NMFS). 2009. Public Draft Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook salmon and Central Valley Spring-Run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead. Available online at: http://swr.nmfs.noaa.gov/ recovery/centralvalleyplan.htm

U.S. Department of Interior, U.S. Fish and Wildlife Service (USFWS). 2001. Final restoration plan for the Anadromous Fish Restoration Program. A Plan to increase Natural Production of Anadromous Fish in the Central Valley of California. Report of the Anadromous Fish Restoration Program Core Group, Central Valley Project Improvement Act to the Secretary of the Interior. Stockton, CA.

STUDY PLAN W&AR-9

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Chinook Salmon Fry Study Plan

July 2011

Related Study Requests: NMFS-08

1.0 Project Nexus

The continued operation and maintenance of the Don Pedro Project (Project) influences the magnitude and timing of flows in the Lower Tuolumne River which may, in turn, contribute to cumulative effects on the temporal and spatial distribution of Chinook salmon fry. Changes in the temporal and spatial distribution of fry could affect their overall survival potential and ultimately the abundance of Chinook salmon spawned in the lower Tuolumne River.

2.0 Resource Agency Management Goals

The Districts believe that four agencies have resource management goals related to salmonid species and/or their habitat: (1) U.S. Department of Interior, Fish and Wildlife Service (USFWS); (2) U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS); (3) California Department of Fish and Game (CDFG); and (4) State Water Resources Control Board, Division of Water Rights (SWRCB). Each of these agencies and their management direction, as understood by the Districts at this time, is described below.

A goal of the USFWS (2001) Anadromous Fish Restoration Program, as stated in Section 3406(b)(1) of the Central Valley Project Improvement Act, is to double the long-term production of anadromous fish in California's Central Valley rivers and streams. Objectives in meeting this long-term goal include: (1) improve habitat for all life stages of anadromous fish through provision of flows of suitable quality, quantity, and timing, and improved physical habitat; (2) improve survival rates by reducing or eliminating entrainment of juveniles at diversions; (3) improve the opportunity for adult fish to reach spawning habitats in a timely manner; (4) collect fish population, health, and habitat data to facilitate evaluation of restoration actions; (5) integrate habitat restoration efforts with harvest and hatchery management; and (6) involve partners in the implementation and evaluation of restoration actions.

NMFS has developed Resource Management Goals and Objectives for species listed under the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §1801 et seq.) and the Endangered Species Act (ESA) (16 U.S.C. §1531 et seq.), as well as anadromous species that are not currently listed but may require listing in the future. NMFS' (2009) Public Draft Recovery

Plan for Sacramento River Winter-run Chinook salmon, Central Valley Spring-run Chinook salmon, and Central Valley steelhead outlines NMFS' framework for the recovery of ESA-listed species and populations in California's Central Valley. For Central Valley steelhead, the recovery actions identified for the Tuolumne River are to: (1) conduct habitat evaluations; and (2) manage cold water pools behind La Grange and Don Pedro dams to provide suitable water temperatures for all downstream life stages. For Central Valley fall/late fall-run Chinook, the relevant goals are to enhance the Essential Fish Habitat downstream of the Project and achieve a viable population of Central Valley fall/late fall-run Chinook salmon in the Tuolumne River.

CDFG's mission is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. CDFG's resource management goals, as summarized in restoration planning documents such as "Restoring Central Valley Streams: A Plan for Action" (Reynolds et al. 1993), are to restore and protect California's aquatic ecosystems that support fish and wildlife, and to protect threatened and endangered species under California Fish and Game Code (Sections 6920-6924).

SWRCB has responsibility under the federal Clean Water Act (33 U.S.C. §11251-1357) to preserve and maintain the chemical, physical and biological integrity of the State's waters and to protect water quality and the beneficial uses of stream reaches consistent with Section 401 of the federal Clean Water Act, the Regional Water Quality Control Board Basin Plans, State Water Board regulations, the California Environmental Quality Act, and any other applicable state law.

3.0 Study Goals

The Chinook salmon fry study will examine the influence of flow modifications on emigration of fry from the Lower Tuolumne River during the early stages of fry rearing Surveys of fry emigration and distribution indicate that fry survival to emigration in the Tuolumne River may be reduced, especially during below normal water years. The abundance of fry estimated to leave the river and the proportion of fry to larger juvenile emigrants varies relative to those conditions observed in other Central Valley streams where Chinook salmon adult escapement estimates are substantially higher. Specific information obtained by this study will update information from prior studies in order to:

- Evaluate the opportunity to induce fry emigration by altering flows
- Evaluate the potential benefits and costs of inducing fry to emigrate early in the rearing period potentially within below normal water years.

4.0 Existing Information and Need For Additional Information

Upon emergence from spawning beds, juvenile salmonid fry begin foraging for food and seek cover in areas of reduced flow or move downstream (Healy 1991). A large downstream movement of Chinook salmon fry shortly after emergence is typical of most fall-run Chinook salmon populations in the Central Valley (Moyle 2000). Most emigrating salmon in the Central Valley begin their downstream movement when less than 50 mm fork length, (Erkkila et al. 1950, Hatton 1940, Hatton and Clark 1942, Willis 1920, Rutter 1902). Seaward migrating fry appear to disperse once they reach the upper reaches of the Delta with some moving into the estuary.

Based on their investigations and results of previous studies conducted prior to the Central Valley Project, Erkkila and others (1950) observed that young stages of anadromous fishes were found in Delta waters in all months of the year. Chinook salmon were dominant from February through May, with peak numbers of fry-sized salmon (35-45 mm fork length FL) occurring in March. Beginning in April, larger-sized juveniles, (50-70 mm FL) appeared. Large numbers of salmon remained in the Delta to the middle of July. Chinook salmon fry entered the Delta from Sacramento River through Georgiana Slough, Three Mile Slough, and, by tidal action, up the mouth of San Joaquin River. They distributed themselves throughout the Delta. Juvenile Chinook salmon entered the Delta from San Joaquin River principally through the channels of Middle River, Old River, and Grant Line Canal, all of which converge on the southwest corner of the Delta. Their dispersal from this point was quite uniform and seemed to follow a definite seaward movement.

It was observed that the early life stages of salmon occurred in abundance in relation to water volume, and it was further observed that populations of fish tended to pile up in large open-water areas most susceptible to tidal action. As a corollary to this principle, evidence was obtained to show that distribution was in proportion to flow. Kjelson et al. (1981) observed that peak catches of Chinook fry in the Sacramento-San Joaquin Delta often followed flow increases and speculated that flow surges influence the numbers of fry that migrate from the upper river spawning grounds to the Delta (CDFG 2010). Healey (2001) also observed that downstream juvenile movement correlates to river flow. Juvenile fall-run Chinook salmon out-migration monitoring in the San Joaquin River tributaries also indicates that fry movement is stimulated by changes in flows in the February and March time frame.

Considering the historical extent of floodplain inundation in the San Joaquin system, and the expanse of Tule marsh along the San Joaquin River prior to land development, it is likely that juvenile Chinook salmon reared on inundated floodplains in the San Joaquin River and its tributaries in the lower reaches where larger numbers and higher growth rates increased survival potential (CDFG 2011). Sommer et al. (2001) found higher growth and survival rates of Chinook salmon juveniles reared on the Yolo Bypass compared with those in the mainstem Sacramento River. Moyle (2007) observed similar results on the Cosumnes River floodplain. Drifting invertebrates, the primary prey of juvenile salmonids, were more abundant on the inundated Yolo Bypass floodplain than in the adjacent Sacramento River (Sommer et al. 2001).

In contrast, the natal stream reaches versus floodplain and the Delta provide reduced rearing capacity and possibly reduced growth potential due to differences in temperature and food availability. In the Tuolumne River, the natal rearing capacity of the natal reaches has been diminished by a variety of actions including flood control, gold mining, gravel mining, flow regulation, and adjacent land use. Predator population densities are reportedly very high potentially yielding an overall reduction in survival potential for fry that remain within the natal stream area.

Flow modifications, or ramping flows, have been associated with increased emigration of juvenile Chinook salmon (Demko and Cramer 1995, 2000). The mechanism that encourages migration may vary depending upon the local conditions. Snider and Titus (2001) observed increased emigration in the lower American River to be related to decreasing flow and that increased flow encouraged lateral movement, to floodplains, rather than longitudinal movement out of the river. Similar relationships have been noted in the Stanislaus River (M. Palmer, FISHBIO, pers. comm. 2011). Erikkla et al. (1950) observed emigration from the San Joaquin River to correspond with reduced flows. Temperature, turbidity, season, fish size, density – all have been considered cues to seaward emigration (Williams 2008).

It is reported that historically, salmon fry reared in high numbers in the lower river reaches and Delta where they would grow to become smolts then leave for the ocean. Accordingly, a smaller proportion of juvenile salmon remained in the natal stream reaches before emigrating, some of which were smolt-sized fish that left as late as June and July. The contribution of these different life history strategies to production of adult salmon likely varied with a myriad of conditions, including dry water year conditions when flow and temperature in the lower river and Delta in the late spring were poorly suited for salmon survival to the ocean. It is likely that during dry water years, opportunity to successfully emigrate to and rear in the Delta is limited to fry emigration in the early season. Flow modifications that would encourage fry to migrate from their natal reaches during such dry years could increase their survival potential. Understanding the disposition of induced emigrating fry would help identify any benefits of induced migration.

5.0 Study Methods

5.1 Study Area

The study area includes the Tuolumne River from the upper rotary screw trap (RST) location at River Mile [RM] 29.8) to the existing downstream RST location at RM 5.2.

5.2 General Concepts

The following general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner and study methodology will be modified appropriately to ensure safety..
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study report.

5.3 Study Methods

The study will be conducted in steps. The first step is to compile and analyze information collected on emigration in the lower Tuolumne River to determine the appropriate magnitude, timing, and duration of the flow modification. The evaluation will involve increasing then decreasing flows within a short, (e.g., three to five-day period), within a short period following peak emergence, to stimulate movement of fry when fry density is greatest. The study will also involve marking and recapturing fish to monitor the response of Chinook salmon fry to the flow modifications. The primary method for capturing emigrating fish will be rotary screw traps currently operated at RM 29.8 and RM 5.2 Several spot checks will be made between the traps and downstream of the trap to potentially refine disbursement of marked fry within the river.

The study will be conducted using the following steps.

Step 1 – Compile Data from Previously Conducted Studies. Information from previously conducted Chinook salmon spawning and emigration studies (e.g., TID/MID 2010, 2011), will be obtained and evaluated to identify potential relationships among flow change conditions and fry emigration to identify potential conditions of flow modification to be used to encourage fry emigration. These information will also be used to identify any relationship among spawning timing, determined from Chinook salmon adult migration surveys, redd surveys, and escapement surveys, and emergence and temporal distribution and abundance of fry. This information will be used to identify the appropriate timing of the modified flow relative to peak of fry abundance.

Step 2 – Collect New Data. The magnitude, timing, and duration of the flow modification will be implemented based on the results of Step 1. The response of the flow modification will be evaluated by acquiring data on the magnitude, timing, composition, and condition of the migrating populations. These data will be collected at the upstream and downstream trapping locations before, during, and after the flow modification. Ongoing emigration monitoring on the Tuolumne River will be used to assist in collecting data on response to flow modifications. Routine sampling protocols currently being used at the two trapping locations (Sonke et al. 2010) will provide the required information.

Additional information will be acquired to determine the travel time and overall temporal distribution of the induced fry emigration, and relative survival during and outside the flow modification, using a mark and recapture approach.

This study element would utilize fish marking to measure transport timing and survival from the upper to the lower river before, during, and after flow modification. Fry collected at the upper trapping site (RM 29.8) will be marked then released. When recaptured at downstream trapping location (RM 5.2), information on each observed marked fish would be recorded. All salmon collected at the upper location will be marked using Bismarck brown, an external mass marking technique that will allow trap technicians to readily identify marked fish when collected at the downstream trapping location. Additionally, subsamples of each release group will be sorted with an narrow size range (e.g., ±3 mm) with each group marked with unique colors using pan jet marking on specific fins to provide information on transport timing between release locations and recapture locations as well as estimates of growth rates. The uniquely marked fish will allow for improved estimates of numbers of recaptured fish.

The ongoing seine surveys will be expanded to include up to two additional sample sites between the two RSTs. Seining will be conducted using the current protocols. The purpose of the seining is to determine distribution at time between the two traps.

Step 3 – Analysis. Using data collected in Steps 1 and 2, the response of Chinook salmon to the flow modification will be summarized by time frame (i.e., prior, during and after flow modification). Individual fish transport times in relation to environmental variables will be determined as well as estimates of growth rates. Summary of magnitude, composition, and condition will be compared among the three time frames to identify changes in those attributes relative to the flow modification

A literature search will also be conducted to address the pros and cons of encouraging juvenile Chinook salmon to emigrate predominantly as fry. The research would compile and analyze data on emigration trends in Central Valley streams, delta salmonid monitoring results, and available information on delta rearing conditions under varying water year types. Such information would help reduce uncertainties regarding the utility of inducing fry emigration.

Step 4 – Prepare Report. The Districts will prepare a report that includes the following sections: (1) Study Goals, (2) Methods and Analysis, (3) Results, (4) Discussion, and (5) Conclusions.

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC issues its Study Plan Determination by December 31, 2011, and the study is not disputed by a mandatory conditioning agency:

- Existing Data Compilation .... November 2011 – January 2012
- New Data Collection ....December 2011 – March 2013
- Data Entry, QA/QC, and Analysis ....April 2013 – June 2013
- Report Preparation .... June 2013 – September 2013
- Report Issuance... January 2014

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

The methods used to monitor response to the flow fluctuations are consistent with the protocols developed by the US FWS (1997, 2008) and methods being used in other similar investigations within the Central Valley.

8.0 Deliverables

The Districts will prepare a report, which will document the methodology and results of the study.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

Brandes, P.L., and J.S. McLain. 2001. Juvenile Chinook Salmon Abundance, Distribution, and Survival in the Sacramento-San Joaquin Estuary, Department of Fish and Game Fish Bulletin 179: Contributions to the Biology of Central Valley Salmonids Volume 2. 2001.

California Department of Fish and Game. 2010. Flows Needed in the Delta to Restore Anadromous Salmonid Passage from the San Joaquin River at Vernalis to Chipps Island. Prepared for the Informational Proceeding to Develop Flow Criteria for the Delta Ecosystem Necessary to Protect Public Trust Resources Before the State Water Resources Control Board March 22, 2010. Exhibit DFG 3.

Demko, D.B. and S.P. Cramer. 2000. Effects of pulse flows on juvenile chinook migration in the Stanislaus River. Annual Report for 1999. Prepared by S.P. Cramer & Associates, Inc. for Oakdale Irrigation District, Oakdale, CA, and South San Joaquin Irrigation District, Manteca, CA.

_____. 1995. Effects of pulse flows on juvenile chinook migration in the Stanislaus River. Annual Report for 1995. Prepared by S.P. Cramer & Associates, Inc. for Oakdale Irrigation District, Oakdale, CA, and South San Joaquin Irrigation District, Manteca, CA.

Erkkila,L.F, J.W. Moffett, B., O.B. Cope, B.R. Smith, and R.S. Nielson 1950. Sacramento-San Joaquin Delta Fishery Resources: Effects of Tracy Pumping Plant and Delta Cross Channel United States Department of the Interior, Oscar L. Chapman, Secretary, Fish and Wildlife Service, Albert.M Day, Director. Special Scientific Report – Fisheries No. 56.

Hatton, R.S. 1940 Progress Report of Central Valley Fishery Investigations, 1939, California Fish and Game, Vol.26, No. 4, pp. 33^-373.

Hatton, R.S and G.H. Clark.1942. A Second Progress Report on the Central Valley Fisheries Investigation, California Fish & Game, Vol. No. 28, No. 2, pp. 116-123.

Healey, M.C. 2001. Patterns of reproductive investment by stream and ocean type Chinook salmon (Oncorhynchus tshawytscha), Journal of Fish Biology. Vol. 58, pp. 1545-1556.

_____. 1991. Life history of Chinook salmon (*Oncorhynchus tshawytscha*), in pacific salmon life histories, C. Groot and L. Margolis, editors, University of British Columbia Press, Vancouver, British Columbia, B.C., pp 311-393.

Kjelson, M.A., P.F. Raquel, and F.W. Fisher. 1981. Influences of freshwater inflow on Chinook salmon (*Oncorhynchus tshawytscha*) in the Sacramento–San Joaquin estuary, pp. 88-102. in R.D. Cross and D.L. Williams (eds.). Proceedings of the National Symposium on Freshwater Inflow to estuaries. U.S. Fish and Wildlife Service Biol. Serv. Prog. FWS/OBS-81/04(2).

Moyle, P.B. 2000. Inland Fishes of California. University of California Press, Berkeley. 502 pp.

Moyle, P.B., P.K. Crain, and K. Whitener. 2007. Patterns in the Use of a Restored California Floodplain by Native and Alien Fishes. San Francisco and Estuary Watershed Science. Volume 5 (3).

Palmer, Michelle. 2011. Personal communication between Bill Snider, Senior Fisheries Biologist, HDR, and Michelle Palmer, FISHBIO. June 10, 2011.

Reynolds, F.L., Mills, T.J., Benthin, R., and A. Low. 1993. Restoring Central Valley streams: a plan for action. Inland Fisheries Div., Calif. Dept. of Fish and Game. Sacramento CA. 184 p.

Rutter, C. 1902. Natural History of the Quinnat Salmon Investigation on Sacramento River, U. S. Bureau of Fisheries Bulletin No. 22.

Snider, B. and R.G. Titus. 2001. Lower American River emigrations survey, October 1997-September 1998. Calif. Dept. Fish and Game, Habitat Conservation Division, Stream Evaluation Program Technical Report No. 01-6.

Sommer, T.R., M.L. Nobriga, W.C. Harrel, W. Batham, and W.J. Kimmerer. 2001. Floodplain rearing of juvenile Chinook salmon: evidence of enhanced growth and survival. Canadian Journal of Fisheries and Aquatic Sciences 58:325-333.

Sonke, C.L., A.N. Fuller, and S.M. Ainsley. 2010. Outmigrant Trapping of Juvenile Salmonids in the Lower Tuolumne River, 2010. Prepared for Turlock Irrigation District and Modesto Irrigation District. December 2010. Accessible online at: <http://tuolumnerivertac.com/documents.htm>.

Turlock Irrigation District and Modesto Irrigation District (TID/MID). 2010. FERC 2010 Lower Tuolumne River Annual Report. Available online at: <http://tuolumne rivertac.com/documents.htm>.

______. 2009. FERC 2009 Lower Tuolumne River Annual Report. Available online at: <http://tuolumnerivertac.com/documents.htm>.

U.S. Department of Commerce, National Marine Fisheries Service. 2009. Public Draft Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook salmon and Central Valley Spring-Run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead. Available online at: <http://swr.nmfs. noaa.gov/recovery/centralvalleyplan.htm>.

U.S. Department of Interior, Fish and Wildlife Service (USFWS). 2008. Draft rotary screw trap protocol for estimating production of juvenile Chinook salmon. Document prepared by the U.S. Fish and Wildlife Service, Comprehensive Assessment and Monitoring Program. Sacramento, California. 44 pp.

_____. 2001. Final restoration plan for the Anadromous Fish Restoration Program. A Plan to increase Natural Production of Anadromous Fish in the Central Valley of California. Report of the Anadromous Fish Restoration Program Core Group, Central Valley Project Improvement Act to the Secretary of the Interior. Stockton, CA.

_____. 1997. Comprehensive Assessment and Monitoring Program (CAMP) Implementation Plan. A Comprehensive Plan to Evaluate Effectiveness of CVPIA Actions in Restoring Anadromous Fish Production. Prepared for USFWS by Montgomery Watson, Jones & Stokes, and CH2M HILL. March 1997. Available online at: <http://www.fws.gov/ sacramento/camp/CAMP_documents/CAMP_Implementation_Plan_1997.pdf>.

Williams, J.G. 2006. Central Valley Salmon: A Perspective on Chinook and Steelhead in the Central Valley of California. San Francisco Estuary and Watershed Science, 4(3) San Francisco Estuary and Watershed Science, John Muir Institute of the Environment, UC Davis. http://escholarship.org/uc/item/21v9x1t7

Willis R.H. 1920 Early History of Seaward Migration of Chinook Salmon in the Columbia & Sacramento River; U.S. Bureau of Fisheries Bulletin, Vol. 37, Doc. 887.

STUDY PLAN W&AR-10

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

***Oncorhynchus mykiss* Population Study Plan**

July 2011

Related Study Requests: SWRCB-05, 06

1.0 Project Nexus

The continued operation and maintenance (O&M) of the Don Pedro Project (Project) may contribute to cumulative effects on habitat availability and production of in-river life stages of *Oncorhynchus mykiss (O. mykiss*).

2.0 Resource Agency Management Goals

The Districts believe that four agencies have resource management goals related to salmonid species and/or their habitat, including Central Valley steelhead: (1) U.S. Department of Interior, Fish and Wildlife Service (USFWS); (2) U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS); (3) California Department of Fish and Game (CDFG); and (4) State Water Resources Control Board, Division of Water Rights (SWRCB).

A goal of the USFWS (2001) Anadromous Fish Restoration Program (AFRP), as stated in Section 3406(b)(1) of the Central Valley Project Improvement Act, is to double the long-term production of anadromous fish in California's Central Valley rivers and streams. Objectives in meeting this long-term goal include: (1) improve habitat for all life stages of anadromous fish through provision of flows of suitable quality, quantity, and timing, and improved physical habitat; (2) improve survival rates by reducing or eliminating entrainment of juveniles at diversions; (3) improve the opportunity for adult fish to reach spawning habitats in a timely manner; (4) collect fish population, health, and habitat data to facilitate evaluation of restoration actions; (5) integrate habitat restoration efforts with harvest and hatchery management; and (6) involve partners in the implementation and evaluation of restoration actions.

NMFS has developed Resource Management Goals and Objectives for species listed under the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §1801 et seq.) and the Endangered Species Act (ESA) (16 U.S.C. §1531 et seq.), as well as anadromous species that are not currently listed but may require listing in the future. NMFS' (2009) Public Draft Recovery Plan for Sacramento River Winter-run Chinook salmon, Central Valley Spring-run Chinook salmon, and Central Valley steelhead (Draft Recovery Plan) outlines the framework for the recovery of ESA-listed species and populations in California's Central Valley. For Central

Valley steelhead, the relevant recovery actions identified for the Tuolumne River are to: (1) conduct habitat evaluations, and (2) manage cold water pools behind La Grange and Don Pedro dams to provide suitable water temperatures for all downstream life stages.

CDFG's mission is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. CDFG's resource management goals, as summarized in restoration planning documents such as "Restoring Central Valley Streams: A Plan for Action" (Reynolds et al. 1993), are to restore and protect California's aquatic ecosystems that support fish and wildlife, and to protect threatened and endangered species under California Fish and Game Code (Sections 6920–6924).

SWRCB has responsibility under the federal Clean Water Act (33 U.S.C. §11251–1357) to preserve and maintain the chemical, physical and biological integrity of the State's waters and to protect water quality and the beneficial uses of stream reaches consistent with Section 401 of the federal Clean Water Act, the Regional Water Quality Control Board Basin Plans, State Water Board regulations, the California Environmental Quality Act, and any other applicable state law.

3.0 Study Goals

The *O. mykiss Population Study* will examine the relative influences of various factors on the production of in-river life stages of *O. mykiss* in the Tuolumne River, identify critical life-stages that may represent a life-history "bottleneck", and compare relative changes in the population between alternative resource management scenarios.

4.0 Existing Information and Need for Additional Information

Information regarding the status, abundance, and habitat use of *O. mykiss* populations in the Tuolumne River is summarized in the Pre-Application Document (PAD), as well as in annual *O. mykiss* monitoring reports most recently filed with the FERC on January 15, 2011. Based upon both routine surveys conducted by the Districts, as well as more recent intensive snorkel surveys carried out as part of the April 3, 2008 FERC Order (123 FERC ¶ 62,012), the following information regarding in-river rearing population sizes and habitat use of *O. mykiss* is available.

Observations of *O. mykiss* have been recorded in the Tuolumne River since 1981 in various river monitoring programs, including snorkeling, seining, rotary screw trapping, as well as targeted monitoring efforts most recently documented in Stillwater Sciences (2011). These *O. mykiss* monitoring efforts have found juvenile and adult size classes most frequently along 5–10 river miles of the Tuolumne River downstream of La Grange Dam (River Mile 42–52), with very low numbers of individuals found at locations farther downstream. Water temperatures in this reach are generally suitable for *O. mykiss*, typically ranging from 11.8°C (53.2°F) to 23.1°C (70.3°F) in summer (Stillwater Sciences 2009), and from 10.2°C (50.4°F) to 14.4°C (58°F) in winter (Stillwater Sciences 2010). Although specific spawning locations have not been documented to date, routine *O. mykiss* observations in this portion of the river suggest suitable habitat conditions, with decreasing suitability moving downstream as a result of several factors (e.g., water temperature, predator habitat, etc.). A tracking study of adult *O. mykiss* was initiated in spring 2010 and will be completed in 2011. Although low numbers of *O. mykiss* carcasses have been identified during fall spawning surveys conducted since 1997, only one adult *O. mykiss*

(276 millimeters Fork Length) has been identified at the counting weir and very little active spawning by *O. mykiss* has been documented to date by CDFG or other parties.

Despite a growing body of monitoring data, very little information is available regarding steelhead life-history and habitat use specific to the Tuolumne River. For this reason, there have been only limited attempts made to assess the relative importance of factors influencing the anadromous or resident forms of *O. mykiss* in the Tuolumne River. This study plan develops conceptual models that, depending upon data availability, may extend to quantitative modeling of the Tuolumne River *O. mykiss* population to assess the effects of habitat availability during summer and assess potential “bottlenecks” to in-river *O. mykiss* production.

5.0 Study Methods

The *O. mykiss Population Study* will rely upon existing literature and information, including previously conducted Tuolumne River studies, as well as interrelated relicensing studies in the development of both conceptual and possibly quantitative population models to examine the relative importance of factors affecting *O. mykiss* production and population levels.

5.1 Study Area

The study area includes potential spawning and rearing habitat in the Tuolumne River from the La Grange Dam (River Mile 52) downstream to Roberts Ferry Bridge (River Mile 39.5). The downstream extent of the study reach corresponds to the majority of *O. mykiss* observations documented in routine winter and summer *O. mykiss* surveys (Stillwater Sciences 2011).

5.2 General Concepts

The following general concepts apply to the study:

- The model focuses on variables that are influenced by Project and non-Project factors.
- Project-specific and resource-specific data will be used to calibrate and validate the model whenever possible.
- Model outputs consist of representation of the modeled response variable under an existing baseline or initial condition, as well as predictions under one or more scenarios.
- Although model uncertainties will be identified as part of this study, modeling predictions may show statistically significant differences from baseline conditions that are not ecologically or biologically significant. Should this occur, the criteria and rationale for biological significance will be documented along with the results.

5.3 Study Methods

Step 1 – Develop Conceptual Model from Previously Conducted Studies. Information from previously conducted studies, as well as the concurrent *Salmonid Populations Information Integration and Synthesis Study* (Study Plan W&AR-5), will be summarized. Using this information, conceptual models will be developed as narrative and graphical descriptions of the potential density-dependent and density-independent factors affecting each in-river life-stage of *O. mykiss* in the Tuolumne River.

Step 2 – Develop Quantitative Population Model. Using conceptual models developed in Step 1, a quantitative population model will be developed to provide a framework to examine the relative influences of in-river factors in controlling the equilibrium population sizes determined in recent reach-specific surveys (Stillwater Sciences 2008, 2009, 2010). Although habitat-specific density estimates from existing data may be developed as a function of water temperature, the study approach will use these estimates and other sources to develop a multi-stage stock production model (Baker 2009) in which starting numbers of a particular life-stage (stock) are mathematically modeled to predict how the numbers change as the cohort goes through subsequent life-stages.

Since very little information exists supporting the development of a full life-cycle model of anadromous *O. mykiss* that includes outmigration through the Delta as well as ocean residency, it is anticipated that the completed model will only consider in-river life-stages from spawning, to incubation, juvenile rearing, to adult in-river residency, with the potential to consider additional life stages such as modeling small number of out-of-basin immigrants or smolt emigrants from this population. Individual life-stage to life-stage steps will be modeled using independent sub-models, which can be implemented with methodologies ranging from common stock production forms (e.g., Beverton-Holt). This approach allows model structure to be initially developed without detailed consideration of the underlying mechanisms, but also allows the introduction of one or more mechanisms affecting life-stage to life-stage survival. A redd superimposition model may be used for the step from female spawners to deposited eggs if spawning gravel suitability or actual redd superimposition observations suggest this is occurring. A linear model may be used to reflect density-independent mortality (e.g., the step from eggs to emergent fry, in which mortality is not affected by density). Lastly, the Beverton-Holt (1957) and "hockey stick" models (Barrowman and Myers 2000) are typically used for density-dependent[1] interactions (e.g., the life-step from fry to juvenile in circumstances when available habitat limits the population). More elaborate compartment or individual-based models may be introduced as sub-models to reflect variations in habitat conditions due to seasonal shifts in river flow or water temperature, predation or other factors.

The modeled life-stage structure, the factors selected and default values for parameters and stock production forms will be determined from Tuolumne River data and previously conducted studies, literature values, and agency consultation. For example, a carrying capacity (*K*) is generally specified for all density-dependent stock-production relationships. Information from prior habitat use assessments (Stillwater Sciences 2008, 2009, 2010) will be used to provide current estimates of rearing densities by habitat type (e.g., riffle, pool head, run, etc.) and literature review will be used to establish maximum densities. To determine carrying capacity (*K*), maximum densities within particular habitat types will be combined with up-to-date estimates of habitat availability from the ongoing *Tuolumne River Instream Flow Study*[2] as well as the following interrelated studies being conducted as part of relicensing:

[1] Density-dependence in stock-production relationships occurs whenever food or space limitations cause the life-stage specific survival or growth to be related to the numbers of individuals present.

[2] The Tuolumne River Instream Flow Study is currently being conducted in accordance with the May 12, 2010 FERC Order Modifying and Approving Instream Flow and Water Temperature Model Study Plans for the Don Pedro Project (Project No. 2299-072), as modified by Ordering Paragraph (A) of the July 21, 2010 FERC Order.

- Spawning Gravel Study (Study Plan W&AR-4)
- Salmonid Redd Mapping Study (Study Plan W&AR-8)
- Predation Study (Study Plan W&AR-7)
- *Oncorhynchus mykiss* Habitat Assessment Study (Study Plan W&AR-12) and
- Temperature Criteria Assessment Study (Study Plan W&AR-14)

In order to parameterize the model, estimates of life-stage specific survival (*r*) will also be made from literature searches (e.g., incubation success due to gravel quality or temperature) as well as professional judgment. Understanding that very little *O. mykiss* life-history information exists specific to the Tuolumne River, parameter selection will rely more heavily on literature sources and prior modeling experience. Validation of the completed model will be carried out by modeling of summer-rearing population sizes in comparisons to recent population estimates (2008–2011) developed through intensive snorkel surveys (e.g., Stillwater Sciences 2008, 2009, 2010).

Step 3 – Evaluation of Factors Affecting *O. mykiss* Populations. To determine the life-stages and model parameters that most affect *O. mykiss* production, a sensitivity analysis will be conducted of the parameters and values in the model. The sensitivity analysis will evaluate the equilibrium juvenile and adult population sizes using initial parameter values established in Step 2, followed by varying the initial parameter values by:

- Decreasing initial value by 50%
- Decreasing initial value by 25%
- Increasing initial value by 33%
- Increasing initial value by 100%

For each change in value, the model will be used to calculate the equilibrium population size, holding all other values constant For sensitive parameters, additional scrutiny will be focused on the source of data, and the potential for the Project to influence those parameters. It should be noted, however, that sensitivity analyses of this type cannot explore the potential interactions of multiple input values that are simultaneously increased or decreased.

Step 4 – Evaluation *O. mykiss* Population Sizes under Current Project Operations. An evaluation of the population size of *O. mykiss* under the current FERC flow schedules will be compared with observed population estimates during spring and summer (Stillwater Sciences 2008, 2009, 2010).

Step 5 – Prepare Report. The Districts will prepare a report that includes the following sections: (1) Study Goals, (2) Methods and Analysis, (3) Results, (4) Discussion, and (5) Conclusions.

6.0 Schedule

The Districts anticipate the schedule to complete the study proposal as follows assuming FERC issues its Study Plan Determination by December 31, 2011 and the study is not disputed by a mandatory conditioning agency:

- Conceptual Model Development (Step 1) ....January 2012–March 2012
- Population Model Development (Step 1) ....March 2012–September 2012
- Modeling Workshop (Step 2) ....May 2012
- Modeling Sensitivity and Evaluation (Steps 2, 3, and 4) ....June 2012–September 2012
- Report Preparation ....September 2012–December 2012
- Report Issuance ....January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

Population modeling is supported by a large body of literature spanning several decades (e.g., Paulik 1973, Moussalli and Hilborn 1986, Sharma et al. 2005). Population models are commonly employed in FERC relicensing projects to predict relative changes in population levels and salmonid production in response to changing variables.

8.0 Deliverables

In addition to the completed model, the Districts will prepare a report, which will document the methodology and results of the study.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

Baker, P. 2009. Generalizing the multi-stage stock-production paradigm: a flexible architecture for population modeling. *In* Knudsen EE, Michael H (Eds.). Pacific salmon environmental and life history models: advancing science for sustainable salmon in the future. American Fisheries Society Symposium 71. Bethesda, Maryland.

Barrowman N.J. and R.A. Myers. 2000. Still more spawner-recruitment curves: The hockey stick and its generalizations. Canadian Journal of Fisheries and Aquatic Sciences 57: 665-676.

Beverton, R.J.H., and S.J. Holt. 1957. On the dynamics of exploited fish populations. Ministry Agriculture, Fisheries and Food, Fisheries Investigation Series 2, No. 19. London, England.

Moussalli, E. and R. Hilborn. 1986. Optimal stock size and harvest rate in multistage life history models. Canadian Journal of Fisheries and Aquatic Sciences. 43: 135-141.

Paulik, G.J. 1973. Studies of the possible form of the stock-recruitment curve. Rapports et Proces-Verbaux des Reunions, Conseil International pour L'Exploration de la Mer 164: 302-315.

Reynolds, F.L., T.J. Mills, R. Benthin, and A. Low. 1993. Restoring Central Valley streams: a plan for action. Inland Fisheries Div., Calif. Dept. of Fish and Game. Sacramento CA. 184 p.

Sharma, R., A.B. Cooper, and R. Hilborn. 2005. A quantitative framework for the analysis of habitat and hatchery practices on Pacific salmon. Ecological Modeling 183: 231-250.

Stillwater Sciences. 2008. July 2008 population size estimate of *Oncorhynchus mykiss* in the lower Tuolumne River. Study plan. Prepared by Stillwater Sciences, Berkeley, California for Turlock Irrigation District and Modesto Irrigation District.

Stillwater Sciences. 2009. March and July 2009 population size estimates of *Oncorhynchus mykiss* in the lower Tuolumne River. Prepared by Stillwater Sciences, Berkeley, California for Turlock Irrigation District and Modesto Irrigation District.

Stillwater Sciences. 2010. March and August 2010 population size estimates of *Oncorhynchus mykiss* in the Lower Tuolumne River. Prepared for the Turlock Irrigation District and the Modesto Irrigation District by Stillwater Sciences, Berkeley, CA. November.

Stillwater Sciences. 2011. Tuolumne River 2010 *Oncorhynchus mykiss* Monitoring Summary Report. Prepared for the Turlock Irrigation District and Modesto Irrigation District by Stillwater Sciences, Berkeley, California. January.

U.S. Department of Commerce, National Marine Fisheries Service (NMFS). 2009. Public Draft Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook salmon and Central Valley Spring-Run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead. Available online at: <http://swr.nmfs.noaa.gov/recovery/centralvalleyplan.htm>.

U.S. Department of Interior, Fish and Wildlife Service (USFWS). 2001. Final restoration plan for the Anadromous Fish Restoration Program. A Plan to increase Natural Production of Anadromous Fish in the Central Valley of California. Report of the Anadromous Fish Restoration Program Core Group, Central Valley Project Improvement Act to the Secretary of the Interior. Stockton, CA.

STUDY PLAN W&AR-11

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Chinook Salmon Otolith Study Plan

July 2011

Related Study Requests: CCSF-03

1.0 Project Nexus

The continued operation and maintenance (O&M) of the Don Pedro Project (Project) may contribute to cumulative effects on habitat availability and production of in-river life stages of Chinook salmon (*Oncorhynchus tshawytscha*).

2.0 Resource Agency Management Goals

The Districts believe that four agencies have resource management goals related to Chinook salmon and/or their habitat: (1) U.S. Department of Interior (USDOI), Fish and Wildlife Service (USFWS); (2) U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS); (3) California Department of Fish and Game (CDFG); and (4) State Water Resources Control Board, Division of Water Rights (SWRCB).

A goal of the USFWS (2001) Anadromous Fish Restoration Program (AFRP), as stated in Section 3406(b)(1) of the Central Valley Project Improvement Act, is to double the long-term production of anadromous fish in California's Central Valley rivers and streams. Objectives in meeting this long-term goal include: (1) improve habitat for all life stages of anadromous fish through provision of flows of suitable quality, quantity, and timing, and improved physical habitat; (2) improve survival rates by reducing or eliminating entrainment of juveniles at diversions; (3) improve the opportunity for adult fish to reach spawning habitats in a timely manner; (4) collect fish population, health, and habitat data to facilitate evaluation of restoration actions; (5) integrate habitat restoration efforts with harvest and hatchery management; and (6) involve partners in the implementation and evaluation of restoration actions.

NMFS has developed Resource Management Goals and Objectives for species listed under the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §1801 et seq.) and the Endangered Species Act (ESA) (16 U.S.C. §1531 et seq.), as well as anadromous species that are not currently listed but may require listing in the future. NMFS' (2009) Public Draft Recovery Plan for Sacramento River Winter-run Chinook salmon, Central Valley Spring-run Chinook salmon, and Central Valley steelhead (Draft Recovery Plan) outlines the framework for the recovery of ESA-listed species and populations in California's Central Valley. For the Tuolumne

River, the relevant goals are to enhance the Essential Fish Habitat downstream of the Project and achieve a viable population of Central Valley fall/late fall-run Chinook salmon.

CDFG's mission is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. CDFG's resource management goals, as summarized in restoration planning documents such as "Restoring Central Valley Streams: A Plan for Action" (Reynolds et al. 1993), are to restore and protect California's aquatic ecosystems that support fish and wildlife, and to protect threatened and endangered species under California Fish and Game Code (Sections 6920–6924).

SWRCB has responsibility under the federal Clean Water Act (33 U.S.C. §11251–1357) to preserve and maintain the chemical, physical and biological integrity of the Nation's waters and to protect water quality and the beneficial uses of stream reaches consistent with Section 401 of the federal Clean Water Act, the Regional Water Quality Control Board Basin Plans, State Water Board regulations, the California Environmental Quality Act, and any other applicable state law.

3.0 Study Goals

The *Chinook Salmon Otolith Study* will examine evidence of the geographic origin and early life-history of Tuolumne River Chinook salmon spawners as a means of comparing the relative contribution of fry and smolt life-stages to subsequent escapement and any associations with flow or antecedent hydrology. Objectives in meeting these goals include:

- To determine whether otolith[1] micro-structural growth patterns or micro-chemistry allow the discrimination of growth and residence of juvenile salmon in the Sacramento and San Joaquin River Delta and estuary from growth in the Tuolumne River.
- To determine whether otolith micro-structural growth patterns or micro-chemistry allow the discrimination of growth and residence of juvenile salmon originating from hatcheries and from riverine environments of the Central Valley drainage upstream of the Delta separate from growth in the Tuolumne River.

4.0 Existing Information and Need for Additional Information

Seine surveys conducted by the Districts since the 1990s, as well as more recent rotary screw trap (RST) monitoring suggests basin-wide flood years with large and early-season Chinook salmon fry dispersal are associated with higher subsequent escapement of salmon (TID/MID 2005). Peak fry captures in RSTs and downstream fry movements, observed in seining surveys, typically occurred in the January to early March timeframe and were generally associated with higher flows during winter and early spring. Although the current flow management for the benefit of fall-run Chinook salmon in the San Joaquin River tributaries is targeted to benefit smolt outmigration later during spring (e.g., Vernalis Adaptive Management Plan April-May period), juvenile Chinook salmon can exhibit a variety of life history strategies – some entering the Delta and estuary as fry to rear before entering the ocean, and some rearing in the river and moving rapidly through the estuary to the ocean as smolts.

[1] Otoliths (earstones) are calcium carbonate structures in the inner ear of fish that grow in proportion to the overall growth, such that daily or weekly growth increments can be measured to allow the date and fish size at various habitat transitions to be determined.

Brandes and McLain (2001) examined the survival of fry and smolt life-stages in the Delta under a variety of water year types. However, because few studies have quantified life history variations within fall-run Chinook salmon populations in the San Joaquin River Basin, the effects of Project-related or other changes on population structure and resilience of Tuolumne River salmon are poorly understood. The relative contribution of fry and smolts to subsequent escapement has important management implications for the magnitude and timing of flow in the Tuolumne River, as well as the timing of operations of barriers and export facilities in the south Delta.

The proposed study will apply micro-structural and micro-chemical analysis of otoliths to address questions regarding the effects of Project and non-Project factors on the success of various life-history strategies of fall-run Chinook salmon in the Tuolumne River. Early life history events in juvenile salmonid development, including incubation, emergence, and habitat transitioning, can be linked to otolith micro-structural patterns due to changes in temperature and the thermal regime under which these fish were reared. Examination of otolith micro-structure has been used to identify differing rearing environments of juvenile salmon (e.g., Neilson et al. 1985) as well as differences in rearing temperatures (Zhang et al. 1995; Volk et al. 1996). Using one of several methods of analysis, the concentrations of elements (e.g., strontium, barium, calcium) and proportions of stable strontium (Sr) isotopes in otoliths may be compared to those in the water in which the fish inhabits in order to provide a tracer of the location where the fish has been (e.g., freshwater, saltwater, natal stream) (Campana and Neilson 1985). Otolith micro-chemistry has been used to examine early life history rearing environments of salmonids to address questions of streams of natal origin (Ingram and Weber 1999; Campana and Thorrold 2001) as well as the timing of entry into estuarine and saline environments (Zimmerman 2005). The determination of the natal streams of adults that spawn in the Tuolumne River will allow additional quantification of straying rates from other rivers and, hence, more accurate assessments of the population size of indigenous Tuolumne River salmon.

5.0 Study Methods

The study will rely upon the existing inventory of fall-run Chinook salmon otoliths routinely collected by CDFG, as well as other available sources, to conduct a laboratory study of otolith micro-structure and micro-chemistry to examine salmon origin (i.e., river, wild vs. hatchery) as well as timing of rearing habitat use (e.g., riverine, Delta) and to determine whether fry and smolt contributions to adult escapement vary with winter and spring flow magnitude and timing.

5.1 Study Area

The study area includes locations of Chinook salmon carcass recoveries collected from the Tuolumne River, typically extending from La Grange Dam (River Mile 52) downstream to the end of routine spawning surveys conducted by CDFG at approximately River Mile 21.2.

5.2 General Concepts

The following general concepts apply to the study:

- The proposed study is a laboratory study requiring specialized equipment and using existing archives of historically collected samples. No field sampling is anticipated as part of this study.
- The methods presented herein may be modified based upon the most feasible analytical method available to address the study questions. Any modifications made to this study plan will be documented and reported in the draft study reports.

5.3 Study Methods

The study will be conducted using the following steps.

Step 1 – Compile and Validate Existing Sample Inventory. Otolith samples collected from previously conducted spawning surveys conducted by CDFG will be requested for cooperative analysis of otolith micro-structure and micro-chemistry. Information regarding the date of collection, location, fish length, sex, and age (young-of-year, juvenile, adult) will be included with each sample and a separate record of each sample will be established. Depending upon the availability and validation of the source and condition of the existing otolith inventory, sub-samples of otoliths will be selected for subsequent analysis (Step 2) to represent environmental conditions occurring under above and below normal water year types which exhibit high winter/spring flows with the potential to result in differential returns of in-river or out-of-river reared salmon. Approximately 25–40 otoliths from each of three water years of above and below-normal water year types will be selected for laboratory analysis (i.e., 150–240 samples).

Step 2 – Analysis. Using sub-samples of the validated otolith inventory, specimen preparation, appropriate micro-structural examination and micro-chemical analysis will be conducted by a university, public agency, or commercial contract laboratory. Depending upon whether existing otoliths have been previously preserved or remain frozen, sagittal otoliths will be removed, soaked in water, rubbed clean of excess tissue, and air dried. The otoliths will be polished and rinsed for microscopic examination and subsequent micro-chemical analyses.

Elemental composition will be performed by laser ablation or by acid digestion of small regions of the otolith followed by chemical analysis using standard ICP-MS techniques (e.g., Zimmerman 2005, Barnett-Johnson et al. 2008). Randomized transects will be selected within each otolith sample to allow sampling of growth regions from the primordia (i.e., earliest deposited material generally corresponding to maternal environmental conditions prior to spawning) and extending to the outer edge. Additional growth regions will be sampled along the selected transects to indicate otolith composition and regular time intervals.

Stable strontium (Sr) isotope measurements of $^{87}Sr:^{86}Sr$ will be made in several growth regions along the selected sampling transects. For the examination of early life history rearing environments, since the primordial region retain a signature of maternally inherited Sr, sampling will occur in the otolith region where the otolith accreted while in the natal tributary (or hatchery), but after yolk absorption and before outmigration. The resulting $^{87}Sr:^{86}Sr$ ratios at various ages will be compared to ratios corresponding to the Tuolumne River and San Joaquin River and other eastside tributaries, including the Merced River and hatchery recoveries

(Barnett-Johnson et al. 2008). In addition to examination of straying and hatchery contributions to escapement in various water year types, samples exhibiting earlier or later emigration within a given brood-year will be assigned as either fry or smolt out-migrants and the relative contribution of these life-history strategies compared.

Step 3 – Prepare Report. The Districts will prepare a report that includes the following sections: (1) Study Goals, (2) Methods and Analysis, (3) Results, (4) Discussion, and (5) Conclusions.

6.0 Schedule

The Districts anticipate the schedule to complete the study proposal as follows assuming FERC issues its Study Plan Determination by December 31, 2011 and the study is not disputed by a mandatory conditioning agency:

- Existing Data Compilation ....January 2012–March 2012
- Laboratory Analysis ....March 2012–September 2012
- Report Preparation ....September 2012–December 2012
- Report Issuance .... January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

The use of otoliths micro-structure and micro-chemistry are commonly used techniques in salmon research and management.

8.0 Deliverables

The Districts will prepare a report that will document the methodology and results of the study.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

Barnett-Johnson, R., T.E. Pearson, F.C. Ramos, C.B. Grimes, and R.B. Macfarlane. 2008. Tracking natal origins of salmon using isotopes, otoliths, and landscape geology. Limnology and Oceanography, 53(4), 1633-1642.

Brandes, P.L., and J.S. McLain. 2001. Juvenile Chinook salmon abundance, distribution, and survival in the Sacramento-San Joaquin Estuary. In: Brown, R. L., editor. Contributions to the Biology of Central Valley Salmonids. Fish Bulletin 179(2). Sacramento, CA. California Department of Fish and Game. Pp. 39-136.

Campana, S.E., and J.D. Neilson. 1985. Microstructure of fish otoliths. Canadian Journal of Fisheries and Aquatic Sciences 42: 1014-1032.

Campana, S.E., and S.R. Thorrold. 2001. Otoliths, increments, and elements: Key to a comprehensive understanding of fish populations? Canadian Journal of Fisheries and Aquatic Sciences. 58: 30–38.

Ingram, B.L., and P.K. Weber. 1999. Salmon origin in California's Sacramento-San Joaquin river system as determined by otolith strontium isotopic composition. Geology 27: 851–854.

Neilson, J.D., G.H. Geen, and D. Bottom. 1985. Estuarine growth of juvenile Chinook salmon (*Oncorhynchus tshawytscha*) as inferred from otolith microstructure. Canadian Journal of Fisheries and Aquatic Sciences. 42: 899-908.

Reynolds, F.L., T.J. Mills, R. Benthin, and A. Low. 1993. Restoring Central Valley streams: a plan for action. Inland Fisheries Div., Calif. Dept. of Fish and Game. Sacramento CA. 184 p.

Turlock Irrigation District and Modesto Irrigation District (TID/MID). 2005. Ten Year Summary Report of Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 58 of the License for the Don Pedro Project, No. 2299. 1 Volume. March.

U.S. Department of Commerce, National Marine Fisheries Service (NMFS). 2009. Public Draft Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook salmon and Central Valley Spring-Run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead. Available online at: <http://swr.nmfs.noaa.gov/recovery/centralvalleyplan.htm>.

U.S. Department of Interior, Fish and Wildlife Service (USFWS). 2001. Final restoration plan for the Anadromous Fish Restoration Program. A Plan to increase Natural Production of Anadromous Fish in the Central Valley of California. Report of the Anadromous Fish Restoration Program Core Group, Central Valley Project Improvement Act to the Secretary of the Interior. Stockton, CA.

Volk, E.C., S.L. Schroder, and J.J. Grimm. 1996. Otolith thermal marking. *In* Report of the study group on stock identification protocols for finfish and shellfish stocks. ICES (International. Council for the Exploration of the Sea) CM 1996/M:1. pp. 95-129.

Zhang, Z., R.J. Beamish, and B.E. Riddell. 1995. Differences in otolith microstructure between hatchery-reared and wild Chinook salmon (*Oncorhynchus tshawytscha*). Canadian. Journal of Fisheries and Aquatic Sciences 52: 344-352.

Zimmerman, C.E. 2005. Relationship of otolith strontium-to-calcium ratios and salinity: experimental validation for juvenile salmonids. Canadian Journal of Fisheries and Aquatic Sciences. 62:88-97.

STUDY PLAN W&AR-12

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Oncorhynchus mykiss Habitat Survey Study Plan

July 2011

Related Study Requests: AR-13, SWRCB-08

1.0 Project Nexus

The continued project operation and maintenance for the Don Pedro Project (Project) may contribute to cumulative effects on anadromous fish habitat in the lower Tuolumne River. These potential environmental effects include changes in the type of physical habitat available for juvenile *Oncorhynchus mykiss (O. mykiss*). Changes to habitat may include reduction in habitat complexity and structure due to reduced availability of large woody debris (LWD). Lack of habitat complexity may affect fish populations in the lower Tuolumne River.

2.0 Resource Agency Management Goals

The Districts believe that four agencies have resource management goals related to salmonid species and/or their habitat: (1) U.S. Department of Interior, Fish and Wildlife Service (USFWS); (2) U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS); (3) California Department of Fish and Game (CDFG); and (4) State Water Resources Control Board, Division of Water Rights (SWRCB).

A goal of the USFWS (2001) Anadromous Fish Restoration Program, as stated in Section 3406(b)(1) of the Central Valley Project Improvement Act, is to double the long-term production of anadromous fish in California's Central Valley rivers and streams. Objectives in meeting this long-term goal include: (1) improve habitat for all life stages of anadromous fish through provision of flows of suitable quality, quantity, and timing, and improved physical habitat; (2) improve survival rates by reducing or eliminating entrainment of juveniles at diversions; (3) improve the opportunity for adult fish to reach spawning habitats in a timely manner; (4) collect fish population, health, and habitat data to facilitate evaluation of restoration actions; (5) integrate habitat restoration efforts with harvest and hatchery management; and (6) involve partners in the implementation and evaluation of restoration actions.

NMFS has developed Resource Management Goals and Objectives for species listed under the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §1801 et seq.) and the Endangered Species Act (ESA) (16 U.S.C. §1531 et seq.), as well as anadromous species that are not currently listed but may require listing in the future. NMFS' (2009) Public Draft Recovery

Plan for Sacramento River Winter-run Chinook salmon, Central Valley Spring-run Chinook salmon, and Central Valley steelhead outlines NMFS' framework for the recovery of ESA-listed species and populations in California's Central Valley. For Central Valley steelhead, the recovery actions identified for the Tuolumne River are to: (1) conduct habitat evaluations; and (2) manage cold water pools behind La Grange and Don Pedro dams to provide suitable water temperatures for all downstream life stages. For Central Valley fall/late fall-run Chinook, the relevant goals are to enhance the essential fish habitat downstream of the Project and achieve a viable population of Central Valley fall/late fall-run Chinook salmon in the Tuolumne River.

CDFG's mission is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. CDFG's resource management goals, as summarized in restoration planning documents such as "Restoring Central Valley Streams: A Plan for Action" (Reynolds et al. 1993), are to restore and protect California's aquatic ecosystems that support fish and wildlife, and to protect threatened and endangered species under California Fish and Game Code (Sections 6920-6924).

SWRCB has responsibility under the federal Clean Water Act (33 U.S.C. §11251-1357) to preserve and maintain the chemical, physical and biological integrity of the State's waters and to protect water quality and the beneficial uses of stream reaches consistent with Section 401 of the federal Clean Water Act, the Regional Water Quality Control Board Basin Plans, State Water Board regulations, the California Environmental Quality Act, and any other applicable state law.

3.0 Study Goals

The primary goal of this study is to provide information on habitat distribution, abundance and quality in the lower Tuolumne River with a focus on habitat complexity related to LWD. An inventory of habitat quality and availability, and use by salmonids, primarily juvenile *O. mykiss* will be used to inform the evaluation of in-river factors that may affect the quantity and quality of habitat available for juvenile *O. mykiss*.

4.0 Existing Information and Need for Additional Information

Juvenile habitat quality and use has been found to be directly related to habitat complexity (Bustard and Narver 1971; Bisson et al. 1987). Instream habitat complexity is typically associated with large woody debris, pools, and off channel habitat. Cederholme and others (1997) observed a direct relationship between increased steelhead smolt production and increased habitat complexity in the form of LWD. Increases in numbers of anadromous (Ward and Slaney 1981; House and Boehne 1995) and nonanadromous (Gowan and Fausch 1995) fishes after addition of LWD to a stream have been demonstrated.

Instream LWD recruitment is generally from the adjacent riparian forest or allochthonous, originating from the upstream watershed. Large dams, that rarely spill, like Don Pedro Dam, can reduce recruitment from upstream sources. Reduction or elimination of large riparian trees will also reduce LWD recruitment.

The quality and condition of habitat in the lower Tuolumne River has been investigated for Chinook salmon since the 1996 FERC Order (76 FERC 61, 117). The order required that the condition of spawning habitat be assessed along with other monitoring requirements, specific to Chinook salmon. As a result, information is available for other salmonids in the river. For example, McBain and Trush (2000) identified that the uppermost reach of the lower Tuolumne River (River Mile [RM] 46.6 – 52.1) was primarily used for spawning salmon where they found gravel bed and banks, along with little valley confinement within the bluffs. Surveys of the channel downstream of La Grange Dam showed the occurrence of channel downcutting and widening, armoring, and depletion of sediment storage features (e.g., lateral bars and riffles) due to sediment trapping in upstream reservoirs, gold and gravel mining, and other land use changes since the 1850s (DWR 1994; McBain & Trush 2004).

Previous riparian investigations found large scale removal of riparian vegetation that was a direct result of mining activities and urban/agricultural encroachment. Clearing of riparian forests decreased large woody debris recruitment, allowed exotic plants to invade the riparian corridor, reduced shading of the water's surface, and contributed to increased water and air temperatures in the Tuolumne River corridor (McBain & Trush 2000). Grazing and other land uses have also resulted in direct impacts on riparian vegetation.

Salmonid habitat quality and quantity, including characterization of habitat limitations and relative salmonid production potential is routinely assessed through surveys of instream habitat composition and structure, such as those surveys described by CDFG (2010). Results of such surveys can help identify land use and other related effects on habitat quality, thus the relative potential of the anadromous fish population, and identify opportunities to restore or enhance habitat conditions and salmonid production. In July 2008, Stillwater Sciences conducted a focused assessment of *O. mykiss* in the Tuolumne River that incorporated a habitat mapping component. The assessment identified general habitat units (e.g., pool, riffles) and then discussed the relationship between habitat type and observed *O. mykiss* use. An example of Stillwater's data output is displayed in Table 4.0-1. Habitat maps were also created displaying general habitat type from RM 39 to RM 54. The report provides a foundation for this proposed study.

Table 4.0-1 *O. mykiss* summer 2008 bounded count population estimates by fish length and habitat type taken from Stillwater (2008).

Habitat	***O. mykiss* < 150 mm**				***O. mykiss* ≥ 150 mm**				**Total**			
	Seen[1]	**Est.**	**Stdev**	**95% Interval**[2]	**Seen**[1]	**Est.**	**Stdev**	**95% Interval**[2]	**Seen**	**Est.**	**Stdev**	**95% Interval**
Pool Head	12	20	10.1	12–40	17	45	13.2	19–71	29	65	16.7	33–98
Pool Body	0				3	24	18.0	3–59	3	24	18.0	3–59
Pool Tail	1	2	2.6	1–7	0				1	2	2.6	1–7
Run Head	46	166	179.0	46–517	1	6	8.8	1–23	47	172	179.2	47–523
Run Body	5	860	115.6	634–1,087	6	319	77.5	167–471	11	1,179	139.2	906–1,452
Run Tail	0				0				0			
Riffle	65	1,428	198.2	1,039–1,816	13	226	126.7	13–474	78	1,653	235.2	1,192–2,114
Total	**129**	**2,476**	**291.2**	**1,905–3,047**	**40**	**619**	**150.4**	**325–914**	**169**	**3,096**	**327.7**	**2,453–3,738**

[1] Largest numbers seen in any single dive pass for each unit, summed over units. Note that summation of the largest numbers seen within individual (50 millimeter [mm]) size bins yields higher estimates of total fish smaller and larger than 150 mm.

[2] Nominal confidence intervals calculated as +/- 1.96 standard deviations. When this yielded lower bounds less than the numbers seen, the lower bound was truncated accordingly and the interval shaded.

While existing historical data provide a broader characterization of the existing habitat, a more detailed investigation into habitat conditions is proposed. A more detailed assessment of *O.*

mykiss occupancy relative to complexity would include the level and kind of complexity, factors associated with complexity, (such as bars, backwater pools, scour pools, etc.), and the amount of habitat available as a function of complexity and use.

5.0 Study Methods

The study methods described below will be implemented to meet the study objectives.

5.1 Study Area

A one-year habitat assessment will be conducted in the salmonid spawning and rearing reach of La Grange Dam (RM 54) to RM 39 near Waterford.

5.2 General Concepts

The following general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study report.

5.3 Study Methods

The study will rely upon existing broader habitat mapping conducted by Stillwater Sciences (2008) to identify focal research areas where *O. mykiss* occur and then utilize a high-resolution CDFG habitat typing methodology (CDFG 2010) to further characterize and evaluate these areas. CDFG identified four levels of typing, ranging from general broad habitat ID (Level I) to more detailed characterizations entailing 24 different potential habitat descriptors, Level IV. This study will utilize the highest detail, which will allow for a strongly supported assessment of habitat for *O. mykiss* and other fish species.

Step 1 – Site Selection, Field Reconnaissance, and Planning. Researchers will begin by reviewing existing habitat mapping reports conducted by Stillwater Sciences in 2008. These reports will highlight a subset of representative areas in defined reaches where detailed habitat measurements will be conducted.

Sub-sampling is a common practice for habitat mapping. CDFG identified in a database of 200 stream habitat inventories that a sampling level of approximately 10 percent of total habitat would accomplish similar descriptive detail to a complete 100 percent survey (CDFG 2010). To gain an estimate of effort for this survey, the scope of the study is within a 15 mile reach or 24,140 meters (m). The effort will sample 20 percent of the total habitat (or approximately 4,828 meters of habitat) to conservatively ensure sufficient data is collected relative to CDFG's 10 percent standard. Stillwater (2008) found that their identified broader habitat units were generally 150 m in length (not including long pools). So, this would equate to providing detailed measurements of approximately 32 habitat units averaging 150 m in length, which will represent the number of units targeted for this effort. Selected units will be preferentially located where *O.*

mykiss were identified; however, if less than 32 locations occur where *O. mykiss* were identified, additional sites will be selected based upon professional scientific judgment.

Next a general field reconnaissance investigation will be implemented at these selected areas. Reconnaissance will identify accessibility and safety issues. Field researchers will identify where issues exist and create a field implementation plan and schedule. In addition, field technicians will be trained to ensure that habitat typing criteria are being applied consistently across all mapping teams.

<u>Step 2 – Field Data Collection</u>. Field data collection will be implemented using multiple teams of two field technicians. Each team will have a map and aerial photos delineating the portions of reach that will be surveyed. Upon accessing these focal areas, each team will collect a suite of measurements that are detailed in Table 5.3-1. These measurements are representative of the required data collection for Level IV CDFG habitat mapping. Data will be documented on template datasheets to ensure that all data are collected and in a congruent manner between teams. Field measurements will be collected with standard field equipment: a handheld thermometer will be used to collect temperature measurements; a calibrated stadia rod will be used to measure water depth, a steel meter tape or optical range finder will measure site dimensions; and a spherical densitometer will measure percent cover. Each team will also be equipped with a handheld GPS and camera.

Table 5.3-1 A summary of data collected as part of the Level IV CDFG habitat mapping.

Gathered Data	Description
Form Number	Sequential numbering
Date	Date of survey
Stream Name	As identified on USGS quadrangle
Legal	Township, Range, and Section
Surveyors	Names of surveyors
Latitude/Longitude	Degrees, Minutes, Seconds from a handheld GPS
Quadrant	7.5 USGS quadrangle where survey occurred
Reach	Reach name or rivermile range
Habitat Unit #	The habitat unit ID # that the bankfull width was measured
Time	Recorded for each new data sheet start time
Water Temperature	Recorded to nearest degree Celsius
Air Temperature	Recorded to nearest degree Celsius
Flow Measurement	Can be obtained from USGS monitoring stations
Mean Length	Measurement in meters of habitat unit
Mean Width	Measurement in meters of habitat unit
Mean Depth	Measurement in meters of habitat unit
Maximum Depth	Measurement in meters of habitat unit
Depth Pool Tail Crest	Maximum thalweg depth at pool tail crest in meters
Pool Tail Embeddedness	Percentage in 25% bucket ranges
Pool Tail Substrate	Dominant substrate: silt, sand, gravel, small cobble, large cobble, boulder, bedrock
Large Woody Debris Count	> 1-foot diameter (6 feet to 20 feet or >20 feet)
Shelter Value	Assigned categorical value: no shelter, minimal shelter (small debris, bubble curtain etc.), significant shelter (large woody debris, root wads, vegetative cover, etc.)
Percent Unit Covered	Percent of the unit occupied
Substrate Composition	Composed of dominant and subdominant substrate: silt, sand, gravel, small cobble, large cobble, boulder, bedrock
Percent Exposed Substrate	Percent of substrate above water

Percent Total Canopy	Percent of canopy covering the stream
Percent Hardwood Trees	Percent of canopy composed of hardwood trees
Percent Coniferous Trees	Percent of canopy composed of coniferous trees
Right and Left Bank Composition	Identify dominant substrate: sand/silt, cobble, boulder, bedrock
Right and Left Bank Dominant Vegetation	Identify dominant vegetation: grass, brush, hardwood trees, coniferous trees, no vegetation
Right and Left Bank Percent Vegetation	Percent of vegetation covering the bank
Comments	Additional notes as needed

USGS = U.S. Geological Survey

Step 3 – Data Processing and Analyses. Collected data will be stored and managed using a digital spreadsheet database. All data sheets will be physically copied after each week of survey. Data sheets will then be entered into a spreadsheet database. Entered data will be QA/QC'd by two independent technicians reading and confirming each line of data together. Final data will be made available to relicensing participants in digital spreadsheet form.

Entered data will be summarized in tables and figures depicting overall habitat characteristics and conditions by reach. The quality and suitability of the habitat will be assessed in light of existing resources that include *O. mykiss* life history needs. This assessment will also discuss the findings from the Stillwater (2008) report and compare current conditions to population and habitat data collected in 2008. Maps depicting the location of the surveys and images of the surveyed habitat will also be provided within the report.

Data summaries will be used to characterize the quality and quantity of *O. mykiss* habitat relative to complexity. Complexity will be characterized by associated structure (e.g., LWD, boulder, pool depth) and related to observed use by juvenile *O. mykiss*. Assessment of use as a function of complexity and structure will describe the relative suitability of the different instream habitat conditions in the lower Tuolumne River. Ultimately, the quantity, quality, and use of habitat as characterized will be compared to similar information from other anadromous salmonid streams describing relative value of habitat composition to juvenile *O. mykiss* rearing and production. The comparison will identify the occurrence and role of LWD in the Tuolumne River, and provide a basis for assessing the potential reduction of LWD recruitment and implications on *O mykiss* abundance.

Step 4 – Prepare Report**.** The Districts will prepare a report that includes the following sections: (1) Study Goals, (2) Methods and Analysis, (3) Results, (4) Discussion, and (5) Conclusions. The quality and suitability of the habitat will be assessed and reported in light of existing resources that include steelhead life history needs. The report will discuss the findings from the Stillwater (2008) report and compare current conditions to population and habitat data collected in 2008.

The report will also contain GIS maps of sampled areas, organized and labeled photos of select habitat, and relevant summary tables and graphs. The reported data will be organized by reach site to allow for a spatial presentation of the findings. Raw QA/QC'd data will be made available to relicensing participants in spreadsheet form.

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC issues its Study Plan Determination by December 31, 2011, and the study is not disputed by a mandatory conditioning agency:

Project Preparation............April – May 2012
Field Mapping............June – August 2012
Data QA/QC............September 2012
Prepare Report............October – November 2012
Report Issuance............January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

The habitat mapping methodology was developed by CDFG based upon notable prior researchers. The methods described are standards that have been reviewed and used by numerous researchers since 1991. The study will follow the latest survey approach that has been refined into the current 4th edition.

8.0 Deliverables

In addition to GIS-based maps of survey locations documented as part of this study, the Districts will prepare a report, which will document the methodology and results of the study.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

Bisson, P.A., G.H. Reeves, R.E. Bilby, and R.J. Naiman. 1997. Watershed management and Pacific salmon: desired future conditions. Pages 447-474 in D.J. Stouder, PA. Bisson, and R.J. Naiman, editors. Pacific salmon and their ecosystems: status and future options. Chapman and Hall, New York.

Bustard, D.R., and D.W. Narver. 1975. Aspects of the winter ecology of juvenile coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*Salmo gairdneri*). Journal of the Fisheries Research Board of Canada 32:667-680.

California Department of Fish and Game (CDFG). 2010. California Salmonid Stream Habitat Restoration Manual, 4th Edition. Available online at: <http://www.dfg.ca.gov/ fish/resources/ habitatmanual.asp.

California Department of Water Resources (DWR). 1994. San Joaquin River Tributaries Spawning Gravel Assessment: Stanislaus, Tuolumne, Merced Rivers. Department of Water Resources, Northern District, November 1994.

Cederholm, C.J., R.E. Bilby, P.A. Bisson, T.W. Bumstead, B.R. Fransen, W.J. Scarlett, and J.W. Ward. 1997. Response of Juvenile Coho Salmon and Steelhead to Placement of Large Woody Debris in a Coastal Washington Stream. North American Journal of Fisheries Management 17:947-963, 1997

Gowan, C., and K.D. Fausch. 1995. Long-term demographic responses of trout populations to habitat manipulation in six Colorado streams. Ecological Applications 6:93 l-946

House, R.A., J. Anderson, P.L. Boehne, and J. Suther, editors. 1988. Stream rehabilitation manual: emphasizing project design, construction, evaluation. U.S. Bureau of Land Management, and others, Ashland, Oregon

McBain & Trush. 2004. Coarse Sediment Management Plan For the Lower Tuolumne River, Prepared for Tuolumne River Technical Advisory Committee (Don Pedro Project, FERC License No. 2299) by McBain and Trush, Arcata, CA.

McBain & Trush. 2000. Habitat Restoration Plan for the lower Tuolumne River Corridor, Prepared for Tuolumne River Technical Advisory Committee (Don Pedro Project, FERC License No. 2299) by McBain and Trush, Arcata, CA.

Reynolds, F.L., T.J. Mills, R, Benthin, and A. Low. 1993. Restoring Central Valley streams: a plan for action. Inland Fisheries Div., Calif. Dept. of Fish and Game. Sacramento CA. 184 p.

Stillwater Sciences. 2008. July 2008 population size estimate of *Oncorhynchus mykiss* in the Lower Tuolumne River. Prepared for the Turlock Irrigation District and the Modesto Irrigation District by Stillwater Sciences, Berkeley, CA. October.

U.S. Department of Commerce, National Marine Fisheries Service (NMFS). 2009. Public Draft Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook salmon and Central Valley Spring-Run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead. Available online at: <http://swr.nmfs.noaa.gov/recovery/centralvalleyplan.htm>.

U.S. Department of Interior, Fish and Wildlife Service (USFWS). 2001. Final restoration plan for the Anadromous Fish Restoration Program. A Plan to increase Natural Production of Anadromous Fish in the Central Valley of California. Report of the Anadromous Fish Restoration Program Core Group, Central Valley Project Improvement Act to the Secretary of the Interior. Stockton, CA.

Ward, B.R., and P.A. Slaney. 1981. Further evaluation of structures for the improvement of salmonid rearing habitat in coastal streams of British Columbia. Pages 99-108 in Hassler (1984).

STUDY PLAN W&AR-13

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Fish Assemblage and Population Between Don Pedro Dam and La Grange Dam Study Plan

July 2011

Related Study Requests: SWRCB-01

1.0 Project Nexus

The continued operation and maintenance (O&M) of the existing Don Pedro Project (Project) has the potential to affect the fish assemblage and fish populations between Don Pedro Dam and La Grange Diversion Dam.

2.0 Resource Agency Management Goals

The Districts believe that two agencies have resource management goals related to resident fish populations and their habitat within the study area: (1) California Department of Fish and Game (CDFG); and (2) State Water Resources Control Board, Division of Water Rights (SWRCB). Each of these agencies and their management direction, as understood by the Districts at this time, is described below.

CDFG's mission is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. CDFG's resource management goals, as summarized in restoration planning documents such as "Restoring Central Valley Streams: A Plan for Action" (Reynolds et al. 1993), are to restore and protect California's aquatic ecosystems that support fish and wildlife, and to protect threatened and endangered species under California Fish and Game Code (Sections 6920–6924).

SWRCB is the state agency that administers the federal Clean Water Act (CWA) (33 U.S.C. §11251-1357) as applies to California waters with the responsibility to maintain the chemical, physical, and biological integrity of the state's waters and to preserve the water quality necessary to protect the beneficial uses of stream reaches consistent with Section 401 of the federal CWA, the Regional Water Quality Control Board Basin Plans, State Water Board regulations, California Environmental Quality Act, and any other applicable state law.

3.0 Study Goals

The goal of the study is to characterize the fish assemblage and populations between Don Pedro Dam and La Grange Diversion Dam.

The objectives of the study are to: (1) characterize fish species composition, relative abundance (e.g., catch per unit effort [CPUE]), and size length and weight) between Don Pedro Dam and La Grange Diversion Dam; (2) characterize the functional habitat in the reach as either riverine or lacustrine; and (3) characterize fish size and condition factor.

4.0 Existing Information and Need for Additional Information

La Grange Diversion Dam diverts water into the Districts' irrigation infrastructure. The reach between La Grange Dam and Don Pedro Dam is privately owned by the Districts, with no public access. No records of any stocking activities were found during a search of CDFG archives. Additionally, no fishing reports or anecdotal information was discovered by internet searches.

In 2008, Stillwater Sciences conducted a minimal hook and line sampling effort in this reach focused on rainbow trout for the purpose of monitoring mercury levels in fish tissue (Stillwater Sciences 2009). Six rainbow trout ranging from 356 millimeters (mm) to 489 mm (fork length) and an average of 427 mm fork length were captured for tissue mercury sampling. These data represent the only recorded information and the only known fishing activity in this reach of the Tuolumne River (Stillwater Sciences 2009).

Built in 1893, La Grange Dam was the tallest dam of its kind in California. The dam was constructed for the purpose of raising the river to the level required to channel river water to the Districts' off-channel impoundments at Turlock Lake and the Modesto Reservoir (TID/MID 2011). A high flow event in 1997, after the completion of New Don Pedro Dam, brought a large amount of sediment down the Project's spillway and greatly reduced the storage available within the La Grange impoundment. Preliminary information indicates depths range from 5 to 10 feet throughout the reach; the current condition of the area between the two dams is more accurately described as a deep, wide river channel, rather than an impoundment. On average, 900,000 acre-feet of water passes through the reach annually.

Additional safety concerns have been taken into account in the preparation of the following methodology. The headworks of the two canals are open tunnels and pose a safety risk for anyone attempting to work on the impoundment during normal operations. Surplus water is generally spilled over La Grange Dam creating additional safety concerns. However, such spills only occur when excess water over and above the amount that can be diverted into the MID and TID canals is being released from Don Pedro Reservoir.

5.0 Study Methods

5.1 Study Area

The study area is the reach between Don Pedro Dam and La Grange Diversion Dam which is owned by the Districts.

5.2 General Concepts

The following general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner and will modify the study as appropriate to ensure safety.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study report.

5.3 Study Methods

Sampling will use boat electrofishing and gill nets to collect fish following the study methods outlined below. However, the Districts may adapt the existing methodologies to follow any additional criteria identified in the CDFG Scientific Collection Permit or to adapt to prevailing safety concerns. The study reach is best characterized as a swift, wide, shallow water body during most of the year when irrigation water is being delivered to downstream users and when flood management conditions are being maintained by flood releases. Sampling during these typically high flow release periods result in conditions that are unsafe for boating or other activities associated with the proposed fish study. Safe study conditions will only occur during periods of low flow, or outages. Hence, a single sampling effort will be conducted during an annual outage, after the regular irrigation season in order to minimize safety concerns. This is also likely to aid in sampling efficiencies during the sampling effort.

The Districts will obtain all necessary permits prior to performing fieldwork.

The study methods will consist of four steps, each of which is described below.

<u>Step 1 – Field Reconnaissance</u>. A field survey will be conducted prior to sampling to view the existing habitat and identify those areas in which each sampling technique will be most effective. Boat electrofishing and gillnet sampling require specific characteristics in order to accurately sample fishes. Upon documenting habitat with photos and GPS, the Districts will notify relicensing participants of the area and extent to which each method will be utilized.

Electrofishing stations, or sampling units, will be a minimum of 100 meters (m) long. They will be located throughout the study area to represent the diversity of identified near-shore habitats that can be sampled by boat electrofishing. The Districts will make a good faith effort to sample approximately 50 percent of the accessible shoreline of the study reach. The exact number of sampling stations will depend on the diversity of near-shore habitat conditions that will be assessed during field reconnaissance. Diversity conditions will likely include depth, cover, substrate, and proximity to sources of inflow. Sampling stations will be designated on orthophotographs of the study reach and documented using GPS.

The shallow nature of reach between Don Pedro and La Grange dams does not lend itself to successful gillnetting as a sampling method alone. After outage conditions have been assessed, gill nets will be utilized in any areas conducive to required depth and flow criteria. Gill net sampling will occur concurrently with electrofishing activities during daylight hours, with a maximum soak time of six hours. Boat electrofishing and gill net sites will be spatially separated to prevent any potential influences on catch. Sampling stations will be designated on orthophotographs of the study reach and documented using GPS.

Step 2a – Boat Electrofishing**.** Boat electrofishing will be used to sample near-shore habitat in the study reach. Field activity will be conducted during daylight hours due to safety concerns. Boat electrofishing will take place using standard methods (Reynolds 1996). One or two electrode booms will be employed, and the booms and boat will be outfitted with standard non-conductive material in appropriate places for safety. Electrofisher "time on" will be recorded for each sampling site and a consistent effort and pace will be employed at all sites. Fish will be identified, where possible, as to origin; hatchery or wild stock (i.e., basic visual identification, such as a clipped adipose fin). Data recorded for each fish will include species identification, fork length (standard length of all fish species without forked caudal fins), weight, and, if applicable, notes on general condition.

General information recorded will include impoundment name, GPS sample site location, crew member names, weather conditions, air temperature, and water chemistry at approximate fish sampling location (i.e., water temperature, dissolved oxygen, and conductivity). Minimum, maximum, and mean water depths will be recorded.

Step 2b – Gill Netting**.** Habitat and water velocity will be assessed for suitability of sampling. If appropriate conditions are found, gill nets will be deployed in up to five locations across the study area. Samples will be taken using variable mesh gill nets (e.g., adult net: 1-inch to 3-inch mesh, and juvenile net: 0.5-inch to 0.75-inch mesh). At each location one adult net and one juvenile net will be set at the surface, perpendicular to the shoreline. The shallow condition of the reach will preclude the need for nets at multiple depths for each site. The times of deployment and locations of each gillnet set will be recorded, and photographs will be taken of each gillnet after deployment to document both location and placement relative to the shoreline. The gillnets will be set for up to six hours to assure good coverage. Nets will be checked at the end of each day.

Fish will be identified, where possible, as to origin; hatchery, or wild stock (i.e., basic visual identification, such as a clipped adipose fin). After fish are captured, each fish will be processed, and information will be collected regarding species identification, fork length (standard length of all fish species without forked caudal fins), weight, and, if applicable, notes on general condition.

General information recorded will include impoundment name, GPS sample site location, crew member names, weather conditions, air temperature, secchi depth, and water chemistry (i.e., water temperature and dissolved oxygen). Minimum, maximum, and mean water depths will be recorded along with the depth placement of each gillnet. Dissolved oxygen will be measured at the surface and near the bottom at four (25 percent intervals of length along the thalweg of the reach) locations within the reach.

Step 3 – Data Entry and Data Analysis**.** Data will be entered into a database. The database will be organized, compiled, and subjected to quality assurance/quality control procedures. Data will be analyzed graphically and summarize species composition, relative abundance, length frequency, and location.

Gill net and boat electrofishing results will be reported both as total catch and in terms of CPUE. CPUE for fishes captured by boat electrofishing and gill net will be calculated by dividing the number of fish of each species captured by the length of time fished (e.g., fish/hour). CPUE will be summarized for the reach and for each species.

The relative abundance of fish at each site will be calculated to identify fish species composition and distribution patterns throughout the study area.

Fish size and weight will be summarized by fish species and site. Length-weight regressions will be generated to calculate a relative condition factor (K_n) for fish species.

Step 4 – Prepare Report**.** The Districts will prepare a report that includes the following sections: (1) Study Goals and Objectives; (2) Methods and Analysis; (3) Results; (4) Discussion; and (5) Description of Variances from the FERC-approved study, if any. The report will also contain GIS maps of sampled areas and relevant summary tables and graphs. Further, the report will describe daily water surface elevation patterns and approximate pool volumes. The report will include a summary of water quality information collected during sampling and during any other sampling efforts that take place in the sampling year. The report will also include:

- Fish species composition, relative abundance (i.e., CPUE), location, and condition factor by species in the reach.
- Water quality information and dissolved oxygen concentrations will be summarized from the current study.
- Photo documentation of survey efforts and areas assessed or sampled.

If the Districts observe any special-status fish species, the Districts will complete the appropriate California Natural Diversity Database (CNDDB) form and transmit the form to the CNDDB.

6.0 Schedule

The Districts anticipate the schedule to complete the study proposal as follows, assuming FERC's Study Plan Determination is deemed final on December 31, 2011:

Planning .... January – February 2012
Field Work .... February – September 2012
Office Work .... September – December 2012
Report Preparation .... January – March 2013
Report Issuance .... January 2014

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

The study methods discussed above are consistent with the study methods followed in several other relicensings. The methods presented in this study plan also are consistent with those used in recent relicensings in California.

8.0 Deliverables

In addition to GIS-based maps of survey locations documented as part of this study, the Districts will prepare a report, which will document the methodology and results of the study. Interim communications, such as technical memos produced during the course of the study, will be summarized in the final report

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

Reynolds, J.B. 1996. Electrofishing. Pages 221-253 in B. R. Murphy and D. W. Willis, editors. *Fisheries techniques*, 2nd edition. American Fisheries Society, Bethesda, Maryland

Reynolds, F.L., T.J. Mills, R. Benthin, and A. Low. 1993. Restoring Central Valley Streams: A Plan for Action. Inland Fisheries Div., Calif. Dept. of Fish and Game. Sacramento CA. 184 p.

Stillwater Sciences. 2009. Don Pedro Reservoir Fish Mercury Study. Final Report for Turlock Irrigation District and Modesto Irrigation District.

Turlock Irrigation District and Modesto Irrigation District (TID/MID). 2011. Don Pedro Project, FERC No. 2299, Pre-Application Document. February 2011.

STUDY PLAN W&AR-14

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Temperature Criteria Assessment (Chinook and *Oncorhynchus mykiss*) Study Plan

July 2011

Related Study Requests: NMFS-06

1.0 Project Nexus

Turlock Irrigation District's (TID) and Modesto Irrigation District's (MID) (collectively, the Districts) continued operation and maintenance (O&M) of the Don Pedro Project (Project) may contribute to cumulative effects on water temperatures in the lower Tuolumne River. Water temperature varies both seasonally and longitudinally along the river, and may act either independently or in combination with stream flows to affect habitat suitability, disease risk, and predation risk for Central Valley fall-run Chinook salmon (*Oncorhynchus tshawytscha*) and *O Oncorhynchus mykiss (O. mykiss).*

2.0 Resource Agency Management Goals

The Districts believe that four agencies have resource management goals related to Chinook salmon and *O. mykiss* and/or their habitat: (1) U.S. Department of Interior, Fish and Wildlife Service (USFWS); (2) U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS); (3) California Department of Fish and Game (CDFG); and (4) State Water Resources Control Board, Division of Water Rights (SWRCB). Each of these agencies and their jurisdiction and management direction, as understood by the Districts at this time, is described below.

A goal of the USFWS (2001) Anadromous Fish Restoration Program, as stated in Section 3406(b)(1) of the Central Valley Project Improvement Act, is to double the long-term production of anadromous fish in California's Central Valley rivers and streams. Objectives in meeting this long-term goal include: (1) improve habitat for all life stages of anadromous fish through provision of flows of suitable quality, quantity, and timing, and improved physical habitat; (2) improve survival rates by reducing or eliminating entrainment of juveniles at diversions; (3) improve the opportunity for adult fish to reach spawning habitats in a timely manner; (4) collect fish population, health, and habitat data to facilitate evaluation of restoration actions; (5) integrate habitat restoration efforts with harvest and hatchery management; and (6) involve partners in the implementation and evaluation of restoration actions.

NMFS has developed Resource Management Goals and Objectives for species listed under the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §1801 et seq.) and the Endangered Species Act (ESA) (16 U.S.C. §1531 et seq.), as well as anadromous species that are not currently listed but may require listing in the future. NMFS' (2009) Public Draft Recovery Plan for Sacramento River Winter-run Chinook salmon, Central Valley Spring-run Chinook salmon, and Central Valley steelhead (Draft Recovery Plan) outlines NMFS' framework for the recovery of ESA-listed species and populations in California's Central Valley. For Central Valley *O. mykiss*, the recovery actions identified for the Tuolumne River are to: (1) Conduct habitat evaluations, and (2) manage cold water pools behind La Grange and Don Pedro dams to provide suitable water temperatures for all downstream life stages. For Central Valley fall/late fall-run Chinook salmon, the relevant goals are to enhance the essential fish habitat downstream of the Project and achieve a viable population of Central Valley fall/late fall-run Chinook salmon in the Tuolumne River.

CDFG's mission is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. CDFG's resource management goals, as summarized in restoration planning documents such as *Restoring Central Valley Streams: A Plan for Action* (Reynolds et al. 1993), are to restore and protect California's aquatic ecosystems that support fish and wildlife, and to protect threatened and endangered species under California Fish and Game Code (Sections 6920–6924). In addition, California Fish and Game Code (Sections 5937 and 5946) stipulates that the owner of a dam is required to allow sufficient water to pass the dam in order to keep fish[1] in the stream below the dam in good condition.

SWRCB has responsibility under the federal Clean Water Act (33 U.S.C. §11251–1357) to preserve and maintain the chemical, physical and biological integrity of the State's waters and to protect water quality and the beneficial uses of stream reaches consistent with Section 401 of the federal Clean Water Act, the Regional Water Quality Control Board Basin Plans, State Water Board regulations, the California Environmental Quality Act, and any other applicable state law.

3.0 Study Goals

The overall objective is to develop information on the influence of temperature on the in-river life-stages of Chinook salmon and *O. mykiss*. Specific study objectives include the following:

- Identify life stage-specific fisheries population effects related to water temperature (e.g., effects on growth, disease susceptibility, predation risk, etc.).
- Identify life stage-specific water temperature evaluation parameters (i.e., effects associate with expected range of water temperatures).
- Assess and select an acceptable, informative approach to analyzing temperature regimes and their influences on Chinook salmon and O. mykiss in the lower Tuolumne River.
- Evaluate the historical exceedance of identified water temperature criteria.

[1] The term "fish" as defined in California Fish and Game Code Section 45 includes both vertebrate and invertebrate aquatic life.

4.0 Existing Information and Need for Additional Information

As summarized in the PAD, continuous water temperature data of existing flows in the Tuolumne River have been collected at various locations downstream of La Grange Dam since 1986 under the District's real time monitoring (RTM) program. In addition, the CDFG has monitored temperatures in the lower Tuolumne River at nearby locations since 1999. CDFG (2007) responded to the Central Valley Regional Water Quality Control Board's "Public Solicitation of Water Quality Data and Information for 2008 Integrated Report – List of Impaired Waters and Surface Water Quality Assessment," and proposed a Clean Water Act section 303(d) listing for temperature impairment of the lower Stanislaus, Tuolumne, and Merced Rivers on the basis of a portion of the existing data record in comparison with temperature criteria developed by a EPA (2003) literature review.

In response to the July 16, 2009 FERC order (128 FERC ¶ 61,035), the Districts applied an existing water temperature simulation model (RMA 2008) to evaluate the downstream extent of thermally suitable habitat to protect juvenile *O. mykiss* during summer. This included the evaluation of a temperature target of 20ºC (68°F) at Roberts Ferry Bridge (RM 39.5) as well as four additional temperature objectives recommended by the fishery resource agencies to be applied at specific locations and times of year (Stillwater Sciences 2011). This report suggested the need for additional model calibration. In conjunction with model recalibration, a more specific expression of temperature effects on the various life stages of these fish would enhance the understanding of the potential response of Chinook salmon and O. mykiss populations to temperature conditions within the lower Tuolumne River.

5.0 Study Methods

The Study will rely upon existing literature and information, including previously conducted studies and ongoing Tuolumne River monitoring to examine biologically relevant water temperature parameters for in-river life-stages of Chinook salmon and *O. mykiss*.. Additionally, tasks in this study plan that address life stage-specific criteria for anadromous *O. mykiss* also will serve to address life stage-specific criteria for resident *O. mykiss* during freshwater life stages.

5.1 Study Area

The study area includes the observed habitat use by Chinook salmon and ***O. mykiss*** in the Tuolumne River, extending from the La Grange Dam (River Mile 52) downstream to the confluence with the San Joaquin River (River Mile 0). However, because this study plan addresses different Chinook salmon and ***O.** mykiss* life stages, these boundaries could vary by life stage.

5.2 Study Methods

<u>Step 1 – Review Relevant Literature</u>. In order to successfully evaluate the influences of water temperature regimes on salmonid life history, relevant in-river life stages and life-history timing will be identified from existing river-wide monitoring as well as literature sources will be reviewed.

To identify appropriate water temperature evaluation parameters for the selected life stages and identified life history timing, a review of existing water temperature criteria guidance documents will be conducted that will (1) provide logical and biologically sound rationale for each life stage definition and/or combination of life stages; (2) interpret the literature on the life stage-specific fisheries population effects (e.g., egg mortality, growth effects, disease incidence, predation risk, acute lethal temperatures, etc.); and (3) consider the effects of exposure time at either constant or fluctuating temperatures.

The types of literature anticipated to be examined include scientific journals, Master's theses and Ph.D. dissertations, literature reviews, and agency publications. Additionally, to the extent that they are available, data from recent unpublished or ongoing studies also will be evaluated, potentially including reported observations on water temperature-related effects, dose-response studies, and empirical relationships between water temperature and measures of fish biological performance (e.g., egg-retention percentage, fertilization percentage, embryo viability, pre-spawning mortality, onset of smolting, juvenile growth, increased incidence of disease, etc.). The literature review will place emphasis relevant laboratory and field experiments identifying water temperature-related effects on Chinook salmon and ***O. mykiss*** in a hierarchical manner. Specifically, literature that provides information from the Tuolumne River will be given the greatest emphasis, followed by information from the San Joaquin River system, and then followed by other Central Valley streams and rivers, as well as regulatory documents such as biological opinions from NMFS. Studies on fish from outside the Central Valley will be used to establish index values when local studies are unavailable.

Preliminary cursory literature review indicates that the application of temperature parameters to determine potential effects on targeted life stages varies and much of the literature on salmonid water temperature requirements refers to "stressful," "tolerable," "preferred or "optimal" water temperatures or water temperature ranges (e.g., McCullough 1999). Because of the variation in description of potential effects of elevated water temperatures on anadromous salmonids, care will be taken to identify an appropriate range of water temperature criteria that describe the range of effects that could occur. Specifically, water temperature criteria will be identified to represent a gradation of potential effects, from reported optimal water temperatures increasing to lethal water temperatures for each life stage from data gathered in both the laboratory and in the field so as to not bias the results by relying on a temperature recommendation developed using a single technique. In addition, care will be taken to verify the appropriateness of individual temperature criteria, and in particular, recommendations supported by references to other literature. For example, Hinze (1959) actually examines the effects of water temperature on incubating Chinook salmon eggs, yet Hinze (1959) is cited in Boles et al. (1988); Marine (1992); and NMFS (1997) in statements regarding the effects of water temperature on holding Chinook salmon adults. Boles et al. (1988) and Marine (1992) were then further cited by McCullough et al. (2001) in support of statements regarding how water temperature affects the viability of gametes developing in adults.

The results of information developed under Step 1 will identify:

- The relevant life history timing of Chinook salmon and steelhead in the Tuolumne River.
- The types of life stage-specific effects on Tuolumne River Chinook salmon and steelhead that could occur over a range of water temperatures.

- Life stage-specific effects of temperatures in the Lower Tuolumne River on Chinook salmon and *O. Mykiss*.
- The most robust approach to developing parameters applicable to characterizing effects of temperature conditions in the Lower Tuolumne River on its Chinook salmon and O. mykiss populations.

<u>Step 2 – Develop Water Temperature Evaluation Parameters</u>.

Based upon the literature and information review conducted in Step 1, biologically defensible water temperature evaluation parameters will be developed. The criteria development will synthesize existing water temperature reviews and guidance documents (e.g., Marine 1992, Myrick and Cech 2001, USEPA 2003) as well as approaches for criteria development (e.g., Baker et al 1995, Sullivan et al 2000, RMT 2010).

The study will use the term "index" as a means of summarizing temperature data (measured or modeled) over specific time periods of interest (i.e., a life stage) examples include daily or seasonal average temperatures, daily or annual maximum temperatures, 7-day mean of the daily average temperatures, and the annual maximum weekly average temperature (MWAT) among others. Temperature "thresholds" identified in Step 1 above, and are defined as the value of a selected index that temperature must remain below to avoid specified (i.e., adverse) impacts. Temperature "Criteria", are defined as a combination of an index and associated threshold(s).

<u>Acute Criteria</u>. Acute temperature criteria refer to "lethal" conditions (often reported as the upper incipient lethal temperature, or UILT) and will be based primarily on laboratory studies with adjustments for acclimatization and other factors (e.g., Myrick and Cech, 2001) using the appropriate indices reflecting short term exposure (e.g., daily maximum water temperature, or annual maximum of the running 7-day average of daily maximum temperatures [7DADM]). It may also be possible to set acute temperature standards at lower temperatures using a longer term exposure approach (e.g., MWAT) approach if supported by available literature or survey data reliably documenting life-stage presence/absence at conditions corresponding to the selected index.

<u>Sub-lethal Criteria</u>. Sub-lethal criteria will be based upon the effects assessment developed in Step 1 above, including reduced growth, increased susceptibility to disease, predator avoidance, or other identified effects. Literature-based criteria for juvenile life stages developed from literature sources may be adjusted by application of bioenergetics approaches proposed by Sullivan et al (2000). Adaptation of this approach will require (1) review of existing estimates of food consumption and ration size (TID/MID 1997, Report 96-9), (2) identification of biologically relevant growth criteria (e.g., percent reduction from optimal, size at date, etc.), and (3) bioenergetic growth modeling as functions of temperature and fish size (i.e., length or weight). Depending upon the suitability of existing data, criteria specific to the Tuolumne River will be developed and compared with those reviewed in Step 1.

The results of information developed under Step 2 will identify:

- What indices, or metrics, should be used to measure the population-level effects of a specific water temperature regime on Chinook salmon and steelhead in the Tuolumne River?
- What are the appropriate temperature thresholds for protecting identified in-river life-stages of Chinook salmon and steelhead?
- What are the appropriate water temperature evaluation criteria for the Tuolumne River?

Step 3 – Relate Baseline Water Temperature Conditions to Population. Following the literature review and identification of water temperature and population-level fisheries parameters in Steps 1 and 2 above, the criteria will be applied to water temperatures recorded at various locations in the lower Tuolumne River. Exceedance probability distributions will be developed for the various criteria (e.g., optimum, stressful) from ranked and sorted water temperature data and the proportion of time that each of the water temperature evaluation parameters is exceeded will be calculated. Based on these exceedance probabilities, the potential effects on anadromous salmonids summarized and discussed.

The results of information developed under Step 3 will identify:

- In the lower Tuolumne River, how often was each of the life stage-specific water temperature evaluation parameters met under baseline conditions?
- Based on how often water temperature evaluation parameters were met, what were the likely effects on Tuolumne River salmonids?

6.0 Schedule

The Districts anticipate the schedule to complete the study proposal as follows, assuming FERC's Study Plan Determination is deemed final on December 31, 2011, and the study is not disputed by a mandatory conditioning agency:

Review Literature Defining Anadromous Salmonid Life Stage/Temperature	January – April 2012
Develop Water Temperature and Fisheries Evaluation Criteria	March – May 2012
Evaluate Baseline Temperature Conditions	May – June 2012
QA/QC	July 2012
Prepare Report	July – October 2012
Report Issuance	January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

This study consists primarily of conducting a review of relevant, readily available literature on water temperature-related effects on anadromous salmonids and utilizing information gained from the literature to identify relevant water temperature and fisheries population evaluation parameters.

Conducting a literature review is commonly accepted as the first step in attempting to identify the effects of anthropogenic perturbations of habitat variables on organisms (e.g., effects of elevated water temperatures on anadromous salmonids) and has been used during previous FERC relicensing efforts (e.g., the Oroville Facilities Relicensing, FERC Project 2100).

Identifying relevant water temperature evaluation parameters (index values) that describe the gradation of potential effects ranging from no effect (optimal conditions) to lethal effects has been conducted for previous environmental processes including the Lower Yuba River Accord and ongoing Yuba River Management Team efforts. Evaluating baseline conditions utilizing water temperature exceedance probability distributions and comparing observed water temperatures to water temperature evaluation parameters and fisheries population evaluation parameters is the primary method of evaluating river operations-related effects on anadromous fishes in the Central Valley.

8.0 Deliverables

The Districts will prepare a final report, which will document results of the literature review. The report will include a discussion of the methods used to calculate exceedance probability distributions, species and life stage-specific water temperature evaluation parameters, and species and life stage-specific fisheries population evaluation parameters. Results of the application of the temperature criteria to baseline water temperature evaluation will be summarized and discussed.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

Baker, P.F., T.P. Speed, and F.K. Ligon. 1995. Estimating the Influence of Temperature on the Survival of Chinook Salmon Smolts (*Oncorhynchus tshawytscha*) Migrating through the Sacramento-San Joaquin River Delta of California. Canadian Journal of Fisheries and Aquatic Science 52:855-863.

Boles, G.L., S.M. Turek, C.C. Maxwell, and D.M. McGill. 1988. Water temperature effects on Chinook salmon (Oncorhynchus tshawytscha) with emphasis on the Sacramento River: a literature review. California Department of Water Resources. 42 p.

California Department of Fish and Game (CDFG). 2007. Public Solicitation of Water Quality Data and Information for 2008 Integrated Report – List of Impaired Waters and Surface Water Quality Assessment [303(d)/305(b)]. Letter to the Central Valley Regional Water Quality Control Board.

Cech, J.J., Jr. and C.A. Myrick. 1999. Steelhead and Chinook salmon bioenergetics: temperature, ration, and genetic effects. University of California Water Resources Center: Davis, CA.

Hinze, J. A. 1959. Nimbus Salmon and Steelhead Hatchery: Annual Report, Fiscal Year 1957-1958. CDFG Inland Fisheries Administrative Report No. 59-4.

Marine, K.R. 1992. A Background Investigation and Review of the Effects of Elevated Water Temperature on Reproductive Performance of Adult Chinook Salmon (*Oncorhynchus*

Tshawytscha) With Suggestions for Approaches to the Assessment of Temperature Induced Reproductive Impairment of Chinook Salmon Stocks in the American River, California. Department of Wildlife and Fisheries Biology, University of California Davis.

McCullough, D.A. 1999. A review and synthesis of effects of alterations to the water temperature regime on freshwater life stages of salmonids, with special reference to Chinook salmon. Prepared for the U.S. Environmental Protection Agency. Published as EPA 910-R-99-010. July 1999.

McCullough, D.A., S. Spalding, D. Sturdevant, and M. Hicks. 2001. Summary of Technical Literature Examining the Physiological Effects of Temperature on Salmonids - Issue Paper 5. Report No. EPA-910-D-01-005. United States Environmental Protection Agency.

Myrick, C.A. and J.J. Cech. 2001. Temperature Effects on Chinook Salmon and Steelhead: A Review Focusing on California's Central Valley Populations. Bay-Delta Modeling Forum Technical Publication 01-1. Available at http://www.sfei.org/modelingforum/.

Resource Management Associates, Inc. (RMA) 2008. SJR Basin-Wide Water Temperature Model. Website. from: http://www.rmanet.com/CalFed_Nov2008/ [Accessed 21 August 2009].

Reynolds, F.L., Mills, T.J., Benthin, R., and A. Low. 1993. Restoring Central Valley streams: a plan for action. Inland Fisheries Div., Calif. Dept. of Fish and Game. Sacramento CA. 184 p.

Stillwater Sciences. 2011. Tuolumne River water temperature modeling study. Final Report. Prepared by Stillwater Sciences, Berkeley, California for Turlock Irrigation District and Modesto Irrigation District, California. March

Turlock Irrigation District and Modesto Irrigation District (TID/MID). 1997. Aquatic Invertebrate Report. Report 96-9 *In* Report of Turlock Irrigation District and Modesto Irrigation District pursuant to Article 39 of the license for the Don Pedro Project. Turlock, California.

U.S. Department of Commerce, National Marine Fisheries Service (NMFS). 1997. Proposed Recovery Plan for the Sacramento River Winter-Run Chinook Salmon. Long Beach, CA: National Marine Fisheries Service, Southwest Region.

_____. 2009. Public Draft Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook salmon and Central Valley Spring-Run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead. Available online at: <http://swr.nmfs.noaa.gov/recovery/centralvalleyplan.htm>.

U.S. Department of Interior, Fish and Wildlife Service (USFWS). 2001. Final restoration plan for the Anadromous Fish Restoration Program. A Plan to increase Natural Production of

Anadromous Fish in the Central Valley of California. Report of the Anadromous Fish Restoration Program Core Group, Central Valley Project Improvement Act to the Secretary of the Interior. Stockton, CA.

STUDY PLAN W&AR-15

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO HYDROELECTRIC PROJECT
FERC NO. 2299

Socioeconomics Study Plan

July 2011

Related Study Requests: AR-12, BAWSCA-01, BKP-01, CCSF-01, Modesto-01, MR&LI-01, SWRCB-15, Turlock-01

The Don Pedro Project (Project) is a water supply and power generation project located on the Tuolumne River. It is jointly owned by Modesto Irrigation District (MID, 31.54 percent) and Turlock Irrigation District (TID, 68.46 percent), collectively the "Districts." The Project is multipurpose, providing irrigation, municipal and industrial water supply, flood control storage, recreation, power, and fish and wildlife conservation benefits. The Project has contributed directly to the economic well-being of the areas it serves by providing a reliable, cost-effective, and high-quality water supply for consumptive and non-consumptive uses. The economic benefits of the Project are concentrated within the service areas of MID and TID, but also extend to other areas of the San Joaquin Valley and to the San Francisco Bay Area by providing a "water banking" arrangement that benefits the City and County of San Francisco (CCSF).

1.0 Project Nexus

The Project provides critical water supplies for the MID, TID, and CCSF service areas. Potential changes in operations may affect available water supplies and have the potential to directly affect the local and regional agriculture industry, a critical economic engine that supports job creation. In addition, changes in the availability and costs of water for consumptive use for local and San Francisco Bay area municipal and industrial (M&I) water customers will directly and indirectly affect the economic base of the Central Valley and San Francisco Bay areas, including the San Francisco Bay area's technology industry. Recreational users of Don Pedro Reservoir and the Tuolumne River may also be affected by changes in Project operations. Just as changes to flows below the Project are reviewed in terms of direct impacts to fish habitat, these same potential changes to flow must be assessed in terms of direct, indirect, and cumulative impacts to the human environment, costs to the consumers, and job retention and creation.

2.0 Resource Agency Management Goals

A host of state, regional, and local government entities have significant interests in the social and economic resources affected by the Project, including, but certainly not limited to MID, TID, and CCSF. The socioeconomic benefits and impacts of the Project accrue to water users within the respective service areas of the Districts and CCSF, and extend throughout the regional economies in proximity to those areas. The Districts do not have defined socioeconomic resource management goals related specifically to their service areas, but do manage the Project under a "water first" policy which acknowledges the critical role of water supply to the economy. In 2008, CCSF adopted defined resource management goals and objectives specific to its resource area in its Phased Water System Improvement Program.

3.0 Study Goals

The primary goals of the proposed study plan for socioeconomic resources are to quantify the baseline economic values and socioeconomic benefits supported by the Project and to develop methodologies that can be used to evaluate the potential socioeconomic effects of proposed changes in Project operations. The objectives include, broadly, an evaluation of the economic and social effects of potential changes in Project operations. More specifically, the objectives include characterizing the economy in the regions served and affected by the Project and determining the factors affecting regional economic activity; quantifying the economic value generated by water supplies; identifying the role of the Project in the performance of the regional economy; and estimating the socioeconomic impacts likely to result from changes in Project operations.

4.0 Existing Information and Need for Additional Information

Availability of existing information and the need for additional information differ among the users of Project water and geographic location. This section provides background information and addresses information needs by the type of water use and water user.

4.1 Agricultural Use

4.1.1 Background

The Central Valley of California is one of the most productive agricultural areas in the world. This productivity is completely dependent on the availability of a reliable water supply. MID has approximately 3,000 irrigation accounts comprising 59,000 irrigated acres. TID has about 4,900 irrigation accounts comprising 150,000 acres. The principal irrigated crops of the Districts consist of alfalfa, almonds, apples, beans, corn, grains, grapes, hay, pasture, sweet potatoes, walnuts, and other miscellaneous crops. Farmers in the area have invested tens of millions of dollars in the establishment of permanent crops such as almonds, grapes, walnuts, and other perennial crops, and on the irrigation systems to serve these crops, based on the reliability and quality of water from the Project.

The MID and TID service areas are in the northern San Joaquin Valley. MID's agricultural service area lies completely within Stanislaus County. TID's agricultural service area includes parts of Stanislaus as well as northern Merced County. This is a highly productive agricultural region. Climate and water availability are key to this richness, as the area is characterized by a semiarid Mediterranean climate of hot, dry summers and cool, rainy winters.

Due to the availability of a reliable irrigation water supply from the Districts, Stanislaus and Merced counties consistently have been among the top agricultural areas in California. In addition, agriculture in the service areas has gained an increasingly-important role in meeting both domestic and international agricultural market demands. Besides meeting most or all of the total U.S. demands for many specialty crops, farmers in the service areas are important suppliers of many high-value crops for export markets. Water consequently has a very high agricultural value in the Districts' service areas.

Land in both service areas has been farmed for more than 100 years, during which time both a large, diversified farm production sector and a complex of supporting goods- and service-providing businesses have developed. Agriculture has been and remains a core industry in the region. As farming has changed from land-extensive livestock and grain production to irrigated grain, field, fruits, nuts, and other intensively-farmed crops and dairy operations, a comprehensive infrastructure of related businesses has developed around farming. These related sectors include suppliers of purchased inputs, such as feed, seed, fertilizer, irrigation equipment, chemicals, and farm machinery; banks and other financial institutions; food processors; warehousing and storage businesses; and shippers and transportation companies. Moreover, since each of these industries purchases from many other sectors, agriculture has extensive ripple effects throughout the regional economy. The aggregate effect is that agricultural production in the Districts' service areas directly affects thousands of family farms and small businesses and the many thousands of people hired by those businesses.

Changes in Project operations may be expected to alter the quantity and reliability of irrigation water supply in the service areas of the Districts. Irrigators in the two Districts have no viable long-term and sustainable alternative water supplies. Groundwater may be substituted for some surface water, but groundwater quality and availability are not adequate in the long run to support the magnitude and diversity of agricultural production in the Districts' service areas. Consequently, the socioeconomic study will evaluate the potential impacts of unmet irrigation demands resulting from reduced irrigation water supplies associated with changes in Project operations.

4.1.2 Existing Information and Need for Additional Information

The information necessary to analyze baseline agricultural conditions, as well as conditions expected given potential changes in Project operations, include data on the production of crops in the service area, farm characteristics, costs of production, irrigation application rates, and irrigation water costs. Each is discussed below.

Much of the farmland served by the Districts, and which may be directly affected by changes in Project operations, is classified as Prime or Farmland of Statewide Importance by the California Department of Conservation (DOC). Prime farmland is considered to offer the optimal combination of physical and chemical characteristics for crop production which, with favorable climate, supports sustained high crop yields (DOC 2008). Farmland of statewide importance is similar to prime land, but with some limitations such as less favorable slope or less ability to store moisture. The socioeconomic study will utilize the land classification data from the DOC, in combination with other information, to discern which areas of the Districts' service areas are most vulnerable to changes in Project operations.

The key existing information on crop production in the Project area is the annual reports of the Stanislaus County and Merced County Agricultural Commissioner. These reports provide, annually, data on acreage, yield per acre, price per unit of production, and total value of production by key crops. Because the Agricultural Commissioner reports are for entire county areas, additional information will be provided by the Districts. The socioeconomic study will include an evaluation, at minimum, of five years of District annual crop reports in order to account for trends in cropping patterns and rotations of annual crops.

Farm characteristics data are available from the *Census of Agriculture*, published by the U.S. Department of Agriculture (USDA) every five years, and for which the most current release is for 2007. It includes county-level data on numbers and sizes of farms, ages and part-time versus full-time status of farmers, acreages of key crops, and similar data. Any sub-county or other *Census of Agriculture* data not published which are required for the analysis will be obtained as special tabulations from the National Agricultural Statistics Service of the USDA, at costs dependent on the complexity and details of the request.

The key data available on crop production costs are from the enterprise production budgets published by the University of California Cooperative Extension Service (UCCE). These budgets are published for many key crops grown in the San Joaquin Valley, including several of those grown in Stanislaus and Merced counties. Each budget includes assumptions on the size of the enterprise, establishment costs (for permanent crops), and detailed cultural, capital, and overhead costs.

Additional crop production cost data will be required for a rigorous analysis of the impacts on costs of changes in Project operations. Because the UCCE budgets are typically for multi-county areas, the socioeconomic study will validate the budgets for principal crops with a sample of irrigators growing those crops. This will require contacts with representative growers of principal crops grown in the Districts' respective service areas. Growers will be selected based on their willingness to cooperate on the study. Each cooperating grower will be provided with a crop enterprise budget for her/his selected crop and will be asked to review and comment on the figures in the budget based on their own operations, including costs, yields, irrigation system, crop rotations, and water application rates. While this survey will not necessarily be statistically representative, direct communication with growers will be key in validating published data and enhancing the understanding of local conditions.

4.2 Municipal and Industrial Use

4.2.1 Background

Water from the Project currently provides a maximum of 67,500 acre-feet (ac-ft) of water per year for local M&I uses. The Project directly serves M&I customers in the City of Modesto (via MID) and the community of LaGrange (jointly served by TID and MID). The M&I supplies are critical in enabling local agencies to manage their groundwater supplies conjunctively with

Project water, meet local health and safety requirements, and support both current and future economic development and job growth.

In addition, Don Pedro Reservoir provides up to 570,000 ac-ft of "water bank" credits to CCSF that can be used in its management of the Hetch Hetchy water system. Although water stored in the Don Pedro Reservoir is not delivered to CCSF water customers, those storage credits enable CCSF to increase the reliability of water delivered from the Hetch Hetchy System to approximately 2.5 million urban customers in the San Francisco Bay Area. Those M&I customers are served by CCSF directly, or by the 26 member agencies of the Bay Area Water Supply and Conservation Agency (BAWSCA) that depend on purchases of wholesale water from CCSF.

4.2.2 Existing Information and Need for Additional Information

Estimation of the current and future value of Project water for M&I uses will require several types of data over the potential 50-year term of a license. Publicly available information on M&I use in the Districts' service areas is available through the City of Modesto. The California Water Plan published every five years by the California Department of Water Resources includes Stanislaus and Merced counties in its San Joaquin River hydrologic region. The San Joaquin River hydrologic region is bordered by the Sierra Nevada on the east and the Diablo Range of the coastal mountains on the west. It extends through all of the San Joaquin River drainage area from the southern parts of the Delta and includes the northern drainage of the River in Madera County and the southern drainage in Fresno County. The Water Plan offers no M&I data for sub-hydrologic region areas.

Other M&I data are available for Stanislaus County from the Stanislaus County Water Atlas (Stanislaus County 2011). It shows that urban water use in the county is 210,100 ac-ft per year, although without reference to a specific year. Like the California Water Plan, the Water Atlas provides no information below the county level. M&I information analogous to that for Stanislaus County is not available from a single source for Merced County.

Completion of the proposed socioeconomic study will require additional information on M&I water use and costs. Such data for Stanislaus County will be provided by TID, MID, and the cities within the Districts' service areas. The data will include M&I uses for residential, commercial, industrial, and other purposes. The data will extend over a sufficiently lengthy term to allow for measurement of trends in each M&I category and the extent to which production in key M&I sectors has been inadequate during water shortage periods. The data from the Districts will also include cost information, comprising both fixed/standby and variable/volumetric charges.

Other information that will be required for the M&I water value estimation includes the availability and costs of replacement supplies, including the environmental effects of developing such supplies. For the socioeconomic study, all water agencies utilizing District water will be surveyed for information on their water supply portfolios, including the extent of their reliance on Project supplies. Data collected from the agencies will include the individual quantities and costs for each of their water supplies as well as estimated costs of replacement supplies should

Project water supplies be reduced. Information collected from the agencies and other sources will be utilized to develop a probability distribution of shortages under alternative Project operations and water year types. These data will be used to estimate the potential extent to which changes in Project operations will result in unmet M&I water demands.

The Districts recognize the importance of the Project to CCSF and its wholesale water customers. CCSF has indicated to the Districts that it will separately provide to the Districts and FERC an analysis of the value of the “water bank” credits provided by the Don Pedro Reservoir for CCSF’s M&I uses, and the water supply and any attendant environmental impacts and costs of potential changes in Project operations on the San Francisco Bay Area. Some information on M&I water use in CCSF and the San Francisco Bay Area is available in the 2010 *Urban Water Management Plan* for San Francisco (SFPUC 2011). CCSF has also conducted separate analyses of Bay Area municipal and industrial water use, and will be providing the Districts and FERC with additional studies on this topic in this proceeding. Finally, in 2010 CCSF's wholesale customers also updated their own urban water management plans (*see* http://bawsca.org/about/bawsca-agency-profiles for links to individual wholesale customer websites). The Districts believe that CCSF is uniquely qualified for assessing the impacts of potential changes in Project operations on Bay area water users.

4.3 Recreational Use

4.3.1 Background

Don Pedro Reservoir provides a wide-range of recreation opportunities, including boating, fishing, swimming, water-skiing, picnicking, hiking, and camping. Reservoir-based recreation is supported by developed recreation facilities in the project area, as well as commercial businesses at the lake, including two full-service marinas operated by a concessionaire. Between 2001 and 2007, recreation use in the Project area has averaged over 407,000 recreation days annually. Recreation activity at the reservoir is managed by the Don Pedro Recreation Agency (DPRA), which is sponsored by MID, TID, and CCSF. DPRA collects fees for public use of the reservoir.

4.3.2 Existing Information and Need for Additional Information

For the socioeconomic study, data will be collected from the DPRA to measure the extent and types of recreation activity at Don Pedro Reservoir. The value of recreation activity at the reservoir will then be calculated based on DPRA data and information on economic values and representative expenditure patterns for various types of recreation activities, which are available through published sources. For those activities where use data are not available, the economic evaluation will be qualitative.

4.4 Regional Economic Benefits

The beneficial uses of Project water, as well as the assurance of a reliable water supply to CCSF resulting from the “water bank” credits provided by the Don Pedro Reservoir, are the foundation of the performance of the regional economies. Typical measures of regional economic activity include economic output, labor income (including wages and salaries and proprietors’ income), and employment. Total economic effects include direct[1], indirect[2], and induced[3] impacts for the affected industries within a study area.

4.4.1 Existing Information and Need for Additional Information

County-level economic and demographic information, including data for Stanislaus, Merced, and Tuolumne counties, is available from Federal and State sources. The U.S. Census Bureau publishes a wide cross section of data in its decennial census. The Census Bureau also summarizes much of that information in its *State and County QuickFacts* publication, which includes population, by race; housing characteristics; education levels; household incomes and poverty levels; numbers of businesses and employment; manufacturers' shipments, wholesale and retail sales; and building permits. The California Department of Finance publishes *California County Profiles*, a collection of selected economic, social, and demographic data for each county. Data include such measures as population, labor force and employment among industries, housing stock, tax collections and expenditures, and educational enrollment and spending. County-level baseline data as well as long-term projections are published by the California Department of Transportation in its *Long-Term Socio-Economic Forecasts by County* project. Current projections for Stanislaus, Merced, Tuolumne, and all other California counties extend to 2035.

Limited sub-county data are available from different sources. The decennial census includes the data series noted above as well as others for sub-county areas, e.g. cities and census blocks. Information on numbers of businesses and employment, by size and type of business and by zip code are available from the U.S. Department of Commerce *County Business Patterns* publication. Other sub-county data are available for some cities, including population and population projections, and numbers of occupied and vacant housing units, from the California Department of Finance Demographic Research Unit. Some cities within the subject counties also publish economic and demographic information on their websites.

Regional economic benefits generated by the Project will be based on regional economic models and data. As outlined below, it is proposed that IMPLAN be used to estimate regional economic impacts. The use of this model will require county-level data developed in support of the IMPLAN model.

Because it already possesses detailed data on water use, demographics, and economic activity in the San Francisco Bay Area, CCSF is well suited to evaluate the Project's economic impacts on that region. CCSF will provide the Districts and FERC with a separate analysis of the Regional economic impacts of the potential operational modifications of the Don Pedro Project on the San Francisco Bay Area.

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1 Direct effects represent the impacts for the expenditures and/or production values specified as direct final demand changes.

2 Indirect effects represent the impacts caused by the iteration of industries purchasing from industries resulting from the direct final demand changes.

3 Induced effects represent the impacts on all local industries caused by the expenditures of new household income generated by the direct and indirect effects resulting from the direct final demand changes.

The information sources noted above will not directly provide an estimated economic value associated directly with Project water and related activities. Approaches to develop such estimates are described below.

4.5 Environmental Justice

The purpose of this environmental justice analysis is to provide information on the demographic and social characteristics of the general population affected by the Project. Under Executive Order 12898, this information is to be used to determine whether minority and/or low-income populations are disproportionately represented in the study area. Environmental Justice analyses are consistent with National Environmental Policy Act regulations and guidelines because they examine the potential impacts of changes in a project on all people regardless of race, color, national origin, or income.

Environmental Justice information includes data on minority populations residing within the vicinity of the Project, income, poverty levels, housing, and related variables. These data are available from the *Census of Population and Housing* and publications of the California Department of Finance Demographic Research Unit.

5.0 Study Methods

5.1 Study Area

The area for the socioeconomic study includes Stanislaus, Merced, and Tuolumne counties. It also includes the City and County of San Francisco and other areas of the San Francisco Bay Area dependent on wholesale water purchases from CCSF.

5.2 Study Methods

5.2.1 Agricultural Water Use

The value of water to a farmer is the increased net value of crop production attributable to irrigation. For agriculture in the San Joaquin Valley, limited natural rainfall would preclude cultivation of most crops, with the possible exception of dry land grain crops. The value of irrigation water is thus the difference in farm profit between irrigated crop production and any feasible dry land crops. The difference is also reflected in crop diversity and ability to adjust to changing agricultural markets.

Valuation of agricultural uses of Project water will focus on those parts of Stanislaus and Merced counties receiving such water and, in particular, the farm income resulting from such use. To estimate farm income in the MID and TID service areas, the socioeconomic study will rely heavily on UCCE crop enterprise budgets. The budgets will form the basis for estimating total costs and revenues, and therefore net farm income, associated with different crop types, irrigation methods, and other on-farm management decisions. The budgets will be modified to account for cultural practices specific to conditions in the MID and TID service areas.

The acreage, yield, cost, application rate, and other data discussed above will be utilized to develop an agricultural optimization model. The model will be structured to simulate farm-level behavior (including crop acreage, crop type, and irrigation system) under existing conditions and to account for expected responses to changes in the quantities and/or timing of irrigation water supplies. The "objective function" of the model will be to maximize farm net income subject to constraints on water supplies, land, other resources, and cultural practices, as appropriate. Output from the model will include the average and marginal values of water in different agricultural uses and different irrigation systems. The model, once developed and validated, will be used to estimate the direct acreage and revenue impacts of changes in irrigation water supplies attributable to changes in Project operations. These direct impacts will then be used as inputs in to a separate model to estimate the overall economic impacts of such changes at the regional level.

5.2.2 Municipal and Industrial Water Use

The economic value of M&I water supplies is typically considered in the context of average and marginal values. The average value of M&I supplies represents the value of water to local industries as an input to production (measured by production values); and the value of water as a drinking water supply (which is difficult to quantify). Most measures of value for M&I water supplies, however, are based on marginal values, i.e., the value of the last unit of water used. Conceptually, the marginal value of M&I supplies can be measured as the avoided costs of water supply reductions, which can be analyzed based on changes in consumption patterns (e.g., restrictions on water use for landscaping at the household level or declines in industrial production). Alternatively, the marginal value of urban water may be evaluated as the avoided cost of replacement supplies, particularly since many urban uses, including drinking water, are considered essential.

For the socioeconomic study, the value of M&I water supplies from the Project will be analyzed both qualitatively and quantitatively. The study will begin with a comprehensive literature review on the value of M&I supplies. These values could serve as a proxy for the types of value generated by Don Pedro water supplies. In addition, the study will include coordination directly with the M&I retail water suppliers which receive Project water. Information to be collected from those agencies will include, at minimum, the extent of their reliance on supplies from the Don Pedro Project, and their respective water supply portfolios, including costs of alternative supplies and the flexibility to utilize these alternative sources. The agencies will also be requested to provide any increased treatment costs as other lower-quality water sources are substituted for Tuolumne River water.

The information on water supply portfolios, together with estimated changes in supplies attributable to changes in Project operations, will be used to estimate the degree of unmet M&I demands in each area receiving Project water. These data will be used to estimate the losses in business, output, and employment in each area due to changes in Project operations.

CCSF will provide the Districts and FERC with a separate analysis of the economic impacts to the San Francisco Bay Area associated with any potential changes to the operations of the Don Pedro Project.

5.2.3 Recreational Use

People utilize such reservoirs and rivers as Don Pedro and the Tuolumne, respectively, for many types of recreation activities, and the resources consequently provide economic values to recreationists. Unlike such services as utilities and automobile repair, recreation services are usually not allocated and priced in markets. Typically, access to recreational activities is available to all participants at prices which most frequently do not vary by intensity of demand. Consequently, measurement of the values provided by recreation activities relies on "nonmarket" techniques as proxies for markets which respond directly to demand and supply factors. The cost and time requirements for collecting data and conducting statistical analysis for these methodologies are frequently very high. One alternative, recommended for this study plan, is the use of the "benefit transfer" method to estimate recreation-based economic values.

The benefit transfer method uses available information on economic values for recreation from studies already completed in another location and/or context and applies them to the project being analyzed. The basic premise of benefit transfer is to estimate benefits for one location (typically referred to as the "policy" site) by adapting an estimate of benefits from some other location (referred to as the "study" site). This approach yields representative values as long as the policy and study sites are relatively comparable.

Benefits transfer data for recreational activities at reservoirs are available from several sources. Rosenberger and Loomis, for example, present a comprehensive bibliography of literature citations on recreation use valuation studies (Rosenberger and Loomis 2001). Information includes benefit measures for various recreation activities, valuation methodologies, and location. The authors also include guidelines for applying the benefit transfer methods discussed.

5.2.4 Regional Economic Impacts

For the socioeconomic study, the regional analysis will include explicit consideration of the uses of Project water for agricultural, M&I, and recreational purposes. As noted above, Project water supplies are critical to the productivity and viability of the Stanislaus and Merced counties' agricultural sectors and the economy of the San Francisco Bay Area; to the health and safety of residents and support of businesses in many industries; and to the enjoyment of the recreational resources in the Project area.

Regional economic analysis measures changes in economic activity resulting from economic linkages in the economy. Linkages may be expressed as both "backward" and "forward." Backward linkages represent the purchases by businesses and households in the local economy, including the inter-industry purchases of goods and services. Examples include connections between production agriculture and the many industries which supply that industry, such as farm machinery and chemical and seed dealers and lenders. Forward linkages represent the purchases of goods and services of industries as raw materials in other industries. Examples include shipment of such farm products as tomatoes and cotton to processing plants and cotton gins.

Direct recreational benefits from the Project accrue primarily to Tuolumne and Stanislaus counties. Tuolumne County benefits arise because of the location of the Project and the most proximate local businesses associated with recreational activities. Stanislaus County benefits because of the many businesses associated indirectly with recreation activities at both Don Pedro Reservoir and on the Tuolumne River.

Input-output (I-O) models use information on sales and expenditures by industry, including the shares of expenditures paid to in-region businesses, to estimate economic multipliers. The multipliers can be used to estimate the total economic impact per dollar of direct output change for any industry. The ratio of the total economic activity to the direct impact is called a "multiplier," which can be developed for all measures of regional economic activity. For the proposed socioeconomic study, the estimation of regional economic impacts attributable to the Project will require the use of I-O software and data, or data alone, readily available from various commercial sources. One of the most commonly used is IMPLAN (IMpact Analysis for PLANning), which consists of two components: the software and the database. The software performs the necessary calculations, using study area data, to create regional I-O models. The databases, which are available at the state, county, and zip code area levels, provide the base economic information needed to create regional IMPLAN models. IMPLAN models incorporate the mathematical formulae needed to conduct economic impact analyses for a broad range of projects and policies in the study areas for which the models have been developed.

I-O multiplier data at the county level can also be purchased from the U.S. Department of Commerce Bureau of Economic Analysis through its Regional Input-Output Modeling System (RIMS) program. RIMS provides county-level multipliers to estimate how much a one-time or sustained change in economic activity in a particular region will affect industries located in the region. Uses of the RIMS multipliers include a wide variety of studies, including the assessment of local impacts of government regulations on individual industries, of regional economic impacts of government policies or business retention and attraction programs, and of regional impacts of natural disasters.

While RIMS multipliers are less expensive to purchase than IMPLAN software and data, IMPLAN will be utilized to assess the regional economic impacts associated with the Project. IMPLAN offers much more detail and flexibility than the RIMS program, including the ability to incorporate local data not reflected in the underlying RIMS information. In addition, IMPLAN is a more suitable approach to the estimation of forward linkages, which are an important factor in describing the value of Project water to the overall agribusiness sector in Stanislaus and Merced counties.

Based on the assumption that IMPLAN will be used, the main steps to assess the regional economic impacts of the Project include the following:

- **Define study area.** The appropriate study area must be defined to develop the IMPLAN models. For the Project assessment, the study area will depend in part on what driver of economic activity is being considered. For example, agricultural water use may extend from Stanislaus into Merced County, and the regional economic linkages will extend even further. On the other hand, recreation activity is limited primarily to the immediate project area. This step will require a careful evaluation of where agricultural production and recreation spending occur, as well as the geographic extent of support industries.

- **Develop and validate IMPLAN model(s).** Once the study areas are defined the appropriate regional economic models will be constructed using IMPLAN software and data. The study area model will include, at minimum, Stanislaus and Merced counties. In addition, a statewide economic model will be developed to estimate the regional economic benefits across the state.

- **Translate direct economic values to IMPLAN inputs.** It will be necessary to quantify the direct value of agricultural production and recreation spending under baseline conditions as inputs into the IMPLAN model. Agricultural production values will be based on the types and acreages of crops specifically supported by the Project. Estimates of recreation spending will reflect recreation use estimates and representative recreation spending profiles corresponding to the types of recreation activity occurring in the Project area.

- **Run IMPLAN models.** Using the appropriate data inputs, the IMPLAN models will be run to estimate the direct, indirect, and induced effects attributed to agricultural water use and recreation activity at Don Pedro Reservoir.

- **Analyze and interpret results.** The results of the IMPLAN model run will describe the direct, indirect, and induced economic impacts attributable to Project water in agricultural and recreational uses. These results will represent an economic baseline rather than impacts of changes in Project operations.

Changes in use of Project water may also have regional economic impacts in the San Francisco Bay Area. Because of its expertise in studying water use issues and the regional economy of the Bay Area, CCSF will separately provide the Districts and FERC with an analysis of those impacts.

5.2.5 Environmental Justice

The Environmental Justice section of the socioeconomic study will include detail on the demographics, income, and employment within the Project area as part of the baseline. Analysis of the impacts of alternative Project operations will focus on the potential adverse effects on low income, minority, or Tribal populations disproportionately represented in the study area. Variables utilized will include, at minimum, income, poverty, substandard housing, and unemployment.

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC issues its Study Plan Determination by December 31, 2011 and the study is not disputed by a mandatory conditioning agency:

- Preparation .... January 2012
- Data Collection .... February – May 2012
- Data Processing .... June – October 2012
- Quality Assurance/Quality Control .... Continuous
- Report Issuance .... December 2012

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

The methods presented in this study plan are consistent with those used in recent relicensings in California including those for the Southern California Edison Big Creek Project and the Placer County Water Agency Project on the Middle Fork of the American River.

8.0 Deliverables

Three written deliverables are anticipated. The first written deliverable would be a detailed outline of the proposed report, including data requirements, costs, and time to complete. The second written deliverable would be a draft report. The third written deliverable would be a final report.

9.0 Level of Effort and Costs

The costs of this study will be included in the Districts' Revised Study Plan.

10. References

California Department of Conservation (DOC). 2008. Farmland Mapping and Monitoring Program. Stanislaus County Important Farmland. Available online at: <ftp://ftp.consrv.ca. gov/pub/ dlrp/FMMP/pdf/2008/sta08_no.pdf>. Accessed July 6, 2011.

Rosenberger, R.S., and J.B. Loomis. 2001. Benefit transfer of outdoor recreation use values: a technical document supporting the Forest Service Strategic Plan (2000 revision). General Technical Report RMRS-GTR-72. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Fort Collins, Colorado.

San Francisco Public Utilities Commission (SFPUC). October 30, 2008. Resolution No. -08-200 approving Phased Water System Improvement Program Goals and Objectives.

San Francisco Public Utilities Commission (SFPUC). 2011. 2010 Urban Water Management Plan for the City and County of San Francisco. San Francisco Public Utilities Commission. San Francisco, California. June 22.

Stanislaus County. 2011. Stanislaus County Water Atlas. Available online at: <http://gis.stancounty.com/wateratlas/>. Accessed July 15, 2011.

APPENDIX C

REDLINED VERSIONS OF DISTRICTS' 10 PROPOSED STUDY PLANS

STUDY PLAN CR-1

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Historic Properties Study Plan

July 2011

Related Study Requests: BLM-01, 02, 11, 12, 13, and 14

1.0 Project Nexus

Together, Turlock Irrigation District (TID) and Modesto Irrigation District (MID) (collectively, the Districts), both public agencies, own the Don Pedro Project (FERC Project No. 2299) located in Tuolumne County, California. Continued operation and maintenance (O&M) of the Don Pedro Project (Project) may affect historic properties that are listed on or eligible for listing on the National Register of Historic Places (NRHP). The effect may be direct (e.g., result of ground disturbing activities), indirect (e.g., public access to recreation areas), or cumulative (e.g., caused by a Project activity in combination with other non-Project activities). Certain Project O&M activities may affect historic properties within the Project Boundary or outside the Project Boundary if a result of Project-related activities.

Several terms used throughout this Study Plan warrant definition.

- **Historic Properties.** This term is defined under 36 Code of Federal Regulations (CFR) § 800.16(l)(1), as prehistoric or historic sites, buildings, structures, objects, districts, or traditional cultural properties (TCP)[1] included in or eligible for inclusion in the NRHP. Historic properties are identified through a process of evaluation of specific criteria found at 36 CFR § 60.4.
- **Cultural Resources.** For the purpose of this study plan, this term is used to mean any prehistoric or historic district, site, building, structure (to include any industrial/engineering systems), object, or TCP, regardless of its NRHP eligibility. As well, if the results of this study warrant it, a landscape approach may be used to determine if there are any cultural landscapes present.

2.0 Resource Management Goals

A new FERC license for the Project may permit activities that "…cause changes in the character or use of historic properties, if any such historic properties exist…" (36 CFR § 800.16(d)). FERC must therefore comply with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and its implementing regulations at 36 CFR 800. These

[1] TCPs are addressed in a separate study proposal (Native American Traditional Cultural Properties Study).

regulations require the head of any federal department or independent agency having authority to license any undertaking to take into account the effects of the undertaking on historic properties.

As provided for in 18 CFR § 5.5(e), the Districts will request that FERC designate them as FERC's non-federal representatives for purposes of initiating consultation under Section 106 of the NHPA and implementing regulations found at 36 CFR § 800.2(c)(4).

Additionally, the State Historic Preservation Officer (SHPO), in accordance with Section 101(b)(3) of NHPA "…advises and assists Federal agencies in carrying out their Section 106 responsibilities…" by ensuring historic properties are taken into account early in the planning and development processes.

The U.S. Department of Interior, Bureau of Land Management (BLM) Mother Lode Field Office has management responsibility within the Project's Area of Potential Effects (APE) on any federal lands administered by BLM. The primary goal of BLM is that FERC comply with Section 106 and that historical properties are appropriately considered and managed. As defined in 36 CFR 800.16(d), the APE is "...the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historical properties, if any such properties exist." ~~For the Don Pedro Project, the APE has been initially defined as all lands within the Project Boundary.~~

~~The State of California also has an interest within the Project's APE. Section 5.11(d)(2) states that an applicant for a new license must in its proposed study "Address any known resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied." If the State of California provides a brief written description of their interest in the resource to be addressed in this study, TID and MID will insert the full description. If not, prior to issuing the PAD, TID and MID will describe to the best of its knowledge and understanding of the relevant management goals of the State of California in the resource addressed in this study.~~

Study results may be used in the development of Project facilities and/or license terms of the new license for the purpose of protecting or treating impacts to historic properties that would result from continued Project O&M, or for the purpose of enhancing historic properties that would be affected by continued Project O&M. These facilities, operations and management activities, which are referred to collectively as protection, mitigation, and enhancement (PM&E) measures, could include development of a Historic Properties Management Plan (HPMP)[2] that would describe and implement PM&E measures for historic properties potentially affected by continued Project O&M. A HPMP is a plan for considering and managing effects on historic properties that may occur from constructing, operating, and maintaining hydropower, transmission, and distribution projects, and establishes a decision-making process for considering those effects. Because it is not possible to determine all of the effects of various activities that may occur over the course of a license, FERC typically requires, as a license condition, that a licensee develop and implement a HPMP that considers and manages effects on historic properties throughout the term of the license. For hydropower relicensings~~licensing actions~~, FERC typically completes Section 106 by entering into a Programmatic Agreement (PA) or Memorandum of Agreement

[2] While not a part of this study, the information developed by this and other relicensing studies may be used to develop a HPMP in consultation with interested parties, and include a ~~final~~ draft HPMP with the Draft License Application and a final HPMP~~including evidence of consultation in the~~ in the Final License Application~~ when filed with FERC~~.

(MOA) with the Advisory Council on Historic Preservation (ACHP) and the SHPO that typically requires the licensee to develop and implement a HPMP. However, it should be noted that the Section 106 process is still active throughout the life of the new license, particularly regarding new activities by the license holder that have not undergone Section 106 requirements or newly identified cultural resources that also have not undergone Section 106 consideration. As such, while the HPMP and PA or MOA conclude the process needed for obtaining a new FERC license, the Project must continue to comply with Section 106 requirements, the guidelines for which are developed and provided in the HPMP. Additionally, FERC requires that a licensee develop the HPMP in consultation with various other federal, state, tribal, and non-government parties that have interests in the project.

3.0 Study Goals and Objectives

The primary study goal is to assist FERC in meeting its compliance requirements under Section 106 of the NHPA, as amended, by determining if licensing of the Project will have an adverse effect on historic properties. The objective of this study is to identify ~~archaeological sites and historic architecture~~cultural resources within the APE, formulate a plan to evaluate their eligibility to the NRHP, if needed, and identify Project-related effects on those resources. At a later date the results of the study will then be used to develop the HPMP, which will ensure that all cultural resources identified within the APE will be appropriately considered and managed during the life of the new FERC license.

To address effects on historic properties, as required under Section 106, the APE is defined as all lands ~~within the FERC Project Boundary~~containing Project designated facilities and ~~a 60 m buffer above the high water mark to take into account impromptu camping along the water edge~~areas where there is ~~no~~ previous evidence of ~~any~~ dispersed recreation or use. It is possible that the studies implemented as part of the relicensing process may identify Project-related activities that have the potential to affect historic properties outside ~~the FERC Project Boundary~~this APE. It is also possible that during relicensing, Project improvements may be proposed that are outside the ~~current FERC Project Boundary~~APE. If such areas are identified, the APE will expand in accordance with 36 CFR 800.4(a)(1) in consultation with the SHPO, BLM, Tribes, and other interested parties, as appropriate. Additional cultural resource inventories~~surveys~~ will be completed as part of this study if the APE is expanded.

The study will also comply~~Project is also subject to compliance~~ with other relevant federal laws including the National Environmental ~~Protection~~ Policy Act (NEPA), the Archaeological Resources Protection Act (ARPA) of 1974 (16 USC 469), the American Indian Religious Freedom Act (AIRFA) of 1978 (42 USC 1996 and 1996a), the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 (25 USC 3001), Executive Order 11593 (Protection and Enhancement of the Cultural Environment) of 1971 (16 USC 470), the American Antiquities Act of 1906, and Executive Order 13007 (Indian Sacred Sites) of 1996 (73 Federal Register 65, pp. 18293-24).

4.0 Existing Information and Need for Additional Information

Section 5.8 of the Pre-Application Document (PAD) describes existing, relevant, and reasonably available information regarding cultural resources. This information is summarized below.

To gather existing, relevant, and reasonably available information regarding cultural resources in the Project APE and vicinity, the Districts performed a records search in July 2010 at the Central California Information Center (CCIC) of the California Historical Resources Information System at California State University (CSU), Stanislaus in Turlock. In addition to identifying ~~historic properties~~cultural resources, this research also served to obtain background information pertinent to understanding the archaeology, history, and ethnohistory of the Project vicinity and APE. The data gathering area included the ~~Project~~FERC Project Boundary, which is much larger than the APE ~~APE~~, plus an additional 0.25-mile buffer beyond, to identify previously recorded cultural resources and previous cultural studies that may require consideration during the Project.

The records search included reviews of cultural resources records and site location maps, historic General Land Office (GLO) plats, NRHP, California Register of Historic Resources, Office of Historic Preservation Historic Property Directory, *California State Historic Landmarks* (CDPR 1996), *California Inventory of Historic Resources* (CDPR 1976), historic topographic maps, and the Caltrans Bridge Inventory.

The records search indicates that the Project area is highly sensitive for prehistoric and historic-era properties and that some areas within the Project have been subject to previous cultural surveys (see Section 5.8 in the PAD). However, the research also revealed that many areas within the APE have not yet been surveyed for cultural resources~~remains~~ and a portion of previously surveyed areas should be reexamined to meet current professional standards for identifying historic properties. To accomplish this, and to meet the study plan objective, additional archival research and field surveys are necessary. This study plan will be used to guide efforts in acquiring the additional information.

The existing information described below is not adequate to meet the goal of the study. Information necessary to address the study goal includes site-specific cultural resources inventory.

4.1 Summary of Record Searches

4.1.1 Previous Cultural Studies

The above-described records search identified 43 previous cultural resource investigations within 0.25-mile of the FERC Project Boundary~~APE~~, of which 18 fall within the FERC Boundary~~APE~~. The investigations date from the 1960s to 2009 and were ~~conducted prior to~~prompted by a variety of different ground-disturbing developments, to include water control/treatment facilities, utilities, housing developments, mining activities, road/highway construction, recreation facilities, and grazing leases. Two of the previous investigations are articles from *The Quarterly of the Tuolumne Historical Society*, and one is comprised of documentation of monuments and plaques of the E Clampus Vitus organization.

4.1.2 Previously Recorded Archaeological Sites

The records search identified 146 known archaeological sites previously documented within 0.25 mile of the FERC Project Boundary~~APE~~, of which 61 fall within the FERC Boundary~~Project APE~~. Of the 146 sites within 0.25 mile of the FERC Boundary~~APE~~, one includes both prehistoric and protohistoric components, five sites have both prehistoric and historic-era ~~cultural remains~~components, six sites did not have any information on file at the Information Center and therefore are unknown as to their site type, 57 sites are prehistoric in age, and 77 sites are historic in age. Of the 61 sites within the FERC Boundary~~APE~~, 32 are prehistoric, 21 are historic, six are those sites with no site form, and two are multi-component, with both prehistoric and historic-era components~~cultural remains~~. The prehistoric components typically include flaked stone with and without bedrock milling stations, with both short- and long-term occupation sites represented. The historic components are predominantly represented by refuse scatters and/or remains of habitation structures/buildings. According to the Office of Historic Preservation's *Archaeological Determinations of Eligibility* list and the *Directory of Properties in the Historic Property Data File* on file at the CCIC, of the 146 sites recorded in the vicinity of the Project APE, four have been determined eligible for inclusion on the NRHP, all of which are located within the FERC Boundary~~APE~~. The remaining 142 resources remain unevaluated for the NRHP.

4.1.3 Potential Historic-Period Cultural Resources ~~Sites~~

Historic period U.S. Geological Survey (USGS) topographic ~~quadrangles~~ maps and GLO plats were reviewed during the records search to identify locations of potential historic-era sites and features within the FERC Project Boundary~~APE~~ and within 0.25 mile of the FERC Boundary~~Project APE~~. This resulted in the identification of well over 50 locations where unrecorded historic period sites or features may be present. These sites and features include potential roads and trails, the town site of Jacksonville, buildings, mines, ditches, the Hetch Hetchy Railroad/Yosemite Short Line Railroad, the Hetch Hetchy Aqueduct, and other features.

Historic period maps often provide a general idea of where sites may be located but are not necessarily accurate. Today's maps and mapping standards are not translatable to the past and plots cannot be taken as exact. Because of the disparity between historic period maps and modern maps, it is not known if physical attributes associated with the potential sites and features still exist, are accessible, or if the remains are within the FERC Boundary~~APE~~. Potential site locations will be plotted on field maps prior to fieldwork and the survey crew will carefully scrutinize such areas for physical remains.

5.0 Study Methods

5.1 Study Area

The study area that will be investigated to accomplish the current study is the APE.~~,~~ As defined in 36 CFR 800.16(d), the APE is "...the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historical properties, if any such properties exist." The APE for the Don Pedro Project relicensing study effort is defined as including all Project-designated facilities (recreation areas, hydroelectric facilities, Project access roads, designated Project recreation access roads), and areas where there is previous evidence of dispersed recreation or use . ~~which includes all lands, Project facilities, and features within the Project Boundary~~. If, at a later time, the Districts propose Project activities that are outside of the study area that may affect resources addressed by this study proposal, the study area will be expanded, if necessary, to include these areas. As well, should large resources, such as TCPs, be identified that continue outside of the Project APE, those resources will be recorded in their entirety, if appropriate and accessible (i.e., linear resources such as roads may not be followed out to their terminus), and the APE may be expanded to incorporate them if it is determine that Project O&M could effect these areas. As required under Section 106 [36 CFR § 800.4(a)(1)], maps depicting the APE will be submitted to the SHPO for formal review, comment, and approval. The proposed APE ~~(Project Boundary)~~ is shown in Appendix C of the PAD.

5.2 General Concepts

The following general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- The Districts will make a good faith effort to obtain permission in advance of performance of the study to access private property where needed. Field crews may make minor modifications in the field to adjust to and accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study reports.

5.3 Study Methods

The study approach will consist of the following six steps:

Step 1 - Obtain SHPO Approval of APE. As required under Section 106 [36 CFR § 800.4(a)(1)], the Districts will submit maps depicting the APE to the SHPO for formal review, comment, and concurrence[3]. Once approved, the maps including SHPO's concurrence letter, will be filed with FERC.

The Districts may request that SHPO concur with a modified APE during the study if the Districts determine that the Project affects historic properties outside the previously SHPO-approved APE.

Step 2 - Archival Research. Information has been obtained from the record search that identified previous cultural surveys and recorded archaeological and historic-era properties within or adjacent to the APE. Archival research will also be conducted at the repositories listed below to obtain additional information specific to the prehistory and history of the Project area, the hydroelectric system in whole, and its individual features. The results of the archival research will serve as the basis for preparing the prehistoric and historic contexts against which archaeological and historic-era properties may be evaluated. Historical photographs located during the archival research may be cited in the text as figures, unless they are subject to copyright laws. Previous NRHP evaluations of resources, if they exist, will be used as much as possible. The places to be contacted or visited may include:

- Bancroft Library, University of California, Berkeley
- California State Library, California History Room and Government Publications
- Bureau of Land Management, Mother Lode Field Office Data Files
- Turlock Museum and Archives

[3] Participating Tribes and agencies will be provided the opportunity to review and comment on all determinations prior to submission to the SHPO.

- Modesto Museum and Archives
- Sacramento History Center and Archives
- Sierra Miwuk Tribal Archives
- Tuolumne County Assessor's and Recorder's Offices
- Tuolumne County Historical Society
- Southern Tuolumne County Historical Society
- Archives of the Hetch Hetchy Water and Power/San Francisco Public Utilities Commission
- Oral Histories of Project Personnel and/or Local Residents, Historians, or Enthusiasts
- Turlock Irrigation District and Modesto Irrigation District
- Sonora Bypass Project Archaeological Documents Produced by the Far Western Anthropological Group

Step 3 - Field Survey. ~~FERC is required to make a reasonable and good faith effort to identify historic properties that may be affected by the Project. FollowingAs described at 36 CFR § 800.4(b)(1), this willmay be accomplished through sample field investigations and/ora comprehensive field surveys that isare implemented in accordance with the Secretary of the Interior's Standards and Guidelines for Identification (NPS 1983) and the BLM standards, per the 8100 manual series. FERC is also required to consider any other applicable professional standards and tribal, state, or local laws or procedures to complete the identification of historic properties.~~FERC is required to make a good faith effort to identify historic properties that may be affected by the proposed federal undertaking (i.e. the relicensing) (36 CFR § 800), which does not include identifying past project related effects, other than noting present resource conditions in order to determine their existing level of integrity. A comprehensive and intensive field survey will be completed in accordance with the Secretary of Interior's Standards and Guidelines for Identification (NPS 1983) and the BLM's Class III/intensive standards, per the BLM's 8100 manual series. All BLM lands within the Project APE will be inventoried at this level, unless it is determined unsafe to do so by the Districts in consultation with the BLM.

Archaeological Field Survey. To assist FERC in meeting its compliance obligations, and to develop appropriate management measures for historic properties identified within the APE, a field survey will be performed to verify locations of previously recorded cultural resources and to examine all accessible lands not previously surveyed or which were surveyed to less than adequate standards. Areas within the APE that cannot be accessed in a safe manner ~~(e.g., certain locations containing dense vegetation, or unsafe slopes)~~ will not be included within the survey or recording of archaeological and historic-era properties; these areas will be identified in the resulting survey report in text and maps with~~and~~ an explanation for survey exclusion~~ will be provided~~.

The field survey will be directly supervised ~~and/or conducted~~in the field by qualified, professional archaeologists (i.e., individuals who meet the Secretary of the Interior's Standards for professional archaeologists and are listed on a California State BLM permit which require the permit holders to have extensive California archaeological experience). Prior to beginning field work, the field crew will visit a prehistoric archaeological assemblage recovered from a location near the Project vicinity to become familiar with prehistoric materials that might be encountered during the field survey of the Project APE. The purpose of the field survey is to: (1) examine lands which have not been previously surveyed; (2) examine lands previously surveyed but where the field strategy is unknown; and (3) examine lands previously surveyed but for which the field strategy does not meet current professional standards, as defined in the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation* (NPS 1983).

If conditions allow, lands will be examined that are typically inundated by the Project reservoir but which may become accessible during the survey season as a result of normal reservoir draw-downs.

Locations of previously recorded cultural resources will be verified and the sites re-recorded only if their existing site records or other documentation do not meet current standards for recording, or if the condition and/or integrity of the property has changed since its previous recording. Newly discovered cultural resources, including isolated finds, will be fully documented following the recordation procedures outlined in *Instructions for Recording Historical Resources* (OHP 1995), which utilizes state of California Department of Parks and Recreation (CDPR) forms CDPR 523 A-L. Prehistoric isolates will be defined as three or less artifacts (flakes, groundstone, etc.) per 50 square meters. Prehistoric isolated features will not be treated as isolated finds, but will be recorded as a site. Historic isolates will be defined on a case by case basis, depending on the types of historic resources identified within the APE. A sketch map for each site recorded or re-documented will be drawn to scale and the property photographed. The locations of all archaeological sites and isolates documented during the survey will be plotted by the Districts' cultural resources specialist or cultural consultant onto the appropriate USGS 1:24,000-scale topographic map at the time of discovery. Field personnel will use a GPS receiver to document the location of cultural resources (including isolates) recorded during the survey, which will be plotted onto the appropriate USGS topographic quadrangle using the UTM coordinate system. GPS data related to recordation of historic properties will adhere to CDPR specifications for accuracy and site specific procedures. Additionally, the areas examined will be plotted onto the appropriate USGS 7.5-minute topographic quadrangle for comparison with previous survey coverage maps.

Archaeological surveys that occur on BLM lands will require valid permits. The Districts' ~~or, as appropriate, their~~ consultants will possess a valid Cultural Resource Use Permit issued through the BLM California State Office and will obtain a Field Authorization through the BLM Mother Lode Field Office~~all required permits~~ prior to examining BLM lands. The Districts' consultants also will notify BLM when fieldwork is scheduled to begin. All artifacts encountered during the field survey will be left in place; no artifacts will be collected during the field survey.

Historic-Era Inventory of the Built Environment. A field inspection, documentation, and subsequent NRHP evaluation (see below) of any historic-era built environment resources will be undertaken by qualified, professional individuals meeting the Secretary of the Interior Standards for Architectural and Engineering Documentation. Individual components will be recorded or re-recorded to meet current CDPR standards. This will include digital color photography and sketch maps of each built resource and each associated feature.

Discovery and Treatment of Human Remains. If an inadvertent discovery of human remains occurs on federal lands, the person making the discovery shall follow the procedures outlined in 43 CFR § 10(4)(b) of NAGPRA and the guidance provided by the ACHP, requiring that they immediately notify the BLM and affected Tribes, as appropriate, by telephone, and provide written confirmation of the discovery. On BLM-administered land, NAGPRA responsibilities cannot be delegated to FERC or the Districts. All work in the immediate area of the discovery will cease and the area will be secured to protect the remains. The Districts' cultural resources specialist will consult with the affected Tribes to contact the lineal descendent and ascertain the cultural affiliation, as outlined in NAGPRA under 43 CFR § 10(14), in order to otherwise abide by NAGPRA to determine the disposition of the discovered human remains (43 CFR § 10[6]).

On privately owned lands, the California Penal Code (CPC), California Health and Safety Code (CH&SC), and California Public Resources Code (CPRC), also prohibit damage, defacement, or disinterment of human remains without legal authority, and establish civil and criminal penalties for actions associated with private landholdings. Although the CH&SC and CPRC technically apply only to those portions of the APE not under federal jurisdiction, in practice the law is applied throughout the area. Criminal sanctions provided for in the CPC, CH&SC, and CPRC would be above and beyond the penalties authorized by the ARPA. Other state laws and codes may also apply.

Step 4 - National Register of Historic Places Evaluation. During documentation of archaeological sites and features in Step 3, the Districts will also document the condition of each resource to assist in identifying potential and existing Project-related effects and level of integrity to provide recommendations for NRHP eligibility or evaluations. ~~All previously unevaluated sites that can be evaluated at this phase, based on the documented remains, background research, and site conditions, will be formally evaluated for SHPO consultation and concurrence. Any NRHP evaluations completed for sites located on federal agency lands will be submitted to the appropriate agency for review prior to obtaining SHPO concurrence. Archaeological rResources requiring further cultural resources management consideration beyond the study field efforts or additional archival research to complete NRHP evaluations, including lands not surveyed during relicensing efforts will be identified and included in the Districts' PM&Es for implementation and management outside the study plan, likely under a FERC-approved HPMP, unless more immediate action is deemed necessary to address Project-related effects.~~ All previously unevaluated cultural resources that are currently being, or would be negatively affected by the Project will be evaluated at this phase if possible, based on the documented remains, background research, and other pertinent information. The NRHP evaluations will be submitted to the SHPO for concurrence. Any NRHP evaluations completed for sites located on federal agency lands will be submitted to the appropriate agency for review prior to obtaining SHPO concurrence. Resources requiring further cultural resources management consideration beyond the study will be identified and included in the Districts' PM&Es for implementation, likely under a FERC-approved HPMP, unless more immediate action is deemed necessary to address Project-related effects.

The Districts will utilize the National Register criteria for all sites to be evaluated, which are defined in 36 CFR 60.4, and which include the following:

> ***National Register Criteria for Evaluation.*** *The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and*
>
> *(a) that are associated with events that have made a significant contribution to the broad pattern of our history;*
> *(b) that are associated with the lives of persons significant in our past;*

(c) *that embody the distinctive characteristics of a type, period, or method of construction or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction;*
(d) *that have yielded, or may be likely to yield, information important to prehistory or history.*

As well, properties not normally considered for listing in the National Register (i.e., cemeteries, birthplaces, or graves of historical figures, properties owned by religious institutions or used for religious purposes, structures that have been moved from their original locations, reconstructed historical buildings, properties primarily commemorative in nature, and properties that have achieved significance within the past 50 years) may qualify if they are integral parts of districts that do meet the criteria for evaluation or can apply the *Criteria Considerations* found at 36 CFR 60.

Evaluation of Historic Project System Features. Previously evaluated historic Project systems or individual features will not be re-evaluated unless substantial changes in their conditions have been observed and documented during the study, or the evaluation is more than 10 years old. If deemed appropriate by a qualified, professional cultural resources specialist, individual historic-era features may be evaluated together as a district.

All previously unevaluated historic-era Project features will be formally evaluated for eligibility to the NRHP. The evaluation will consist of three tasks: (1) development of a historic context for the APE using archival research; (2) examination of each historic feature to document and assess the level of integrity, both individually and as an element of a potential Hydroelectric Historic District; and (3) the historical information and the physical site data obtained during background and field research will be used to evaluate the eligibility of each Project feature individually and as part of a potential historic district for inclusion on the NRHP.

Step 5 - Identify and Assess Potential Project Effects on National Register-Eligible Properties. As required under 36 CFR § 800.5, the Districts will identify and assess, in consultation with the SHPO, BLM, and potentially affected Indian Tribes, any adverse effects on historic properties or potential historic properties resulting from Project O&M. Adverse effects are defined as follows:

> *An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative (36 CFR § 800.5(a)(1).*

Step 6 - Reporting. See Section 9.0 for a description of the deliverables generated from this study.

~~6.0 Study-Specific Consultation~~[4]

~~The Districts will engage in the following study-specific consultation:~~

- ~~The Districts will obtain SHPO's concurrence with the APE, for which the participating Ttribes and agencies will have been provided the opportunity to review and comment as part of this study plan (Step 1).~~
- ~~The Districts will notify potentially affected Ttribes and BLM prior to the start of the field survey to provide the proposed field schedule (Step 3).~~
- ~~Any NRHP evaluations completed for cultural resources located on lands managed by federal agencies (i.e., Forest Service, BLM, etc.) will be provided to the federal agency, as appropriate, for review prior to submittal to SHPO for concurrence (Step 4).~~

6.0 Schedule

The Districts anticipate the following schedule for completion of the study:

- Field Work (Steps 1, 2, and 3) ....January 2012 - October 2012[5]
- Office Work (Steps 4 and 5) ....October 2012 - December 2012
- Consultation .... As needed and Quarterly Reports
- Report Preparation (Step 6)... March 2013 - April 2013
- Report Review by Agencies and Tribes (Step 6) ....May 2013 - June 2013
- Report Submittal to SHPO (Step 6) .... July 2013 - September 2013
- Drafting HPMP[6] ....July 2013 - October 2013
- Report Issuance .... January 2014

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

The proposed study methods discussed above are generally consistent with the study methods followed in several recent relicensing projects (i.e., French Meadows Transmission Line Project, FERC No. 2479; Merced River Hydroelectric Project, FERC No. 2179; Yuba-Bear Hydroelectric Project, FERC No. 2266). These methods have been accepted by the participating Indian Tribes, agencies, and other interested parties associated with those projects. The methods presented in this study plan also are consistent with the ACHP's guidelines for compliance with the requirements of Section 106 of the NHPA found at 36 CFR 800.

[4] ~~Copies of all correspondence sent to the SHPO by the Districts will be forwarded to the Ttribes and agencies.~~

[5] Fieldwork will include the time of year when the reservoir level is at its lowest to ensure as much surface area is exposed as possible for the study.

[6] Though the HPMP is not the outcome of the proposed study, the results of the study will be used to help draft an HPMP for the Project relicensing efforts. The FERC generally requests a draft HPMP be submitted with the draft license application and a final HPMP be submitted with the final license application. However, the Districts will not request of the participating tribes and agencies, or SHPO, to complete a Section 106 review of the HPMP until the appropriate cultural resources management reports documenting completed studies are provided to tribes, agencies, and the SHPO.

8.0 Deliverables

The Districts will prepare a technical report prepared to current professional standards consistent with the Archaeological Resource Management Report (ARMR) Guidelines (OHP 1995). The report will include the following sections: (1) Study Goals and Objectives; (2) Environmental and Cultural Setting; (3) Methods and Analysis; (4) Results; (5) Conclusions; and (6) Description of Variances from the FERC-approved Study Plan, if any[7]. Upon completion of the field studies, cultural maps provided with the Districts' report will clearly depict the following on USGS 1:24,000 topographic maps: the study areas examined; inventory coverage, including intensity of coverage; and locations of cultural resources identified within the study areas.

Copies of the final report and detailed locations of identified properties may be withheld from public disclosure in accordance with Section 304 (16 U.S.C. 4702-3) of the NHPA (as amended). Concurrence of report recommendations will be sought from the SHPO. Draft versions of the report will be provided to BLM, Tribes, and other parties, as appropriate.

The results of the study will also be reported in Exhibit E of the License Application, which will include a summary of the information and findings of the study plan. Figures and other pertinent data supporting the summary in Exhibit E will be appended to the License Application. The cultural records and other sensitive information will be included in a Confidential appendix withheld from public disclosure, in accordance with Section 304 (16 U.S.C. 4702-3) of the NHPA as amended.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

California Department of Parks and Recreation (CDPR). 1976. California Inventory of Historic Resources. On file, Central California Information Center, Turlock, California.

——. 1996. California State Historic Landmarks. On file, Central California Information Center, Turlock, California.

Office of Historic Preservation (OHP). 1995. Instructions for Recording Historical Resources. Sacramento, California.

U.S. Department of Interior, National Park Service (NPS). 1983. Archaeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines in the Federal Register, September 29, 1983 (48FR44716). Department of the Interior, Washington, D.C.

[7] The report will meet all of the reporting requirements of the BLM-issued Cultural Resource Use Permit.

STUDY PLAN CR-2

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Native American
Traditional Cultural Properties and Ethnographic Study Plan

July 2011

Related Study Requests: BLM-01, BLM-02, BLM-11, BLM-14, BLM-15.

1.0 Project Nexus

Turlock Irrigation District (TID) and Modesto Irrigation District (MID) (collectively, the Districts), both public agencies, own the Don Pedro Project (FERC No. 2299) located in Tuolumne County, California. Certain ongoing operation and maintenance (O&M) and/or recreation activities at the Don Pedro Project (Project) may affect Traditional Cultural Properties (TCP). The effect may be direct (e.g., result of ground-disturbing activities), indirect (e.g., public access to Project areas), or cumulative (e.g., caused by a Project activity in combination with other past, present, and reasonably foreseeable future projects). This study focuses on the potential for Project-related activities to affect TCPs.

TCPs are not automatically considered historic properties[1]. As defined under 36 Code of Federal Regulations (CFR) 800.16(l), historic properties are prehistoric or historic sites, buildings, structures, objects, districts, or locations of traditional use or beliefs that are included in, or eligible for inclusion in, the National Register of Historic Places (NRHP). Historic properties are identified through a process of evaluation against specific criteria found at 36 CFR 60.4.

To be considered a historic property, a TCP must have integrity and meet at least one of the NRHP criteria. When a place of traditional practices is evaluated as eligible for listing on the NRHP, it is termed a TCP. A TCP is defined as any property that is "…eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community" [NR Bulletin 38 (Parker and King 1998:1)].

TCPs are further defined in National Register Bulletin 38 (Parker and King 1998:1) as:

1. Locations associated with the traditional beliefs of a Native American group about its origins, its cultural history, or the nature of the world.

[1] Historic properties other than TCPs are addressed in a separate study proposal (Historic Properties Study) in the relicensing.

2. A rural community, whose organization, buildings and structures, or patterns of land use reflect the cultural traditions valued by its long-term residents.
3. An urban neighborhood that is the traditional home of a particular cultural group, and that reflects its beliefs and practices.
4. Locations where Native American religious practitioners have historically gone and are known or thought to go to today, to perform ceremonial cultural rules of practice.
5. Locations where a community has traditionally carried out economic, artistic or other cultural practices important in maintaining its historic identity.

The Project nexus with TCPs is the potential effect the Project could have on traditional/Tribal spiritual areas and other traditional uses in the Project Boundary or adjacent locations that are affected by Project activities. These include, but are not limited to: uses of geologic formations (i.e., landmarks); retrieval of fish for both ceremonial and spiritual purposes; gathering of plants for food, medicinal purposes and traditional uses (e.g., basket making); use of signal points including sightlines for fire signals; and access by Tribe members to and transit on trails and banks of the Tuolumne River traditionally used by Tribes.

2.0 Resource AGENCY Management Goals

FERC licenses may permit activities that may "…cause changes in the character or use of historic properties, if any such historic properties exist…" (36 CFR § 800.16[d]). FERC must therefore comply with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and its implementing regulations at 36 CFR Part 800 that require any federal department or independent agency having authority to license any undertaking to take into account the effects of the undertaking on historic properties.

As provided for in 18 CFR § 5.5(e), the Districts under separate cover will request that FERC designate them as FERC's non-federal representative for purposes of initiating consultation under Section 106 of the NHPA and the implementing regulations found at 36 CFR § 800.2(c)(4).

Additionally, the State Historic Preservation Officer (SHPO), in accordance with Section 101(b)(3) of NHPA "…advises and assists Federal agencies in carrying out their Section 106 responsibilities…" by ensuring historic properties are taken into account early in the planning and development processes.

The Bureau of Land Management (BLM) also has management responsibility for federal lands within the Project's Area of Potential Effects (APE). As defined in 36 CFR 800.16(d), the APE is "...the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historical properties, if any such properties exist." ~~For the Don Pedro Project, the APE has been initially defined as all lands within the Project Boundary.~~
~~The State of California also retains an interest within the Project APE. Section 5.11(d)(2) states that an applicant for a new license must in its proposed study "Address any known resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied."~~

3.0 Study Goals

The primary study goal is to assist FERC in meeting its compliance requirements under Section 106 of the NHPA, as amended, by determining if licensing of the Project will have an adverse effect on TCPs. The objective of this particular study is to identify TCPs that may potentially be affected by Project O&M, evaluate their eligibility to the NRHP, and identify Project-related activities that may affect TCPs, including locations of ethnographic use. At a later date, the results of the study will then be used to develop the Historic Properties Management Plan (HPMP), which will ensure that all cultural resources identified within the APE will be appropriately considered and managed during the life of the new FERC license.

The Project is also subject to compliance with other relevant federal laws including the National Environmental Policy Act (NEPA), the Archaeological Resources Protection Act (ARPA) of 1974 (16 USC 469), the American Indian Religious Freedom Act (AIRFA) of 1978 (42 USC 1996 and 1996a), the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 (25 USC 3001), Executive Order 11593 (Protection and Enhancement of the Cultural Environment) of 1971 (16 USC 470), the American Antiquities Act of 1906, and Executive Order 13007 (Indian Sacred Sites) of 1996 (73 Federal Register 65, pp. 18293-24).

The term TCP has been in use only in recent decades, thus many older historic studies, oral traditions, and other background materials identified during this study may not use this term specifically, although in principal the information may address what is now termed TCP. Working with indigenous/aboriginal people and gathering any pertinent studies, information, or reports that are used to identify significant indigenous/aboriginal sites will contribute to the understanding of TCPs, and possibly other locations of tribal importance, taking into account relevant tribal values and knowledge as required in FERC's relicensing guidelines. In addition to the Tribal consultation process described more fully in Section 6.3 of this study proposal, significant, relevant studies conducted by ethnographers, graduate students, cultural journalists, and oral historians that are archived in public and private libraries will be reviewed and the relevant data included in the study results.

4.0 Existing Information and Need for Additional Information

Sections 5.8 and 5.10 of the Pre-Application Document (PAD) describe existing, relevant, and reasonably available information regarding cultural resources. This information is summarized below.

A records search was conducted during July of 2010 at the Central California Information Center (CCIC) of the California Historical Resources Information System at California State University (CSU), Stanislaus in Turlock. The records search included reviews of cultural resources records and site location maps, historic General Land Office (GLO) plats, NRHP, California Register of Historic Resources, Office of Historic Preservation Historic Property Directory, *California State Historic Landmarks* (CDPR 1996), *California Inventory of Historic Resources* (CDPR 1976), historic topographic maps, and the Caltrans Bridge Inventory.

The records search included all lands within the ~~Project APE~~FERC Project Boundary and a 0.25-mile buffer beyond. The purpose of the record search was to identify any previously recorded TCPs that may be in the FERC Boundary~~APE~~ or in the vicinity~~ of the APE~~, and to identify characteristic resource types previously identified within the FERC Boundary~~APE~~ and vicinity to help in the preparation of an ethnographic context for the area and/or any potential TCP documentation. The records search also included a 0.25-mile buffer beyond the FERC Boundary~~APE~~ to allow adequate coverage and flexibility for Project planning.

The records search did not identify any TCPs or Indian Trust Assets (ITA) within the FERC Project Boundary~~APE~~.

ITAs are legal interests in assets held in trust by the federal government for Indian Tribes or individual Indians. Assets can be real property, physical assets, or intangible property rights. A characteristic of an ITA is that it cannot be sold, leased, or otherwise alienated without the United States government's approval. Examples of ITAs are lands, including reservations and public domain allotment; minerals; water rights; hunting and fishing rights; other natural resources; money or claims. ITAs do not include things in which a tribe or individuals have no legal interest. For example, off-reservation sacred lands or archaeological sites in which a Tribe has no interest are not an ITA.

Additionally, the Districts contacted the California Native American Heritage Commission (NAHC) at the beginning of September 2010 to obtain a listing of Tribal groups who should be contacted regarding the Project. The NAHC ~~has yet to provide a tribal contact list for the Project.~~responded in a letter dated February 3, 2011 with a list of potentially affected Tribes. ~~However~~In addition to the NAHC list of tribes, the Districts have identified a number of other Indian Tribes that may have an interest in the relicensing based on the proximity of these groups' traditional territory to the Project APE. The list compiled by the Districts, including the NAHC list, is provided in Table 4.0-1. Additional groups that might be identified ~~by the NAHC, subsequent to this PAD,~~at a later date will be added.

Table 4.0-1 Tribal contact list.

Central Sierra Me-Wuk Cultural & Historic Reba Fuller, Spokesperson PO Box 699 Tuolumne, CA 95379	North Fork Mono Tribe Ron Goode, Chairperson 13396 Tollhouse Road Clovis, CA. 93611
Buena Vista Rancheria Roselynn Lwenya, Ph.D Environmental Resources Director P.O. Box 162283 Sacramento, CA 95816~~Chukchansi Tribe;~~ ~~Choinumni/Mono~~ ~~Lorrie Planas~~ ~~2736 Palo Alto~~ ~~Clovis, CA 93611~~	Buena Vista Rancheria Rhonda Morningstar Pope Chairperson P.O. Box 162283 Sacramento, CA 95816~~North Fork Rancheria~~ ~~Delores Roberts, Chairperson~~ ~~PO Box 929~~ ~~North Fork, CA93643~~
~~Chukchansi Tribe~~ Picayune Rancheria of the Chukchansi Indians Mary Motola, Cultural Specialist 46575 Road 417 #A Coarsegold, CA 93614~~Emmaline Hammond~~ ~~PO Box 852~~ ~~Oakhurst, CA 93644~~	Picayune Rancheria of the Chukchansi Indians Reggie Lewis, Chairperson 46575 Road 417 #A Coarsegold, CA 93614~~North Fork Rancheria~~ ~~Mr. Michel Demers, Tribal Administrator~~ ~~P.O. Box 929~~ ~~North Fork, CA 93643~~

~~North Fork Mono Rancheria~~Southern Sierra Miwuk Nation Sandy Vasquez, Chairperson P.O. Box 1200 Mariposa, CA 95338~~Judy Fink, Tribal Chairperson~~ ~~P.O. Box 929~~ ~~North Fork , CA 93643~~	Southern Sierra Miwuk Nation Jay Johnson, Spiritual Leader 5235 Allred Road Mariposa, CA 956338-9357
Southern Sierra Miwuk Nation Anthony Brochini, Cultural Resources Representative~~Chairperson~~ P.O. Box 1200 Mariposa, CA 95338	Southern Sierra Miwuk Nation Les James, Spiritual Leader P.O. Box 1200 Mariposa, CA 95338
Tuolumne Band of Me-Wuk Indians Stanley Rob Cox, Cultural Resources Department P.O. Box 699 Tuolumne, CA 95379	Tuolumne Band of Me-Wuk Indians Kevin Day, Chairperson P.O. Box 699 Tuolumne, CA 95379
Tuolumne Band of Me-Wuk Indians Reba Fuller, Spokesperson P.O. Box 699 Tuolumne, CA 95379	Mono Nation (non-profit organization associated with the North Fork Mono Rancheria) James Bethel, President 58288 Road 225 North Fork, CA 93643
Chicken Ranch Rancheria of Me-Wuk Melissa Powell, Cultural Resources Coordinator P.O. Box 1159 Jamestown, CA 95327	Chicken Ranch Rancheria of Me-Wuk Lloyd Mathiesen, Chairperson P.O. Box 1159 Jamestown, CA 95327
California Valley Miwok Tribe Silvia Burley, Chairperson 10601 N. Escondido Place~~.~~ Stockton, CA 95212-9231	

Prior to the mid-September 2010 public meetings for the Project relicensing, the Districts sent letters to the Tribal contacts inviting them to the meetings for an initial public introduction to the Project relicensing. Included in these letters was a request for relevant information related to the relicensing. The Tribal contacts were also referred to the public relicensing website and given the names and contact information for the Districts.

To date, no concerns or potential TCPs or ITAs have yet been identified by the Tribes within the FERC Project Boundary~~APE~~ or 0.25 mile beyond.

5.0 Study Methods

5.1 Study Area

The study area that will be investigated to accomplish the current study is the APE. As defined in 36 CFR 800.16(d), the APE is "...the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historical properties, if any such properties exist." The APE for the Don Pedro Project relicensing study effort~~s~~ is defined as including all Project designated facilities (recreation areas, hydroelectric facilities, Project access roads, designated Project recreation access roads) and areas where there is previous evidence of dispersed recreation or use. If, at a later time, the Districts propose Project activities that are outside of the study area that may affect resources addressed by this study proposal, the study area will be expanded, if necessary, to include these areas. As well, should large resources, such as TCPs, be identified that continue outside of the Project APE, those resources will be recorded in their entirety, if appropriate and accessible (i.e., linear resources such as roads may not be followed out to their terminus), and the APE may be expanded to incorporate them if it is determined that Project O&M could ~~e~~affect these areas. As required under Section 106 [36 CFR § 800.4(a)(1)], maps depicting the APE will be submitted to the SHPO for formal review, comment, and approval. The proposed APE is shown in Appendix C of the PAD.

~~The study area is the APE, which includes all lands, Project facilities and features within the Project Boundary and Project-affected locations outside the Project Boundary. The APE may be modified if Project O&M activities occur outside the Project Boundary. As required under Section 106 [36 CFR § 800.4(a)(1)], maps depicting the APE will be submitted to the SHPO for formal review, comment, and approval.~~

5.2 General Concepts

The following general concepts apply to the study:

- Personal safety is the most important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- The Districts will make a good faith effort to obtain permission in advance of performance of the study to access private property where needed. Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study reports.

5.3 Study Methods

The study approach will consist of the following seven steps:

Step 1 - Obtain SHPO Concurrence on the APE. As required under Section 106 [36 CFR § 800.4(a)(1)], the Districts will submit maps depicting the APE to the SHPO for formal review, comment, and concurrence[2]. Once approved, the maps including SHPO's concurrence letter will be filed with FERC.

The Districts may request that SHPO concur with a modified APE during the study if the Districts determine that the Project affects historic properties outside the previously SHPO-approved APE.

Step 2 - Archival Research. The Districts performed initial archival research in preparation of the PAD. In this step, the Districts will, at a minimum, conduct additional archival research at the following places, as appropriate:

- Bancroft Library, University of California, Berkeley
- California State Library, California History Room and Government Publications
- Bureau of Land Management, Motherload Field Office Data Files
- Turlock Museum and Archives

[2] Participating tribes and agencies will be provided the opportunity to review and comment on all determinations prior to submission to the SHPO.

- Modesto Museum and Archives
- ~~Sacramento History Center and Archives~~
- Sierra Miwuk Tribal Archives
- Tuolumne County Assessor's and Recorder's Offices
- Tuolumne County Historical Society
- Southern Tuolumne County Historical Society
- Archives of the Hetch Hetchy Water and Power/San Francisco Public Utility Commission
- Oral Histories of Project Personnel and/or Local Residents, Historians, or Enthusiasts
- Turlock Irrigation District and Modesto Irrigation District
- Other appropriate Tribal, private, state, or federal repositories identified during the research

Step 3 - Tribal Consultation and Identification of Resources. Following the ethnographic literature review in Step 1, the next step in identifying potential TCPs will involve extensive Tribal consultation. Consultation and any fieldwork and potential TCP documentation shall be undertaken in accordance with Section 106 of the NHPA, as amended, and shall be consistent with National Register Bulletin No. 38, *Guidelines for Evaluating and Documenting Identification of Traditional Cultural Properties*. Prior to conducting any fieldwork or field visits on BLM lands, the Districts' ethnographer will obtain a Field Authorization through the BLM Mother Lode Field Office.

In order to facilitate Tribal consultation, the Districts intend to retain a qualified, professional ethnographer who meets the standards for ethnography as defined in Appendix II of National Register Bulletin No. 38. The Districts will coordinate its selection of the ethnographer with the assistance of affected Tribes and other interested cultural/Tribal stakeholders.

The ethnographer, in consultation with designated Tribal representatives (e.g., Tribal Chair), will determine the scope and breadth of interviews. The ethnographer will then contact the appropriate Tribe(s) and interested Tribal and cultural stakeholders to arrange for interviews at a time and location acceptable to those Tribal interviewees. Tribal interviewees and the ethnographer may need to visit the APE together to accurately define potential TCPs. If necessary, the Districts will arrange for an initial introductory meeting between the Districts, Tribal representatives, and the ethnographer.

Interviews may be conducted on a one-on-one basis with the ethnographer. The oral traditions and information collected during the interviews will be used to help define potential TCPs in the APE and to assist in making sound judgments and management decisions in Project planning. All information gathered will be kept confidential and respectfully documented by the ethnographer.

If participating Indian Tribes do not wish to disclose the locations of any potential TCPs, the Districts will instead work with the Tribes to identify the general issues and concerns that the Tribe(s) may have regarding potential impacts of the Project upon resources known to the Tribe(s) and work and with the Tribes and appropriate land management agencies to develop agreeable measures to address these concerns.

Step 4 - Archaeological Site Visit. Tribal interviewees or a physically capable Tribal representative and the ethnographer may want to visit archaeological sites identified during the study or during the Historic Properties Study. The purpose of the visit would be to provide Tribal representatives the opportunity to examine prehistoric archaeological sites encountered during the Historic Properties Study field work, and for the ethnographer to obtain additional information on potential TCPs. After the site visit(s), Tribal representatives may choose to share additional TCP information. BLM will be involved with any site visits on BLM-administered land. BLM will request to meet in advance with those Tribal representatives who wish to visit prehistoric sites on BLM-administered land. This is prudent and reasonable as BLM has ongoing management obligations for resources on lands under its management, regardless of whether these resources are within the FERC Project Boundary. BLM keeps information about archaeological sites and all Native American-related cultural resources confidential. Prior to conducting fieldwork on BLM lands, the ethnographer and other Districts' consultants will possess a valid Cultural Resource Use Permit issued through the BLM California State Office and will obtain a Field Authorization through the BLM Mother Lode Field Office.

Step 5 - National Register of Historic Places Evaluation. Following completion of Step 4, the Districts' ethnographer will evaluate the eligibility of identified TCPs for listing on the NRHP using data collected from the field studies described above. The NRHP codifies the criteria used to evaluate most cultural resources at 36 CFR 60.4, as follows:

> ***National Register Criteria for Evaluation****. The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and*
>
> *(a) that are associated with events that have made a significant contribution to the broad pattern of our history;*
> *(b) that are associated with the lives of persons significant in our past;*
> *(c) that embody the distinctive characteristics of a type, period, or method of construction or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction;*
> *(d) that have yielded, or may be likely to yield, information important to prehistory or history.*

However, amendments to the NHPA in 1992 [§101(d)(6)(A)] specify that properties of traditional religious and cultural importance to an Indian Tribe may be determined eligible for inclusion in the NRHP because of their "association with cultural practices or beliefs of a living community that are: (1) rooted in that community's history; and (2) are important in maintaining the continuing cultural identity of the community." Therefore, a TCP can only be significant if it meets these two criteria. However, if sacred areas or religious locations are identified that do not meet these criteria, they will still be evaluated following the Section 106 process. Formal evaluations will be submitted to the SHPO for concurrence.

As well, properties not normally considered for listing in the ~~National Register~~ NRHP (i.e., cemeteries, birthplaces, or graves of historical figures; properties owned by religious institutions or used for religious purposes; structures that have been moved from their original locations; reconstructed historical buildings; properties primarily commemorative in nature; and properties that have achieved significance within the past 50 years) may qualify if they are integral parts of districts that do meet the criteria for evaluation or can apply the *Criteria Considerations* found at 36 CFR 60.

Step 6 - Identify and Assess Potential Project Effects on National Register-Eligible Properties. As required under 36 CFR § 800.5, the Districts will identify and assess, in consultation with the SHPO, BLM, and potentially affected Indian Tribes, any adverse effects on TCPs resulting from Project O&M. Adverse Effects are defined as follows:

> *An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative* (36 CFR § 800.5(a)(1)).

Step 7 - Reporting. See Section 9.0 for a description of the deliverables generated from this study.

~~6.0 Study-Specific Consultation~~[3]

~~The Districts will engage in the following study-specific consultation:~~

- ~~Consultation with FERC, SHPO, affected Native American representatives, and BLM as described in Section 5.3.~~

6.0 Schedule

The Districts anticipate the following schedule for completion of the study:

- Planning/Pre-field Arrangements .... January 2012 - February 2012
- Field Work (Steps 1, 2, and 3) .... March 2012 - December 2012
- Office Work (Steps 4 ,5, and 6) .... January 2013 - July 2013
- Study Proposal Consultation .... As needed and Quarterly Reports
- Report Preparation (Step 7) .... August 2013 - September 2013
- Report Review by Agencies and Tribes[4] (Step 7) .... September 2013 - October 2013
- Report Submittal to SHPO[5] (Step 7) .... October 2013 - November 2013
- Drafting HPMP[6] .... July 2013 – October 2013

~~[3] Copies of all correspondence sent to the SHPO by the Licensees will be forwarded to the tribes and agencies.~~

[4] Non-confidential portions only.

[5] Non-confidential portions only.

[6] Though the HPMP is not the outcome of the proposed study, the results of the study will be used to help draft an HPMP for the Project relicensing efforts. The FERC generally requests a draft HPMP be submitted with the draft license application and a final HPMP be submitted with the final license application. However, the Districts will not request of the participating tribes and agencies, or SHPO, to complete a Section 106 review of the HPMP until the

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

The proposed study methods discussed above are generally consistent with the study methods followed in several recent relicensing projects (i.e., French Meadows Transmission Line Project, FERC No. 2479; Merced River Hydroelectric Project, FERC No. 2179; Yuba-Bear Hydroelectric Project, FERC No. 2266). These methods have been accepted by the participating Indian Tribes, agencies, and other interested parties associated with those projects. The methods presented in this study plan also are consistent with the ACHP's guidelines for compliance with the requirements of Section 106 of the NHPA found at 36 CFR 800 and with the related guidance set forth in National Register Bulletin 38.

8.0 Deliverables

The Districts will prepare a technical report prepared to current professional standards consistent with the Archaeological Resource Management Report (ARMR) Guidelines (OHP 1995). The report will include the following sections: (1) Study Goals and Objectives; (2) Environmental and Cultural Setting; (3) Methods and Analysis; (4) Results; (5) Conclusions; and (6) Description of Variances from the FERC-approved Study Plan, if any[7]. The report will include the evaluation plan with a detailed assessment of Project effects. Copies of this report will be provided to the affected Indian Tribes, BLM, SHPO, CSU, Stanislaus, CCIC, and FERC. Copies of the final report and detailed locations of identified properties will be withheld from public disclosure in accordance with Section 304 (16 U.S.C. 4702-3) of the NHPA (as amended). Concurrence on report recommendations will be sought from SHPO. BLM and other interested parties will review the cultural report, evaluation plan, and other documents, before they are sent to SHPO for concurrence.

The results of the study will be reported in Exhibit E of the License Application, which will include a summary of the information and findings of the Study Plan. Figures and other pertinent data supporting the summary in Exhibit E will be appended to the License Application. The cultural records and other sensitive information will be included in a confidential appendix withheld from public disclosure, in accordance with Section 304 (16 U.S.C. 4702-3) of the NHPA as amended.

9.0 Level of Effort and Cost

Not yet estimated.

10.0 References

California Department of Parks and Recreation (CDPR). 1976. California Inventory of Historic Resources. On file, Central California Information Center, Turlock, California.

appropriate cultural resources management reports documenting completed studies are provided to tribes, agencies, and the SHPO.

[7] The report will meet all of the reporting requirements of the BLM-issued Cultural Resource Use Permit.

——. 1996. California State Historic Landmarks. On file, Central California Information Center, Turlock, California.

Parker, Patricia L., and Thomas F. King. 1998. Guidelines for Evaluating and Documenting Traditional Cultural Properties. Revised. National Register Bulletin 38. U.S. Department of the Interior, National Park Service, National Register, History, and Education Division, Washington, D.C.

STUDY PLAN TR-01

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Special-Status Plants Study Plan

July 2011

Related Study Requests: USFWS-01

1.0 Project Nexus

Certain aspects of operation and maintenance (O&M) of the Don Pedro Project (Project) may have the potential to affect special-status[1] plants. These effects may be direct (e.g., result of ground-disturbing activities, such as mechanical or chemical clearing of vegetation or trampling of plants), indirect (e.g., due to recreation activity that results in erosion of adjacent land) or cumulative (i.e., caused by a Project activity in association with a non-Project activity, such as loss of habitat due to the introduction of invasive plants from a non-Project vector). This study evaluates Project O&M and recreation activities to assess their potential to impact special-status plants.

Plants listed under the federal Endangered Species Act (ESA) or the State of California Endangered Species Act (CESA) are addressed in a separate study plan. Only special-status plants otherwise not listed as FT (federally threatened), FE (federally endangered), ST (state threatened), and SE (state endangered) are addressed in this Special-Status Plants Study Plan.

2.0 Resource Agency Management Goals

The U.S. Department of Interior, Bureau of Land Management (BLM) has developed specific management goals related to the protection and management of special-status plants. In its 2008 Sierra Resource Management Plan (SRMP), the BLM provides the following guidance for management of sensitive species:

> *In compliance with existing laws, including the BLM multiple use mission as specified in the Federal Land Policy and Management Act (FLPMA), the BLM shall designate sensitive species and implement measures to conserve these species and their*

[1] For the purposes of this Relicensing, special-status plants are considered those plants that are: (1) found on ~~U.S. Department of Interior (USDOI), Bureau of Land Management (~~BLM~~)~~ land and formally listed by BLM as Sensitive (BLM-S); (2) listed under the federal ESA as Proposed or a Candidate for listing as endangered or threatened or proposed for delisting; (3) listed under the CESA as proposed for listing; (4) found on the California Native Plant Society (CNPS) Inventory of Rare Plants and formally listed as a CNPS 1, 2, or 3 plant (CNPS 1, CNPS 2, CNPS 3); or (5) ~~Found~~found on the California Department of Fish and Game's (CDFG) list of California Rare (SR) species listed under the Native Species Plant Protection Act of 1977. Special-status plants do not include plants that are listed as threatened or endangered under the ESA or CESA.

> *habitats,…, to promote their conservation and reduce the likelihood and need for such species to be listed pursuant to the ESA [Endangered Species Act of 1973]…*
>
> *On BLM administered lands, the BLM shall manage Bureau sensitive species and their habitats to minimize or eliminate threats affecting the status of the species or to improve the condition of the species habitat, by determining to the extent practicable, the distribution, abundance, population condition, current threats, and habitat needs for sensitive species.* (BLM 2008a)

In addition, BLM's SRMP provides general guidelines for managing habitat to assist in the recovery of listed species, and preserving and protecting species that have been given special-status by the BLM (BLM 2008a, 2008b). The SRMP also includes management guidelines for the Red Hills Area of Critical Environmental Concern (ACEC), part of which lies within the Project Boundary.

3.0 Study Goals

The goal of this study is to provide information to determine the extent to which certain Project O&M activities and/or recreational activities may have the potential to adversely affect special-status plant species. A Project effect may exist if both of the following occur:

- A special-status plant species is found to occur within the study area as defined in Section 5.1; and
- A specific Project O&M activity has a reasonable possibility of having an adverse effect on the special-status plant species found.

The goal of this study is to gather the information necessary to perform this analysis and evaluate the Project's potential to adversely affect special-status plants.

4.0 Existing Information and Need for Additional Information

Existing and relevant information regarding known and potentially occurring special-status plants in the Project Boundary is available from the California Native Plant Society's (CNPS) Inventory of Rare and Endangered Plants database (CNPS 2010) and the California Natural Diversity Database (CNDDB) (CDFG 2010). Database queries included all U.S. Geological Survey (USGS) 1:24,000 topographic quadrangles that include the existing Project Boundary and the surrounding quadrangles. Quadrangles containing the Project Boundary include Chinese Camp, La Grange, Moccasin, Penon Blanco Peak, Sonora, and Standard. Based on this information, as well as the Project's elevation range and habitats in this region of the Tuolumne River, the Districts identified 31 plants species that are listed as special-status and may have a reasonable potential to be affected by Project O&M and/or recreation activities.

Table 4.0-1 provides for each of the special-status plant species: (1) status; (2) flowering period; (3) elevation range; (4) habitat requirements; and (5) recorded occurrences in the general Project area.

Table 4.0-1 Target list of special-status plant species for the Don Pedro Project.

Common Name / Scientific Name	Status[1]	Flowering Period	Elevation Range (feet)	Habitat Requirements	Occurrence in area surrounding Project[2,3]
Henderson's bent grass *Agrostis hendersonii*	CNPS3	Apr-Jun	200-1,100	Valley and foothill grasslands, vernal pools	New Melones Dam
Jepson's onion *Allium jepsonii*	CNPS1B BLM-S	Apr-Aug	950-4,500	Chaparral, cismontane woodland, lower montane coniferous forest	**Sonora**, Tuolumne
Three-bracted onion *Allium tribracteatum*	CNPS 1B	Apr-Aug	3,600-10,000	Chaparral, lower montane coniferous forest, upper montane coniferous forest, volcanic soils	Columbia SE, Twain Harte
Rawhide Hill onion *Allium tuolumnense*	CNPS 1B, BLM-S	Mar-May	950-2,000	Cismontane woodland, serpentine	**Sonora, Chinese Camp, Moccasin**
Nissenan Manzanita *Arctostaphylos nissenana*	CNPS 1B, BLM-S	Feb-Mar	1,400-3,650	Closed-cone coniferous forest, chaparral	**Sonora**
Big-scale balsamroot *Balsamorhiza macrolepis var. macrolepis*	CNPS 1B, BLM-S	Mar-Jun	290-3,500	Chaparral, cismontane woodland valley and foothill grassland, sometimes serpentine	Hornitos
Hoover's calycadenia *Calycadenia hooveri*	CNPS 1B	Jul-Sep	200-1,000	Cismontane woodland, valley and foothill grassland	**La Grange**, Snelling, Merced Falls, Cooperstown, Keystone
Red Hills soaproot *Chlorogalum grandiflorum*	CNPS 1B, BLM-S	May-Jun	800-4,250	Chaparral, cismontane woodland, lower montane coniferous forest, serpentine, gabbroic and other soils	**Chinese Camp, Sonora** New Melones Dam, Keystone
Small's southern clarkia *Clarkia australis*	CNPS 1B	May-Aug	2,600-6,900	Cismontane woodland, lower montane coniferous forest	Tuolumne, Twain Harte, Coulterville, Hornitos
Mariposa clarkia *Clarkia biloba* ssp. *australis*	CNPS 1B, BLM-S	May-Jul	1,000-3,500	Chaparral, cismontane woodland, serpentine	**Sonora**, Tuolumne, Twain Harte, Coulterville, Hornitos
Beaked clarkia *Clarkia rostrata*	CNPS 1B, BLM-S	Apr-May	190-1,700	Cismontane woodland, valley and foothill grassland	**Penon Blanco Peak, Moccasin**, New Melones Dam, Cooperstown, Snelling, Merced Falls, Coulterville, Hornitos
Hoover's cryptantha *Cryptantha hooveri*	CNPS 1A	Apr-May	0-500	Inland dunes, valley and foothill grassland	Cooperstown
Mariposa cryptantha *Cryptantha mariposae*	CNPS 1B, BLM-S	Apr-Jun	600-2,200	Chaparral, serpentine	**La Grange, Chinese Camp Sonora**, Keystone, Coulterville, Hornitos
Dwarf downingia *Downingia pusilla*	CNPS 2	Mar-May	0-1,500	Valley and foothill grassland, vernal pools	**La Grange**, Cooperstown, Snelling, Merced Falls
Tuolumne button-celery *Eryngium pinnatisectum*	CNPS 1B	May-Aug	700-10,000	Cismontane woodland, lower montane coniferous forest, vernal pools, mesic	**Standard, Sonora, Chinese Camp, Moccasin**, New Melones Dam, Columbia
Spiny-sepaled button-celery *Eryngium spinosepalum*	CNPS 1B	Apr-May	250-900	Valley and foothill grassland, vernal pools	**La Grange**, New Melones Dam, Snelling, Merced Falls
Tuolumne fawn lily *Erythronium tuolumnense*	CNPS 1B, BLM-S	Mar-Jun	1,600-4,200	Broadleafed upland forest, chaparral, cismontane woodland, lower montane coniferous forest	**Standard**, Columbia, Columbia SE, Tuolumne, Twain Harte

Common Name / Scientific Name	Status[1]	Flowering Period	Elevation Range (feet)	Habitat Requirements	Occurrence in area surrounding Project[2,3]
Stink-bells *Fritillaria agrestis*	CNPS 4	Mar-Jun	0-5,200	Chaparral, cismontane woodland, pinyon and juniper woodland, valley and foothill grassland	**Sonora, Chinese Camp, Penon Blanco Peak**
Delicate bluecup *Githopsis tenella*	CNPS 1B	May-Jun	3,500-6,500	Chaparral, cismontane woodland	**Chinese Camp**
Bisbee Peak rush-rose *Helianthemum suffrutescens*	CNPS 3	Apr-Jun	100- 2,800	Chaparral, often serpentine, gabbroic or Ione soils	**Sonora**
Parry's horkelia *Horkelia parryi*	CNPS 1B, BLM-S	Apr-Sep	250-3,500	Chaparral, cismontane woodland, Ione formation	Coulterville
Tuolumne iris *Iris hartwegii* ssp. *columbiana*	CNPS 1B	May-Jun	1,200-4,700	Cismontane woodland, lower montane coniferous forest	Columbia, Columbia SE
Knotted rush *Juncus nodosus*	CNPS 2	Jul-Sep	0-6,600	Meadows, seeps, marshes, swamps	**La Grange**, Cooperstown
Congdon's lomatium *Lomatium congdonii*	CNPS 1B, BLM-S	Mar-Jun	900-7,000	Chaparral, cismontane woodland, serpentine	**Sonora, Chinese Camp, Moccasin**, New Melones Dam, Keystone
Stebbins' lomatium *Lomatium stebbinsii*	CNPS 1B	Mar-May	4,000-6,500	Chaparral, lower montane coniferous forest, gravelly, volcanic clay	Twain Harte
Shaggyhair lupine *Lupinus spectabilis*	CNPS 1B, BLM-S	Apr-May	800-2,800	Chaparral, cismontane woodland, serpentine	**Sonora, Moccasin**, New Melones Dam, Groveland, Coulterville, Hornitos
Slender-stemmed monkeyflower *Mimulus filicaulis*	CNPS 1B, BLM-S	Apr-Aug	2,800-6,000	Cismontane woodland, lower montane coniferous forest, meadows and seeps, upper montane coniferous forest, vernally mesic	Groveland
Pansy-faced monkeyflower *Mimulus pulchellus*	CNPS 1B	Apr-Jul	1,900-6,700	Lower montane coniferous forest, meadows and seeps, vernally mesic, often disturbed areas	**Standard**, Angels Camp, Groveland, Twain Harte
Veiny monardella *Monardella douglasii* ssp. *venosa*	CNPS 1B	May-Jul	150-1,500	Cismontane woodland, valley and foothill grassland, heavy clay	New Melones Dam
Merced monardella *Monardella leucocephala*	CNPS 1A	May-Aug	100-500	Valley and foothill grassland	**La Grange**, Cooperstown
Red Hills ragwort *Packera clevelandii*	CNPS 1B, BLM-S	Jun-Jul	800-1,400	Cismontane woodland, serpentine seeps	**Chinese Camp**, Moccasin

1 Special-status:
BLM-S: Bureau of Land Management Sensitive Plant Species
CNPS: California Native Plant Society listed species
- 1A: Species presumed extinct in California
- 1B: Species considered rare or endangered in California and elsewhere
- 2: Species considered rare or endangered in California but more common elsewhere
- 3: More information needed about this species
- 4: Limited distribution; watch list

2 Occurrence in area surrounding Project was based on a nine-quad CNPS quadrangle search.
3 Quads that are fully or partially included within the Project Boundary are indicated by bold font; quads surrounding, but not included within the Project Boundary are listed in regular font.

There were CNDDB records for 30 special-status plant occurrences located within a one-mile buffer of the Project Boundary. There were nine occurrences of Rawhide Hill onion, six occurrences of Red Hills soaproot, four occurrences each of Congdon's lomatium and Red Hills ragwort, two occurrences each of shaggyhair lupine (*Lupinus spectabilis*), Mariposa cryptantha (*Cryptantha mariposae*), and stink-bells (*Fritillaria agrestis*) and one occurrence of Tuolumne button-celery (*Eryngium pinnatisectum*). Congdon's lomatium, shaggyhair lupine, Rawhide Hill onion, Red Hill ragwort, Red Hills soaproot and Mariposa cryptantha are all BLM-S. The dates on the reports ranged from 1937 to 2007 (CDFG 2010).

A botanical survey of the Red Hills Management Area (now the Red Hills ACEC) was completed in 1984. The surveys located Rawhide Hill onion (*Allium tuolumnense*), Congdon's lomatium (*Lomatium congdonii*), Red Hills soaproot (*Chlorogalum grandiflorum*), and Red Hills ragwort (*Packera clevelandii*) (BLM 1985).

Few of the available reports are from surveys within the Project Boundary and, of those that are, many are outdated.[2] Additional information needed to address the study goal is the specific location of special-status plants in relation to Project O&M activities, Project-related recreation, and other Project-related activities that might affect special-status plants.

5.0 Study Methods

5.1 Study Area

The study area consists of the area within the Project Boundary that is subject to Project-related O&M and/or recreation activities, including high-use dispersed recreation areas. The ~~Districts have developed~~study area is described in Appendix A of this study plan, and includes the following ~~guidance for~~ the following specific ~~study area~~areas within the Project Boundary:

- ~~100 feet around recreation~~ The Blue Oaks, Fleming Meadows, and Moccasin Point Recreation areas and related facilities
- ~~60 feet around intakes, gatehouses, surge tanks, adits, portals and microwave/radar towers and other Project facilities~~
- ~~30 feet around ancillary facilities,~~ including ~~stream gages and weirs~~the 3.5 mile Don Pedro Shoreline Trail;
- ~~25 feet from centerline of access roads~~High-use dispersed recreation areas as described in Appendix A;
- Lands within the Project Boundary
- ~~20 feet around the perimeter~~ designated as part of the Red Hills Area of ~~reservoirs and impoundments where erosion activity is apparent beyond the high water mark or where soil types occur which are known to be preferred habitat for special-status plants~~Critical Environmental Concern;
- ~~20 feet around the perimeter of powerhouses and switchyards~~
- ~~20 feet from centerline of managed trails~~

[2] Annual or short-lived perennial species may require annual monitoring to accurately document population conditions, while long-lived perennials may only require surveys at five-year intervals (CDFG 2009).

- Don Pedro Dam, Powerhouse, and Switchyard, including related maintenance and storage facilities and the powerhouse access road;
- The Don Pedro Spillway channel and related access roads;
- The Gasburg Creek diversion dike and related access roads;
- Districts Employee Housing near Don Pedro Dam;
- Don Pedro Recreation Agency headquarters and visitor center;
- Dikes A, B, and C in the vicinity of Don Pedro Dam; and
- The Wards Ferry take-out.

The study area also includes habitats adjacent to each of these project features to the extent they could reasonably be affected by Project O&M and/or recreation, generally understood to be less than 100 feet. If special-status plant occurrences are located, the study area will be expanded to the full extent of the occurrence or the Project Boundary, whichever is less.

5.2 General Concepts

These general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study report.

5.3 Study Methods

The study approach will consist of the following five steps:

Step 1 – Gather Data and Prepare for Field Effort. The Districts will identify and map known occurrences of special-status plants within the study area, and prepare field maps for use by survey teams. The maps will include aerial imagery, Project features, and known special-status plant occurrences. Survey timing will be planned based on blooming periods and herbarium collection dates.

Step 2 – Conduct Field Surveys. The Districts' surveyors will conduct special-status plant surveys that generally follow the CDFG's Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities (CDFG 2009).[3] Field surveys will be conducted at the proper times of year when special-status plants potentially occurring in a given survey area and are both evident and identifiable. Surveys will use a random meander technique, and focus additional efforts in high-quality habitats or those with a higher probability of supporting special-status plants (e.g., serpentine outcrops). Surveys will be floristic in nature, documenting all species observed; taxonomy and nomenclature will be based on The Jepson Manual (Hickman 1993). On lands managed by the BLM, surveys will be consistent with BLM survey protocols required for National Environmental Policy Act/ESA compliance.

[3] For the purpose of this Relicensing and differing from the CDFG 2009 protocol, ESA- and CESA-listed plants are not considered special-status and are addressed in separate study proposals.

In the event special-status plants are found within the study area, surveyors will collect the following data, to the edge of the occurrence, or to ~~500 feet outside~~the edge of the Project Boundary, whichever is less:

- Digital photographs, if needed, to describe the occurrence, its habitat, and any potential threats (at least one digital photograph will be collected for each occurrence, with other photographs to document potential threats, or as needed).
- Estimated area (approximate length and width) covered by the special-status plant population and estimated number of individual plants in the population. If plant population is estimated to cover an area greater than 0.1 acre, surveyors will delineate the occurrence boundary using a handheld GPS, collecting either polygon data, or sufficient point data that a realistic occurrence polygon can be constructed from the point data using GIS.
- For occurrences less than 0.1 acre in size, location of the approximate center of the occurrence taken as point data using a handheld GPS unit.
- Dominant and subdominant vegetation in the area, and topographic features.
- Estimated distance to nearest Project facility, feature, or Project-related activity.
- Activities observed in the vicinity of the population that have a potential to adversely affect the population (e.g., recreational trails and uses).
- Estimated phenology and descriptions of reproductive state.

For all special-status species observations, the appropriate CNDDB form or spreadsheet will be completed. A copy of the CNDDB form or spreadsheet will be provided to BLM if the occurrence is on or immediately adjacent to federal lands.

Step 3 – Compile Data and Perform Quality Assure/Quality Control. Following field surveys, the Districts will develop separate GIS maps depicting special-status plant and noxious weed occurrences, Project facilities, features, and specific Project-related activities which have the potential to affect the special-status species (e.g., dispersed use camping) and other information collected during the study including the complete floristic list. Field data will then be subject to QA/QC procedures, including spot-checks of transcription and comparison of GIS maps with field notes to verify locations of special-status plant occurrences.

Step 4 ~~– Consult with the Districts' Project O&M Staff.~~ Threats Assessment. Once the location of special-status plants ~~and noxious weeds~~ in the study area is determined, Districts will assess all potential threats to these species, including noxious weeds, Project operations and, and ~~DPRA~~Project-related recreation. In particular, Don Pedro Recreation Agency staff will be consulted to identify Project O&M and recreation activities that ~~typically~~ occur in the area of the plant occurrences that have a potential to affect special-status ~~plant populations or spread noxious weeds~~plants.

Step 5 – Prepare Report. The Districts will prepare a report that includes the following sections: (1) Study Goals; (2) Methods; (3) Results; (4) Discussion; and (5) Description of Variances from the study plan, if any. The Districts will make the report available to Relicensing Participants upon completion.

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC issues its Study Determination by December 31, 2011 and the study is not disputed by a mandatory conditioning agency:

- Planning (Step 1) .... January 2012 – March 2012
- First Study Season (Step 2) .... March 2012 – July 2012
- QA/QC Review (Step 3) .... August 2012
- Threats Assessment (Step 4) .... August 2012
- Study Report Preparation (Step 5) .... September 2012 – December 2012
- Report Issuance .... January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Principles

This study is consistent with the goals, objectives, and methods outlined for FERC hydroelectric relicensing efforts in California, and uses standard botanical survey methods as defined by the CDFG.

8.0 Deliverables

The Districts will prepare a report, GIS-based maps showing findings and, if applicable, submit records to the CNDDB.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

California Department of Fish and Game. 2009. Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities. Available online at: <www.fws.gov/sacramento/es/.../Listed_plantsurvey_guidelines.PDF>.

——. 2010. Biogeographic Data Branch. California Natural Diversity Database (CNDDB). Available online at: <www.dfg.ca.gov/biogeodata/cnddb/pdfs/TEPlants.pdf.> Accessed July 6, 2010.

California Native Plant Society. 2010. Inventory of Rare and Endangered Plants (online edition, v7-08a). California Native Plant Society. Sacramento, California. Available online at: <http://www. cnps.org/inventory>. Accessed July 6, 2010.

Hickman, J.C., editor. 1993. The Jepson Manual, 3rd Edition. University of California Press, Berkeley, California.

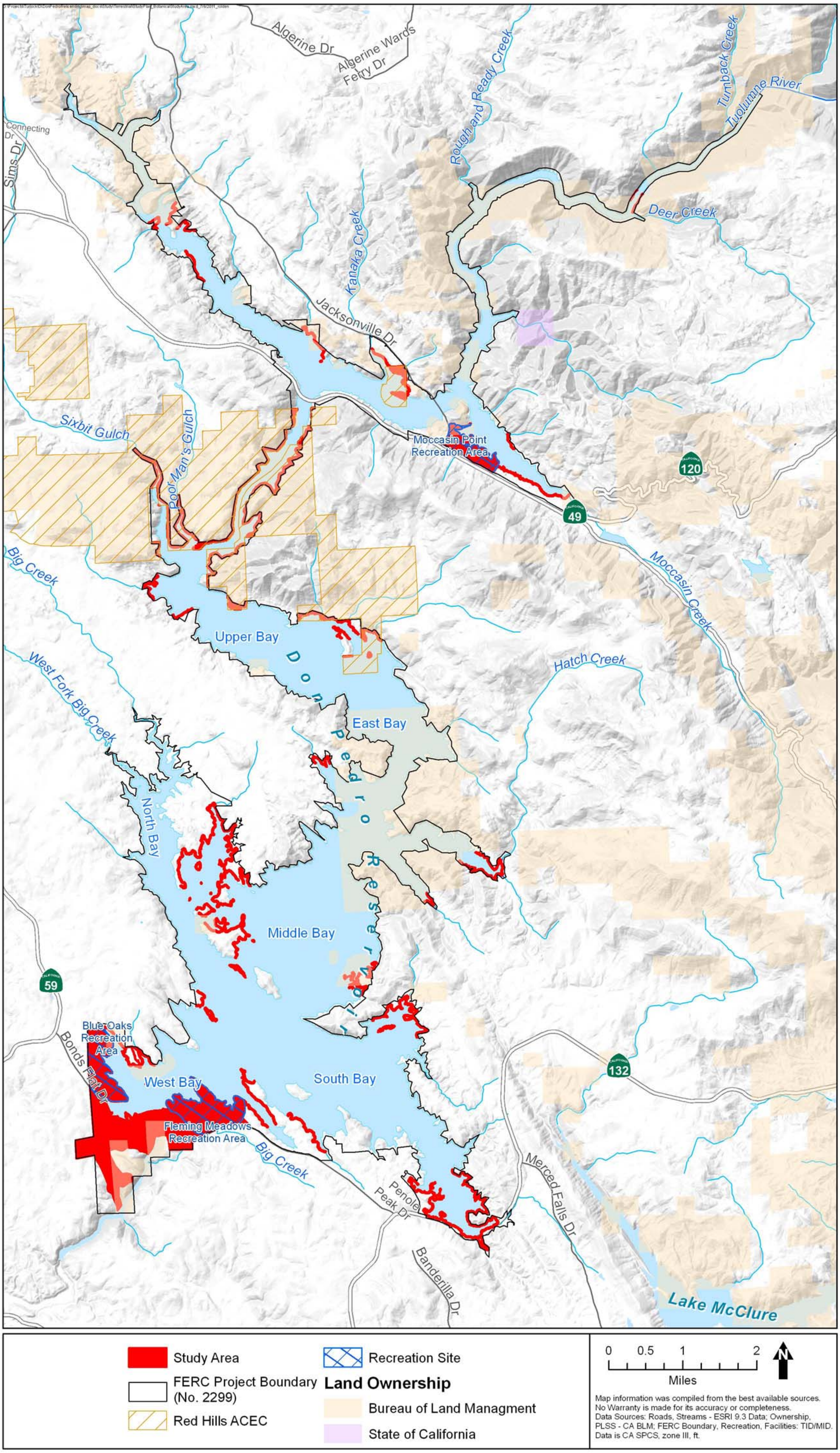
U.S. Department of the Interior, Bureau of Land Management (BLM). 1985. Final Red Hills Management Plan and Environmental Assessment. Bakersfield, California.

——. 2008a. BLM Manual 6840 - Special Status Species Management.

——. 2008b. Sierra Resource Management Plan and Record of Decision. February 2008. Folsom, California.

APPENDIX A

SPECIAL STATUS PLANTS STUDY AREA



Algerine Dr
Algerine Wards Ferry Dr
Rough and Ready Creek
Tumback Creek
Tuolumne River
Connecting Dr
Sims Dr
Deer Creek
Kanaka Creek
Jacksonville Dr
Sixbit Gulch
Poor Man's Gulch
Moccasin Point Recreation Area
120
49
Big Creek
Moccasin Creek
Upper Bay
Don Pedro Reservoir
Hatch Creek
West Fork Big Creek
East Bay
North Bay
Middle Bay
59
Blue Oaks Recreation Area
West Bay
South Bay
132
Bonds Flat Dr
Fleming Meadows Recreation Area
Big Creek
Penole Peak Dr
Merced Falls Dr
Banderilla Dr
Lake McClure
Study Area
FERC Project Boundary (No. 2299)
Red Hills ACEC
Recreation Site
Land Ownership
Bureau of Land Managment
State of California
0 0.5 1 2
Miles
N
Map information was compiled from the best available sources.
No Warranty is made for its accuracy or completeness.
Data Sources: Roads, Streams - ESRI 9.3 Data; Ownership, PLSS - CA BLM; FERC Boundary, Recreation, Facilities: TID/MID.
Data is CA SPCS, zone III, ft.

STUDY PLAN TR-2

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

ESA- and CESA- Listed Plants Study Plan

July 2011

Related Study Requests: USFWS-06, 07 & 08

1.0 Project Nexus

Certain activities associated with the ongoing operation and maintenance (O&M) of the Don Pedro Project (Project) and/or Project-related recreation activities may have the potential to affect plants listed under the federal Endangered Species Act (ESA) as endangered (FE) or threatened (FT) and/or plants listed under the California Endangered Species Act (CESA) as endangered (SE) or threatened (ST). These effects may be direct (i.e., result of ground-disturbing activities, such as mechanical or chemical clearing of vegetation or trampling of plants), indirect (i.e., due to activities, such as soil compaction, which limits plant growth) or cumulative (i.e., caused by a Project activity in association with a non-Project activity, such as loss of habitat due to the introduction of invasive plants from a non-Project vector). This study evaluates the potential for Project-related activities to impact ESA- or CESA-listed plants.

Special-status plants[1] are addressed in a separate study plan: the Special-status Plants Study Plan. Note that if a plant is listed as FT, FE, ST, or SE, but also meets the definition of a special-status plant, that plant species is addressed under this ESA- and CESA-listed plants study plan.

2.0 Resource Agency Management Goals

Several resource agencies have resource management responsibilities related to ESA and CESA-listed plants at the Project: the U.S. Department of Interior, Bureau of Land Management (BLM) on federal lands administered by BLM; the California Department of Fish and Game, for species listed under the CESA, and the U.S. Fish and Wildlife Service (USFWS) which has responsibility for administering the ESA. In order to meet its obligations under Sections 2 and 7 of the ESA, FERC must consult with the USFWS regarding the effects of the Project on ESA-

[1] For the purposes of this Relicensing, special-status plants are considered those plants that are: (1) found on BLM land and formally listed by BLM as Sensitive (BLM-S); (2) listed under the federal ESA as proposed or a candidate for listing as endangered or threatened or proposed for delisting; (3) listed under the CESA as proposed for listing; (4) found on the California Native Plant Society (CNPS) Inventory of Rare Plants and formally listed as a CNPS 1, 2 or 3 plant (CNPS 1, CNPS 2, CNPS 3); or (5) found on the CDFG list of California Rare (SR) species listed under the Native Species Plant Protection Act of 1977. Special-status plants do not include plants that are listed as threatened or endangered under the ESA or CESA.

listed species. A primary purpose of this study is to provide FERC with information adequate to complete its consultation efforts.

BLM's resource management goals are consistent with the ESA and BLM implementing policy. The ESA, Section 7(a)(1) states:

> *All federal agencies shall… utilize their authorities in furtherance of the purposes of this Act, by carrying out programs for the conservation of endangered species and threatened species listed pursuant to section 4 of this Act.*

BLM's implementing policy for ESA compliance in Manual 6840 states:

> *Actions authorized by BLM shall further the conservation and/or recovery of federally listed species…*
>
> *Section 7(a)(1) (Conservation Programs). Section 7(a)(1) requires the BLM to use its authorities to further the purposes of the ESA by implementing programs for the conservation of threatened and endangered species and the ecosystems on which they depend. Ways in which BLM can carry out these responsibilities include, but are not limited to:*
>
>> *determining to the extent practicable, the occurrence, distribution, population, and habitat condition of all ESA-listed species on BLM-administered lands; and*
>>
>> *Monitoring and evaluating ongoing management activities to ensure conservation objectives for listed species are being met* (BLM 2008a).

BLM's Sierra Resource Management Plan (SRMP) (BLM 2008b) provides general guidelines for managing ESA-listed plants. These guidelines include managing edaphically unique areas that often support both sensitive plant species and federally listed species to assist in the recovery of listed species, and coordinating with the USFWS on implementation of recovery plans for ESA-listed plants to promote the recovery of listed species. The SRMP also includes management guidelines for the Red Hills Area of Critical Environmental Concern (ACEC), part of which lies within or adjacent to the Project Boundary.

The USFWS' management goal for ESA-listed plants is to recover listed species to levels where protection under the Act is no longer necessary (USFWS 1988).

Two agencies have management responsibilities for CESA-listed plants within the Project. The BLM in California recognizes species listed by the State of California under CESA as BLM-sensitive species. BLM guidance for sensitive species states:

> *In compliance with existing laws, including the BLM multiple use mission as specified in Federal Land Policy and Management Act (FLPMA), the BLM shall designate sensitive species and implement measures to conserve these species and their habitats….to promote their conservation and reduce the likelihood and need for such species to be listed pursuant to the ESA (Endangered Species Act of 1973)…*

> *On BLM administered lands, the BLM shall manage Bureau sensitive species and their habitats to minimize or eliminate threats affecting the status of the species or to improve the condition of the species habitat, by determining the extent practicable, the distribution, abundance, population condition, current threats, and habitat needs for sensitive species…* (BLM 2008a).

BLM's SRMP (BLM 2008b) provides general guidelines for managing special-status species. These guidelines include managing unique edaphic areas that support unusual floras to both conserve BLM-sensitive species, including state-listed species. There is also discussion of coordination with CDFG on implementation of recovery plans and conservation strategies for CESA-listed plants and promoting the recovery of state-listed species. The SRMP also includes management guidelines for the Red Hills ACEC.

The CDFG also has management responsibility for CESA-listed plants. The CESA requires state lead agencies preparing California Environment Quality Act (CEQA) documents to consult with CDFG regarding potential impacts of projects on state-listed species. The state lead agency must adopt reasonable and prudent alternatives as specified by CDFG to prevent jeopardizing the continued existence of the CESA-listed plant.

3.0 Study Goals

The goal of this study is to provide information to determine the extent to which Project O&M and/or recreational activities may have the potential to adversely affect ESA- or CESA-listed plant species. A Project effect may occur if each of the following conditions are met:

- An ESA- or CESA-listed plant species is found to occur within the study area; and
- A specific Project O&M or recreation activity has a reasonable possibility of having an adverse effect on the ESA- or CESA-listed plant species found.

The goal of this study is to gather the information necessary to identify whether Project-related activities have the potential to impact ESA- or CESA-listed plant species.

4.0 Existing Information and Need for Additional Information

Existing and relevant information regarding known and potentially occurring ESA- and CESA-listed plants in the Project area is available from the California Native Plant Society (CNPS) Inventory of Rare and Endangered Plants database (CNPS 2010), the USFWS Endangered Species Program (USFWS 2010), and the California Natural Diversity Database (CNDDB) (CDFG 2010). Database queries included all U.S. Geological Survey (USGS) 1:24,000 topographic quadrangles that include the existing Project Boundary and the surrounding quadrangles. Quadrangles containing the Project Boundary include Chinese Camp, La Grange, Moccasin, Peno Blanco Peak, Sonora, and Standard. Based on this information, as well as the Project's elevation range and potential habitats, 10 plant species were identified that are listed as FT, FE, SE, or ST and that have a reasonable potential to be affected by the Project.

Table 4.0-1 provides the following information for each of these ESA- and CESA-listed target plant species: status; flowering period; elevation range; habitat requirements; and recorded occurrence in the general Project area.

There were CNDDB records for 10 ESA-listed plant occurrences located within a one-mile buffer of the Project Boundary. There were five occurrences each of Layne's ragwort (*Packera layneae*) and Red Hills vervain (*Verbena californica*) (CDFG 2010). A botanical survey of the Red Hills Management Area (now the Red Hills ACEC) was completed in 1984. The survey located the ESA-listed Layne's ragwort and Red Hills vervain (BLM 1985).

Few of the available reports are from surveys within the Project Boundary, and, of those that are, many are outdated.[2] Additional information needed to address the study goal is the specific location of ESA- and CESA-listed plants in relation to Project O&M activities, Project recreation, and any other Project-related activities that might affect listed plants.

5.0 Study Methods

5.1 Study Area

The study area consists of the area within the Project Boundary that is subject to Project-related O&M and/or recreation activities, including high-use dispersed recreation areas. The study area is described in Appendix A of this study plan, and includes the following the following specific areas within the Project Boundary:

- The Blue Oaks, Fleming Meadows, and Moccasin Point Recreation areas and related facilities, including the 3.5 mile Don Pedro Shoreline Trail;
- High-use dispersed recreation areas as described in Appendix A;
- Lands within the Project Boundary designated as part of the Red Hills Area of Critical Environmental Concern;
- Don Pedro Dam, Powerhouse, and Switchyard, including related maintenance and storage facilities and the powerhouse access road;
- The Don Pedro Spillway channel and related access roads;
- The Gasburg Creek diversion dike and related access roads;
- Employee Housing near Don Pedro Dam;
- Don Pedro Recreation Agency headquarters and visitor center;
- Dikes A, B, and C in the vicinity of Don Pedro Dam; and
- The Wards Ferry take-out.

The study area also includes habitats adjacent to each of these Project features to the extent they could reasonably be affected by Project O&M and/or recreation, generally understood to be less than 100 feet. If noxious weed occurrences are located, the study area will be expanded to the full extent of the occurrence or the Project Boundary, whichever is less.

[2] Annual or short-lived perennial species may require annual monitoring to accurately document population conditions, while long-lived perennials may only require surveys at five-year intervals (CDFG 2009).

Table 4.0-1 Target list of ESA-listed plant species for the Don Pedro Project.

Common Name/ Scientific Name	Status[1]	Flowering Period	Elevation Range (feet)	Habitat Requirements	Occurrence in Area Surrounding the Project[2,3]
Chinese Camp brodiaea *Brodiaea pallida*	CNPS 1B, FT, SE	May-Jun	1,000-1,250	Ultramafic, valley and foothill grassland, cismontane woodland, vernal streambeds, often serpentine	**Chinese Camp, Sonora**, New Melones Dam
Succulent owl's clover *Castilleja campestris* ssp. *Succulent*	CNPS 1B, FT, SE	Apr-May	150-2,500	Vernal pools	Cooperstown, Snelling, Merced Falls
Hoover's spurge *Chamaesyce* hooveri	CNPS 1B, FT	Jul-Sep (Oct)	75-900	Vernal pools	Cooperstown, Turlock Lake
Delta button-celery *Eryngium racemosum*	CNPS 1B, SE	Jun-Oct	0-350	Riparian scrub	Turlock Lake
Colusa grass *Neostapfia colusana*	CNPS 1B, FT, SE	May-Aug	0-700	Vernal pools	Cooperstown, Turlock Lake
Hairy Orcutt grass *Orcuttia pilosa*	CNPS 1B, FE, SE	May-Sep	100-700	Vernal pools	Cooperstown, Turlock Lake
Layne's ragwort *Packera layneae*	CNPS 1B, FT, SR	Apr-Aug	0-3,300	Chaparral, cismontane woodland, serpentine or gabbroic, rocky	**Chinese Camp, Moccasin**
Hartweg's golden sunburst *Pseudobahia bahiifolia*	CNPS 1B, FE, SE	Mar-Apr	0-500	Cismontane woodland, valley and foothill grassland	**La Grange**, Cooperstown, Snelling, Merced Falls, Tuolumne
Greene's tuctoria *Tuctoria greenei*	CNPS 1B, FE, SR	May-Jul (Sep)	0-3,600	Vernal pools	Cooperstown
Red Hills vervain *Verbena californica*	CNPS 1B, FT, ST	May-Sep	800-1,400	Cismontane woodland, valley and foothill grassland, usually serpentine seeps and creeks	**Sonora, Chinese Camp**, Keystone

1 Special-status:
- FE: Federal Endangered Species
- FT: Federal Threatened Species
- SE: California Endangered Species
- SR: California Rare Species
- ST: California Threatened Species
- CNPS: California Native Plant Society listed species
  - 1B: Species considered rare or endangered in California and elsewhere

2 Occurrence in area surrounding Project results based on a CNPS nine quadrangle search.

3 Quads that are fully or partially included within the existing Project Boundary are indicated by bold font; quads surrounding, but not included within the Project Boundary are listed in regular font.

5.2 General Concepts

These general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study report.

5.3 Study Methods

The study will be completed in five steps:

Step 1 – Gather Data and Prepare for Field Effort. The Districts will identify and map known occurrences of ESA- and CESA-listed plants within the study area, and prepare field maps for use by survey teams. The maps will include aerial imagery, Project features, and known plant occurrences. Survey timing will be planned based on blooming periods and herbarium collection dates.

Step 2 – Conduct Field Surveys. The Districts' surveyors will conduct plant surveys that generally follow CDFG's Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities (CDFG 2009).[3] Field surveys will be conducted at the proper times of year when ESA- and CESA-listed plants potentially occurring in a given survey area and are both evident and identifiable. Surveys will use a random meander technique, and focus additional efforts in high-quality habitats or those with a higher probability of supporting plants (e.g., serpentine outcrops).

Surveys will be floristic in nature, documenting all species observed; taxonomy and nomenclature will be based on The Jepson Manual (Hickman 1993).

In the event ESA- and/or CESA-listed plants are found within the study area, surveyors will collect the following data, to the edge of the occurrence, or to 500 feet outside the Project Boundary, whichever is less:

- Digital photographs, if needed, to describe the occurrence, its habitat, and any potential threats (at least one digital photograph will be collected for each occurrence, with other photographs to document potential threats, or as needed).
- Estimated area (approximate length and width) covered by the occurrence and estimated number of individual plants in the population. If a plant occurrence is estimated to cover an area greater than 0.1 acre, surveyors will delineate the occurrence boundary using a handheld GPS, collecting either polygon data, or sufficient point data that a realistic occurrence polygon can be constructed from the point data using GIS.
- For occurrences less than 0.1 acre in size, location of the approximate center of the occurrence taken as point data using a handheld GPS unit.
- Dominant and subdominant vegetation in the area, and topographic features.

[3] For the purpose of this relicensing and differing from the CDFG 2009 protocol, ESA- and CESA-listed plants are not considered special-status and are addressed in separate study proposals.

- Estimated distance to nearest Project facility, feature, or Project-related activity.
- Activities observed in the vicinity of the occurrence that have a potential to adversely affect the population (e.g., recreational trails and uses).
- Estimated phenology and descriptions of reproductive state.

For all ESA- and CESA-listed species observations, the Districts will complete the appropriate CNDDB form or spreadsheet and transmit the form to the CNDDB. The Districts will provide a copy of the CNDDB form or spreadsheet to BLM.

Step 3 – Prepare Data and Quality Assure/Quality Control. Following field surveys, the Districts will develop GIS maps depicting ESA- and CESA-listed plant occurrences, Project facilities, features, and specific Project-related activities (e.g., dispersed use camping) and other related information collected during the study, including the complete floristic list. Field data will then be subject to QA/QC procedures, including spot-checks of transcription and comparison of GIS maps with field notes to verify locations of ESA- and CESA-listed plant occurrences.

Step 4 ~~– Consult with the Districts' Project Operations and DPRA Staff.~~ Threats Assessment. Once the location of ESA- and CESA-listed plants in the study area is determined, Districts will assess all potential threats to these species, including noxious weeds, Project operations and, and ~~DPRA~~Project-related recreation. In particular, Don Pedro Recreation Agency staff will be consulted to identify Project O&M and recreation activities that occur in the area of the plant occurrences that have a potential to ~~adversely~~ affect ~~the~~ESA and CESA-listed species.

Step 5 ~~–~~ – Prepare Report. The Districts will prepare a report that includes the following sections: (1) Study Goals; (2) Methods; (3) Results; (4) Discussion; and (5) Description of Variances from the study plan, if any. The Districts will make the report available to Relicensing Participants upon completion.

~~6.0 Study-Specific Consultation~~

~~The Districts will notify USFWS within five working days if ESA-listed plants are detected at any location and will notify the BLM if the occurrence is located on or immediately adjacent to BLM-administered land.~~

~~The Districts, as FERC's non-federal representatives, intend to undertake this study as part of their informal consultation under Section 7 of the ESA, and plan to consult with USFWS prior to, during, and after study implementation.~~

~~The Districts will notify CDFG within five working days if CESA-listed plants are detected at any location and will notify BLM if the occurrence is located on or immediately adjacent to BLM-administered land.~~

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC issues its Study Determination by December 31, 2011 and the study is not disputed by a mandatory conditioning agency:

- Planning (Step 1) ....January 2012 – March 2012
- Field Season (Step 2).. March 2012 – July 2012
- QA/QC Review (Step 3) ....August 2012
- Threats Assessment (Step 4) ....August 2012
- Study Report Preparation (Step 5) ....September 2012 – December 2012
- Report Issuance ....January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Principles

This study is consistent with the goals, objectives, and methods outlined for FERC hydroelectric relicensing efforts in California, and uses standard botanical survey methods as defined by the USFWS and CDFG.

8.0 Deliverables

The Districts will prepare a report, GIS-based maps showing findings and, if applicable, submit records to the CNDDB.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

California Department of Fish and Game. 2009. Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities. Available online at: <www.fws.gov/sacramento/es/.../Listed_plant_survey_guidelines.PDF>.

——. 2010. Biogeographic Data Branch. California Natural Diversity Database (CNDDB). Available online at: www.dfg.ca.gov/biogeodata/cnddb/pdfs/TEPlants.pdf. Accessed July 6, 2010.

California Native Plant Society. 2010. Inventory of Rare and Endangered Plants (online edition, v7-08a). California Native Plant Society. Sacramento, California. Available online at: http://www.cnps.org/inventory. Accessed July 6, 2010.

Hickman, J.C., editor. 1993. The Jepson Manual, 3rd Edition. University of California Press, Berkeley, California.

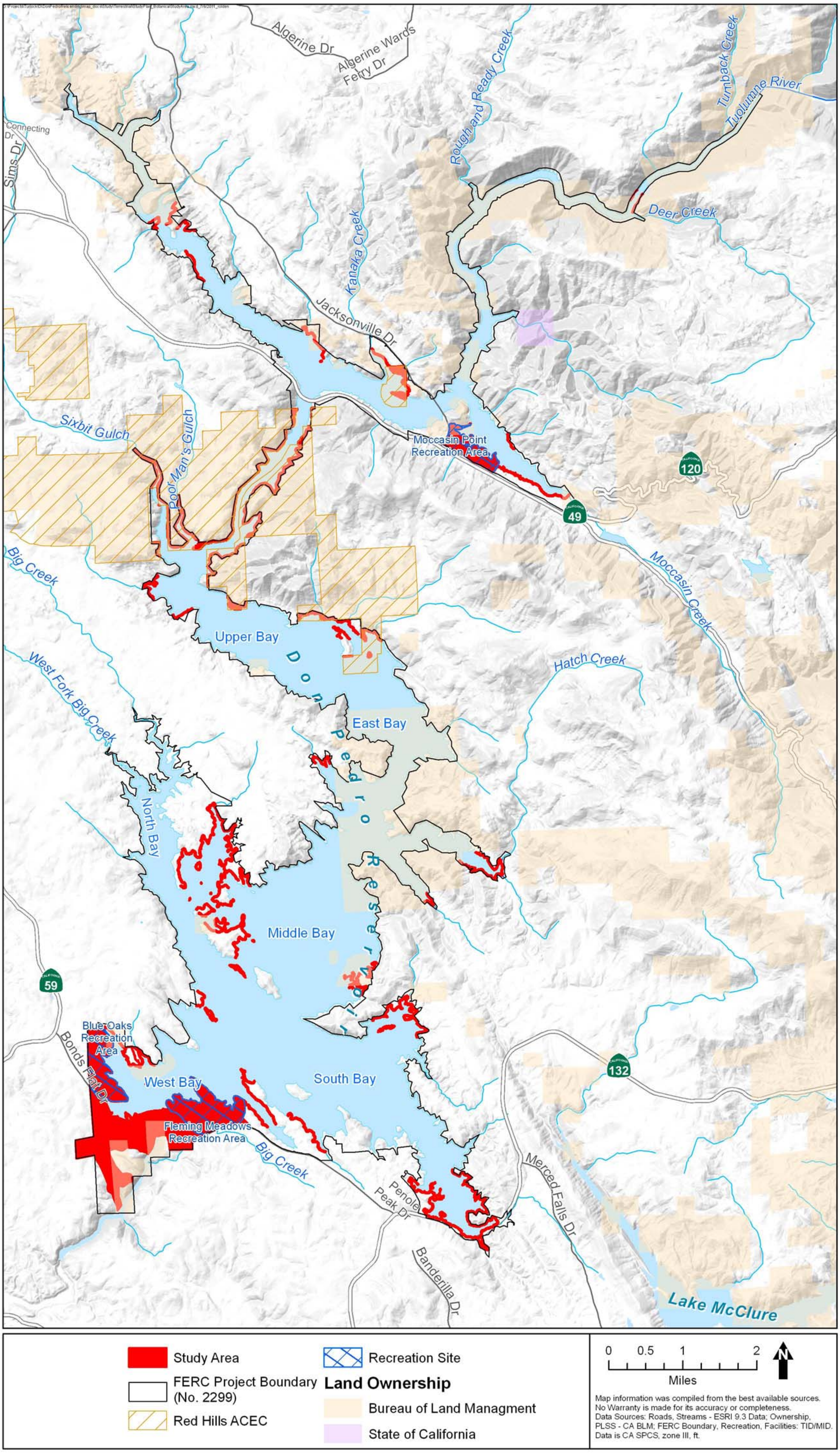
U.S. Department of the Interior, Bureau of Land Management. 1985. Final Red Hills Management Plan and Environmental Assessment. Bakersfield, California.

——. 2008a. BLM Manual 6840 - Special Status Species Management.

——. 2008b. Sierra Resource Management Plan and Record of Decision. February 2008. Folsom, CA.

U.S. Department of the Interior, U.S. Fish and Wildlife Service. 1988. Endangered Species Act of 1973 [(16 U.S.C. 1531-1544, 87 Stat. 884)], as amended through the 100th Congress.

_____. 2010. Sacramento Fish and Wildlife Office. Endangered Species Lists. Query ran for the following quads: Chinese Camp (458C), La Grange (440B), Moccasin (458D), Penon Blanco Peak (440A), Sonora (458B), and Standard (458A). Available online at: <http://www.fws.gov/sacramento/es/spp_lists/auto_list_form.cfm>. Accessed July 16, 2010.


Algerine Dr
Algerine Wards Ferry Dr
Rough and Ready Creek
Tumback Creek
Tuolumne River
Connecting Dr
Sims Dr
Deer Creek
Kanaka Creek
Jacksonville Dr
Sixbit Gulch
Poor Man's Gulch
Moccasin Point Recreation Area
120
49
Big Creek
Moccasin Creek
Upper Bay
Don Pedro Reservoir
West Fork Big Creek
Hatch Creek
East Bay
North Bay
Middle Bay
59
Blue Oaks Recreation Area
West Bay
South Bay
132
Bonds Flat Dr
Fleming Meadows Recreation Area
Big Creek
Penole Peak Dr
Merced Falls Dr
Banderilla Dr
Lake McClure
Study Area
FERC Project Boundary (No. 2299)
Red Hills ACEC
Recreation Site
Land Ownership
Bureau of Land Managment
State of California
0 0.5 1 2
Miles
N
Map information was compiled from the best available sources.
No Warranty is made for its accuracy or completeness.
Data Sources: Roads, Streams - ESRI 9.3 Data; Ownership, PLSS - CA BLM; FERC Boundary, Recreation, Facilities: TID/MID.
Data is CA SPCS, zone III, ft.

STUDY PLAN TR-5

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

ESA-Listed Wildlife - Valley Elderberry Longhorn Beetle Study Plan

July 2011

Related Study Requests: USFWS-04 & 05

1.0 Project Nexus

Certain aspects of the ongoing operation and maintenance (O&M) of the Don Pedro Project (Project) may potentially affect valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (VELB) populations. Project O&M activities including vegetation management and routine maintenance at Project facilities may disrupt VELB habitat. This study focuses on the presence of VELB habitat, which may potentially be affected by Project O&M and/or Project-related recreation activities.

VELB is a terrestrial wildlife species that is listed as threatened under the federal Endangered Species Act (ESA). VELB has a reasonable potential to occur in the Project Boundary and may be affected by certain Project O&M or recreation activities.

2.0 Resource Agency Management Goals

The U.S. Department of Interior (USDOI), Fish and Wildlife Service (USFWS) administers the ESA as it relates to VELB. Potential impacts to VELB are also of interest to the USDOI, Bureau of Land Management (BLM) on federal lands administered by the BLM.

USFWS has issued conservation guidelines for VELB (USFWS 1999), which include survey protocols and compensation requirements for elderberries with one or more stems measuring one inch or greater in diameter at ground level that may be directly or indirectly impacted by the construction or operation of a project. Where impacts to plants are anticipated as a result of an action, elderberry plants with stems that meet the one-inch-diameter threshold on or adjacent to the site must be thoroughly searched for beetle exit holes and the number of stems tallied by diameter size class and location (i.e., riparian or upland) for determination of compensation ratios. Elderberry plants lacking stems one inch or greater in diameter at ground level are considered unsuitable for use by the beetle and are not protected under the guidelines. Surveys are valid for a period of two years.

The BLM's resource management goals are consistent with the ESA and BLM implementing policy. The ESA, Section 7(a)(1) states:

> *All federal agencies shall… utilize their authorities in furtherance of the purposes of this Act, by carrying out programs for the conservation of endangered species and threatened species listed pursuant to section 4 of this Act.*

BLM's implementing policy for ESA compliance in Manual 6840 states:

> *Policy. Actions authorized by BLM shall further the conservation and/or recovery of federally listed species…*
>
> *Section 7(a)(1) (Conservation Programs). Section 7(a)(1) requires the BLM to use its authorities to further the purposes of the ESA by implementing programs for the conservation of threatened and endangered species and the ecosystems on which they depend. Ways in which BLM can carry out these responsibilities include, but are not limited to:*
>
> *Determining to the extent practicable, the occurrence, distribution, population, and habitat condition of all ESA-listed species on BLM-administered lands…*
>
> *Monitoring and evaluating ongoing management activities to ensure conservation objectives for listed species are being met* (BLM 2008a).

BLM's Sierra Resource Management Plan (SRMP) (BLM 2008b) provides general guidelines for sustaining existing VELB populations on BLM land and sustaining and managing viable habitat for VELB through conservation and management of its host plant, elderberry.

3.0 Study Goals

The goal of this study is to provide information to the relicensing participants concerning VELB presence and distribution within the Project Boundary. The specific objective of this study is to gather information, including:

- Identify and map the location of appropriate elderberry shrubs.
- Classify habitat where shrubs are found into riparian or non-riparian, and whether shrubs are isolated or clumped.
- Document the presence or absence of VELB or evidence of VELB when surveys are performed.

4.0 Existing Information and Need for Additional Information

VELB were historically distributed throughout the Central Valley, extending upstream in river canyons in the Sierra Nevada foothills to an elevation of about 3,000 feet. The beetle is completely dependent upon its host plant, elderberry, which is a common component of the remaining riparian forests and adjacent uplands. The beetles' use of elderberries is not readily apparent; often the only exterior evidence is an exit hole created by the larva just prior to pupation. The life cycle takes one or two years to complete with most of that time spent as larva living within the stems of the plant. Adults generally emerge from late March through June, and adults are short-lived (USFWS 1999).

All existing and available information regarding previous surveys in the Project are occurrences outside of the Project Boundary. The Districts located a total of four California Natural Diversity Database (CNDDB) reports spanning from 2000 to 2007. These reports pertained to two occurrences in each of two U.S. Geological Survey 7.5-minute quadrangles: Sonora and Standard. Of these, two are reported VELB sightings and two are reports of VELB exit holes (CDFG 2010). ~~None of the reported occurrences are located in the Project Boundary.~~

Existing information is not adequate to meet the goal of the study. Information necessary to address the study goal includes a current assessment of elderberry plants and VELB in the Project.

5.0 Study Methods

5.1 Study Area

The study area consists of the area within the Project Boundary ~~where~~that is subject to Project-related O&M and/or recreation activities~~ may potentially impact VELB habitat. Specifically, the~~, including high-use dispersed recreation areas. The study ~~will be performed~~area is described in Appendix A of the Districts' Special-Status Plants Study Plan (Study Plan TR-01), and includes the following the following specific areas within the ~~following study sites~~Project Boundary:

- ~~100 feet around developed recreation~~ The Blue Oaks, Fleming Meadows, and Moccasin Point Recreation areas and related facilities~~ and regularly used undeveloped recreation sites~~
- ~~60 feet around intakes, gatehouses, surge tanks, adits, portals and microwave/radar towers and other Project facilities~~
- ~~30 feet around ancillary support facilities~~, including ~~stream gages and weirs~~the 3.5 mile Don Pedro Shoreline Trail;
- ~~25 feet from centerline of access roads~~High-use dispersed recreation areas as described in Appendix A;
- Lands within the Project Boundary ~~20 feet around the perimeter~~ designated as part of the Red Hills Area of ~~powerhouses and switchyards~~Critical Environmental Concern;
- ~~20 feet from centerline of managed trails~~
- Don Pedro Dam, Powerhouse, and Switchyard, including related maintenance and storage facilities and the powerhouse access road;
- The Don Pedro Spillway channel and related access roads;
- The Gasburg Creek diversion dike and related access roads;
- Employee Housing near Don Pedro Dam;
- Don Pedro Recreation Agency headquarters and visitor center;
- Dikes A, B, and C in the vicinity of Don Pedro Dam; and
- The Wards Ferry take-out.

The study area also includes habitats adjacent to each of these Project features to the extent they could reasonably be affected by Project O&M and/or recreation, generally understood to be up to 100 feet. If elderberry occurrences are located, the study area will be expanded to the full extent of the occurrence or the Project Boundary, whichever is less.

5.2 General Concepts

These general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study report.

5.3 Study Methods

The study will be completed in six steps, each of which is described below.

Step 1 – Known Occurrences. The Districts will identify and map known occurrences of elderberry plants and VELB within the study area.

Step 2 – Conduct Field Surveys for Elderberry Plants. In conjunction with the Special-Status Plants Study, the Districts will document all occurrences of elderberry within the study area with GPS and take photographs of each occurrence. Occurrences will be documented by classifying the largest stem at ground level of the shrub into one of three categories: (1) greater than or equal to one inch but less than or equal to three inches; (2) greater than three inches but less than five inches; and (3) greater than five inches. ~~Classify the~~The habitat surrounding the shrub will be classified as either riparian or non-riparian~~. Indicate~~, and whether the shrub was isolated or part of a larger clump. In addition, surveyors will collect a total stem count by size class.

Step 3 ~~–~~ Conduct Surveys for Evidence of VELB. All elderberry shrubs with one or more stems measuring ~~1.0~~one inch or greater in diameter at ground level that occur within the study area must be thoroughly searched for beetle exit holes (external evidence of beetle presence). The exit holes should be characterized as to whether they are recent (shavings may be present) or not. Incidental observations of VELB on the plants will be noted and reported to the appropriate agencies (see Section 6.0).

Step 4 ~~–~~ Compile Data and Perform Quality Assurance/Quality Control. Following field surveys, the Districts will develop GIS maps depicting VELB occurrences, potential habitat, Project facilities, and features, and other information collected during the study. Field data will then be subject to QA/QC procedures, including spot-checks of transcription and comparison of GIS maps with field notes on locations of any VELB occurrences.

Step 5 ~~–~~ Consult with the Districts' Project Operations and Don Pedro Recreation Agency Staff. Once the locations of VELB and habitat in the study area are defined, Project operations and

Don Pedro Recreation Agency staff will be consulted to identify O&M and recreation activities in those areas that may have the potential to adversely affect the population.

Step 6 – Prepare Report. The Districts will prepare a report that includes the following sections: (1) Study Goals; (2) Methods; (3) Results; (4) Conclusions; and (5) Description of Variances from the FERC-approved study proposal, if any. Confidential information will not be included in the report, but provided to appropriate resource agencies.

Step 7 – Study Specific Consultation. The Districts, as FERC's non-federal representatives, intend to undertake this study as part of their informal consultation under Section 7 of the ESA, and plan to consult with USFWS prior to, during, and following study implementation.

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC issues its Study Determination by December 31, 2011 and the study is not disputed by a mandatory conditioning agency.

- Planning (Step 1) .... January – March 2012
- Field Season (Step 2) .... March – July 2012
- Compile Data and QA/QC Review (Steps 3 and 4) .... August 2012
- Operations and DPRA Staff Consultation (Step 4) .... August 2012
- Study Report Preparation (Step 5) .... September – December 2012
- Report Issuance .... January 2013

7.0 Deliverables

The Districts will prepare a report, GIS-based maps showing findings and, if applicable, submit records to the CNDDB.

8.0 Consistency of Methodology with Generally Accepted Scientific Principles

This study is consistent with the goals, objectives, and methods outlined for recent FERC hydroelectric relicensing efforts in California, and uses methods from the USFWS, BLM, and other expert sources.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

California Department of Fish and Game. 2010. Biogeographic Data Branch. California Natural Diversity Database (CNDDB). Available online at: <www.dfg.ca.gov/biogeodata/cnddb/ pdfs/TEPlants.pdf>. Accessed July 6, 2010.

U.S. Department of Interior, Bureau of Land Management (BLM). 2008a. BLM Manual 6840 - Special Status Species Management.

——. 2008b. Sierra Resource Management Plan and Record of Decision. February 2008. Folsom, California.

U.S. Department of Interior, Fish and Wildlife Service (USFWS). 1999. Conservation Guidelines for the Valley Elderberry Longhorn Beetle. U.S. Fish and Wildlife Service, Sacramento, California.

STUDY PLAN TR-6

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Special-Status Amphibians and Reptiles Study Plan

July 2011

Related Study Requests: None

1.0 Project Nexus

Certain operation and maintenance (O&M) activities and recreation activities at the Don Pedro Project (Project) have a potential to affect special-status amphibians (Class Amphibia) and aquatic turtles (Class Chelonia).[1] Two such special status-species may occur in the Project area: foothill yellow-legged frog (FYLF; *Rana boylii*) and western pond turtle (WPT; *Actinemys* [formerly *Emys* or *Clemmys*] *marmorata*). The Project may provide suitable habitat for these species. Water level changes in reservoir tributaries, ground-disturbing activities, recreation foot traffic, and vegetation clearing are Project-related activities that could directly and indirectly affect special-status amphibians and aquatic turtles and their habitat.

FYLF is a stream-associated species affected by seasonal flow regimes that influence water stage, velocity, and temperature. Project effects on water levels at the mouths of reservoir tributaries could affect habitat availability and suitability for all life stages. Project operations that may result in changes in water levels and velocity may affect the suitability of instream habitat and if water levels decline, has the potential to strand egg masses and tadpoles. However, the Don Pedro Reservoir is not likely to be suitable FYLF habitat. FYLF may occur in the Tuolumne River in the upper most reaches of Don Pedro Reservoir or in tributaries that flow into the reservoir; however, the Project does not include any facilities or features upstream of Don Pedro Reservoir, nor do the Districts perform any Project O&M activities upstream of Don Pedro Reservoir.

Project O&M activities may affect WPT if this species is present in the Project reservoirs, slow-moving stream reaches, or other water bodies within the Project Boundary tributary to the

[1] For the purpose of this relicensing, special-status amphibians and aquatic turtles are considered those amphibian and aquatic turtle species: (1) potentially-occurring on U.S. Department of Interior, Bureau of Land Management (BLM) land and formally listed by BLM as a Sensitive Species; (2) listed by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) as Sensitive; (3) listed under the federal ~~endangered~~Endangered Species Act (ESA) as Proposed or Candidate for listing as endangered or threatened or proposed for delisting; (4) listed under the California Endangered Species Act (CESA) as proposed for listing; or (5) formally listed by California Department of Fish and Game (CDFG) as a Species of Concern. Species listed as threatened or endangered under the ESA or CESA are addressed separately and not considered special-status for the purpose of the relicensing proceedings.

Project. The Project is well within the elevational range of this species. More specifically, Project water level changes could result in inundation of potential nesting habitat.

2.0 Resource Agency Management Goals

Two agencies are likely to have a direct interest in the two special-status species addressed by this Study Plan: CDFG and BLM. CDFG has designated these species as species of concern. BLM, which administers public land in the Project area, has issued resource management plans that also relate to these two species. The Districts understand that BLM's resource management goals regarding special-status species, including special-status amphibians and aquatic turtles, are to maintain, improve or enhance native fish and wildlife populations and the ecosystems upon which they depend; ensure that all management activities and BLM authorization are consistent with the conservation needs of special-status species; manage special-status species habitat to assist in the recovery of listed species; protect and manage significant and sensitive resources on BLM lands; maintain and/or improve meadow and wetland habitat and riparian and aquatic habitat for all life stages of native fish, macroinvertebrates, other aquatic species, and special-status species; and to sustain and manage viable populations of the FYLF in the planning area.

3.0 Study Goals

The goal of this study is to provide information to the relicensing participants concerning FYLF and WPT associated with the Project, and related Project recreation features or activities. The specific objectives of this study are:

- Identify, compile, and map known occurrences of FYLF and WPT, including life history stage and associated habitat information as available. At a minimum, produce a map of known occurrences with a supplemental table that includes information on the location, date found, how many individuals (if available), and the source of the sighting (museum database, agency record, etc.).
- Identify and map habitats in the study area potentially suitable for FYLF and WPT, including potential WPT nesting habitat surrounding the Project reservoir, and evaluate the suitability of these habitats for the species.
- Document the distribution and abundance of FYLF and WPT in the study area.
- Perform FYLF and WPT surveys in suitable habitats where there is some evidence of a potential adverse Project effect.
- Compile incidental observations of FYLF and WPT and other aquatic special-status species and non-native amphibians, turtles, and crayfish from other aquatic studies.
- Provide information to enable an assessment of Project impacts.

4.0 Existing Information and Need for Additional Information

Existing and relevant information regarding known and potentially occurring locations of special-status amphibians and aquatic turtles in the Project vicinity is available from California Natural Diversity Database (CNDDB), museum records, and other sources. WPT is the only special-status turtle in the area (there are no special-status reptiles, i.e., Class Reptilia, snakes, and lizards, in the area). This information and a life history description of each species, included in Section 5.3 of the Pre-Application Document (PAD), are useful in identifying preferred habitats and documenting where the species have been found to date. Table 4.0-1 summarizes habitat requirements of each species by life stage.

Table 4.0-1 Special-status amphibians and aquatic turtle habitat requirements by life stage.[1]

Species	Egg Masses	Larvae/Hatchling Turtles	Adults
Foothill yellow-legged frog	Egg masses are deposited in low to moderate gradient streams, usually within shallow, edgewater areas of low velocity with cobble/boulder substrate in open, sunny areas with little riparian vegetation; often adjacent to low gradient cobble/boulder bars, tributary confluences, side and backwater pools, or pool tail-outs with coarse substrates. In small streams may occur in step pools and other microhabitats that meet basic conditions for substrate, water depth, and velocity.	Generally in low velocity segments of streams, such as edgewater habitat adjacent to riffles or cascades, in main channel pools, and plunge-pools that provide escape cover (e.g., substrate interstices, vegetation, and detritus for cover). Larvae, at least in early stages, show affinity to oviposition sites, but may disperse to shallow, warm, low velocity near-shore habitats with smaller substrate (i.e., gravel/sand) as the season progresses.	Perennial streams and ephemeral creeks with pools. Prefer areas that provide exposed basking sites and cool shady areas adjacent to water's edge. Shallow, flowing water, preferentially in small to moderate-sized streams with some cobble-sized substrate.
Western Pond Turtle	Upland, low gradient slopes (less than 15 degrees) with high clay or silt content in the vicinity of aquatic habitats. Eggs are deposited in a shallow excavation ("nest") in a dry location in summer. Nests are typically located on an unshaded slope that may be partly south-facing.	Hatchlings emerge from nests in spring. Require shallow water with dense submergent vegetation or short emergent vegetation.	Permanent ponds, lakes, reservoirs, low-flow regions of rivers, river side channels, and backwater areas. Isolated occurrences in lakes and reservoirs sometimes represent deliberate releases of pets. May also use seasonal streams or ponds when these are available. The presence of basking sites is important and these may be provided by emergent large woody debris, overhanging vegetation, rock outcrops, and mats of submergent vegetation. Deep pools and undercut banks may represent overwintering refugia. Often aestivate or overwinter in terrestrial habitats, including forests and riparian thickets, where they burrow in leaf litter.

1 Sources of information: Ashton et al. 1997; Holland 1991; Rathbun et al. 1992; Jennings and Hayes 1994, PG&E 2001, Lind 2005; Vollmar 2002.

4.1 Western Pond Turtle

WPT is a habitat generalist occurring in a wide variety of aquatic habitats with still- or slow-moving water up to about 6,000 feet elevation; the species is uncommon in high-gradient streams

(Jennings and Hayes 1994). Adult WPT have been documented traveling long distances from perennial watercourses for both aestivation and nesting, with long range movements to aestivation sites averaging about 820 feet and nesting movements averaging about 295 feet (Rathbun et al. 2002). Reese and Welsh (1997) documented WPT away from aquatic habitats for as much as seven months per year and suggested that terrestrial habitat use was at least in part a response to seasonal high flows.

WPT breeding activity may occur year-round in California, but egg-laying tends to peak in June and July in colder climates, when females begin to search for suitable nesting sites upslope from water. During the terrestrial period, Reese and Welsh (1997) found that radio-tracked WPT were burrowed in leaf litter.

Introduced species of turtles (e.g., red-eared sliders [*Trachemys scripta*]) may out-compete WPT for basking sites and the American bullfrog (*Lithobates catesbeianus*) [formerly *Rana catesbeiana*] is known to consume hatchling WPT.

There are several reports of WPT in the Project vicinity including records at: (1) Moccasin Creek; (2) Piney Creek, north of Lake McClure and east of Don Pedro Reservoir; and (3) Table Mountain; (4) First Creek; and (5) on an unnamed tributary west of Moccasin Peak. WPT are also reported from Bobcat Flat downstream of the Project, at approximately River Mile 43. In most cases, existing information is too general to meet the objectives of the study. Additional information needed includes specific and current localities of the species and its habitats in relation to Project facilities; and sufficient information on normal Project O&M activities that might affect populations.

4.2 Foothill Yellow-Legged Frog

FYLF is a stream-adapted species and is not associated with ponds, lakes, or other lentic habitats. Current distribution of FYLF is predominately between 600 and 5,000 feet elevation (Moyle 1973, Laabs et al. 2002, Seltenrich and Pool 2002, ECORP Consulting, Inc. 2005). Within large streams, FYLF often occurs near tributaries, which may provide important seasonal habitats (e.g., in winter and during the hottest part of the summer) (VanWagner 1996; Seltenrich and Pool 2001). Breeding tends to occur in spring or early summer and eggs are laid in areas of shallow, slow moving, waters near the shore. FYLF are infrequent in habitats where introduced fish and American bullfrog occur (Jennings and Hayes 1994).

A review of CNDDB, Museum of Vertebrate Zoology (2010), California Academy of Sciences (2010), and BLM records from the Project area indicates that FYLF has five observations within the Project vicinity: (1) one occurrence at Hatch Lake (on BLM and private land); (2) one occurrence at Second Lake (on private land); (3) one occurrence near the confluence of Big Jackass Creek and Moccasin Creek (on BLM land); (4) one occurrence south of Table Mountain (on private land); and (5) one occurrence on an unnamed tributary west of Moccasin Peak.

In most cases, existing information is too general to meet the objectives of the study. Additional information needed includes: (1) specific and current localities of the species and its habitats in relation to Project facilities; and (2) more detailed information on normal Project O&M activities that might affect populations.

5.0 Study Methods

5.1 Study Area

The study area consists of suitable aquatic habitats within the existing FERC Project Boundary and extends 0.5 mile from the normal maximum water surface elevation of the Project reservoir and Project-affected stream reaches, including the section of the Tuolumne River up to River Mile 79. In addition, the study area includes tributaries up to 1.0 mile upstream of the reservoirs. FYLF and WPT may make seasonal movements between tributaries and mainstem streams.

5.2 General Concepts

The following general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study report.

5.3 Study Methods

The study will be completed in six steps, each of which is described below. Prior to conducting fieldwork, the necessary CDFG scientific collection permits will be obtained. Field investigation will adhere to accepted decontamination guidelines to minimize the likelihood of transmitting diseases (USFWS 2005).

Step 1 – Identify and Map Known Occurrences. Known occurrences of FYLF and WPT will be mapped and identified based on agency consultation and review of the latest existing information, including a query of the CNDDB, agency records, museum records, and consultation with regional experts. The map will be supplemented with a table that includes information on the exact location, date found, how many individuals (if available), and the source of the sighting (museum database, agency record, etc.).

Step 2 – Identify and Map Potential Habitat. Available data sources will be reviewed to identify areas of potentially suitable habitat for each of the two special-status species based on the description of habitat elements presented in Table 4.0-1. Data sources may include aerial photographs and Google Earth, National Wetland Inventory maps, U.S. Geological Survey (USGS) 1:24,000 topographic quadrangles, hydrologic data, and other sources of information that would allow for assessment of habitat conditions within the study area.

Potential WPT nesting (oviposition) habitat within the Project Boundary will be identified and mapped in Geographic Information System (GIS) based on certain attributes associated with known WPT nest sites, including distance from aquatic habitats, percent slope, aspect, and soil type (Holland 1991; PG&E and NID 2008). The mapping criteria for WPT are defined as follows:

- Within 100 meters of the Project reservoir and other water bodies associated with the Project;
- Slope of 2 to 15 degrees;
- Southeast, south or southwest aspect;
- Canopy cover of less than 10 percent; and
- Compacted soils of clay or loam (this criterion will be used if suitable soil maps exist).

A field reconnaissance may be conducted at specific locations to assess on-site habitat conditions for FYLF and WPT if other data sources are not adequate to this purpose. Sites will be logged by GPS position, photographs will be taken of each site from various angles, and a preliminary habitat assessment will be conducted. Pertinent habitat characteristics to be recorded will include habitat type, hydrologic regime, vegetation types (e.g., aquatic, emergent, overhanging, and canopy), gradient, aquatic substrate, and stream channel form.

Step 3 – Select Survey Sites. Based on the results of Step 2, a representative set of sites with potentially suitable aquatic habitat within or immediately adjacent to the Project Boundary will be selected for FYLF and WPT surveys. The selection of survey sites will take into account site-specific conditions, including safety, accessibility (i.e., road or trail access, topography), permission from landowners to survey on private lands, and potential impact from Project O&M activities. To the extent reasonable, WPT survey sites will be co-located with other relicensing study sites.

Step 4 – Conduct Surveys and Compile Incidental Observations.

Foothill Yellow-Legged Frog

Visual Encounter Survey Procedures

Surveys for FYLF will occur during the breeding season and will follow the visual encounter survey (VES) standard protocols developed by Pacific Gas & Electric Company (PG&E) for hydroelectric project applications (Seltenrich and Pool 2002; PG&E and NID 2009).

Specifically, two surveyors working in tandem will search stream banks, back channel areas, and potential instream habitats for FYLF walking slowly while one observer scans ahead. Habitats along each bank will be searched. To aid in the detection of eggs and larvae, surveyors will use a viewing box in shallow margin areas. In water too deep to survey by wading, or where substrate configuration (e.g., large boulders) or other factors render the viewing box ineffective, snorkeling will be employed in appropriate habitats during searches where safely accessible. Survey site length will range from 750 to 1,000 meters based on the extent of suitable habitat and access. Data collected during each survey includes:

- **Sampling Site:** time of survey (start, end and total search effort), GPS locations (start and end), weather conditions, and water and air temperatures (at start, mid-day, and end of survey) in both the channel margin and main channel, and;
- **Observation**: lifestage, sex, size, GPS location, as well as associated habitat data based on procedures described in Seltenrich and Pool (2002) and as updated in PG&E and NID (~~2008~~2009).

Survey Schedule

Three FYLF VES visits per site will be conducted; two visits in the spring/early summer for the detection of eggs and early tadpoles, and one in the late summer/early fall to detect older tadpoles and recently metamorphosed frogs. The first spring visit will be completed when river temperatures have reached a daily average of 11°C and/or when breeding has been verified in one or more comparison sites or the survey sites. Following the initial VES, surveyors will complete a habitat characterization of each study location, following standard operating procedures (PG&E and NID ~~2008~~2009). A reduced (single visit) VES effort may be performed in locations where the primary objective is to confirm habitat suitability.

Western Pond Turtle

The distribution of WPT will be evaluated by two means: (1) visual surveys at representative suitable sites within the Project Boundary as selected in Step 3, and (2) compilation of opportunistic observations incidental to the performance of other field studies for the relicensing (e.g., ~~foothill yellow-legged frog~~FYLF surveys, ~~California red-legged frog~~CRLF habitat assessments, botanical surveys, etc.). Incidental observations of turtles will include identification (i.e., WPT, exotic species, such as red-eared slider, or "unknown species"), estimated size, turtle behavior (e.g., basking on log), location, time, and a brief description or photograph of the habitat.

In general, incidental observations of WPT are most likely to occur during studies that involve quiet observation (e.g., scanning a site with binoculars), snorkeling, rafting or boat work associated with deep pools and backwaters. Turtles may also be observed when a site is first approached (WPT typically dive from basking sites when approached even at a long distance [Holland 1991; Reese undated]) or on roads when turtles make overland movements. Personnel performing other studies will be trained in how best to observe WPT. Field crews will also be instructed to document skeletal remains and evidence of WPT nests, such as the scrapes produced by females when digging nest-holes, signs of nests opened by predators, and remnants of hatched eggshells.

Visual surveys for WPT are adapted from USGS (2006) and will be supplemented by deployment of artificial basking platforms at survey sites where appropriate (Alvarez 2006). The use of basking platforms is an efficient and effective technique that has been shown to substantially increase detection rates, particularly at sites where existing basking sites are limited (Alvarez 2006). Surveys will be conducted at a time of day and under weather conditions when turtles are likely to be basking (e.g., sunny mornings May-July). Sites will be initially searched by binoculars from a distance to identify potential basking locations, such as sunlit rocks, logs, exposed banks, and floating vegetation. If turtles are observed, the species, number, and relative size of turtles will be recorded. The observer will then slowly and quietly approach the site, assume a suitable viewing position, and continue to scan the site for at least 30 minutes, focusing on basking sites and the surrounding water. Splashes of water that may signify a turtle entering the water will be noted. The length of time devoted to scanning each site will be recorded; and the locations of turtle sightings and possible evidence of WPT, including splashes, and locations where photographs are taken will be marked on a sketch of the site. Observers will also identify locations where the addition of artificial basking platforms may increase the likelihood of turtle detections. Artificial basking platforms will be placed at survey sites in suitable open water areas where potential basking substrates are scarce or obscured by vegetation. Each floating platform will consist of a rough-textured rectangular wood board; additional floatation at one end; and a tethered concrete anchor (Alvarez 2006). Platforms will be left in place for five to seven days to allow turtles to become acclimated and adopt platforms for basking. Sites will then be surveyed again for basking turtles.

Where turtles are found, the following data will be collected: (1) presence and name of exotic plant species; (2) presence of exotic turtles or bullfrogs; (3) percent overhead canopy; (4) percent submergent and emergent vegetation; (5) type of upland and riparian vegetation community; (6) presence and type of potential aquatic refugia (undercut banks, submerged tree roots, woody debris, rock crevices, aquatic submerged vegetation, emergent vegetation, and floating material); and (7) presence and type of any recent site disturbance. At the beginning of each survey, the following data will be recorded: date, observer, time, general weather description, ambient air temperature, average wind speed, water temperature, and estimated water velocity. Changes in weather conditions during surveys that could affect turtle detection (e.g., increased cloud cover or wind) will be noted. All survey sites will be photographed from multiple vantage points and the following information recorded: presence or absence of slow moving water and water depths ≥0.5 meters; quantity (none, few, or many) and types of basking sites (sunny rocks, open banks, fallen logs, and other); aquatic and streamside refugia, and upland habitat.

Survey sites for WPT will be assessed for the presence of American bullfrog by listening for calls, scanning suitable areas with binoculars or spotting scope for egg masses and basking frogs, and looking in shallow edges for larvae. After a site has been surveyed for WPT from a stationary position, at least one observer will walk along the shoreline listening and scanning ahead for jumping frogs—juvenile American bullfrogs often vocalize as they jump in alarm.

This study is not specifically designed to trap or capture WPT or other turtles. However, when a turtle is observed during this or other studies, capture may be attempted if feasible and without injuring or unduly stressing the animal. Field staff will be authorized by CDFG permits to capture WPT. Turtles that are captured will be measured (amphibian and turtle study teams will use calipers; other study teams will use a ruler photographed next to the turtle). Captured turtles will be categorized by sex (if determinable) and photographed in dorsal (carapace) and ventral (plastron) view alongside a ruler for later measurements and estimating age (counting scutal rings).

The Districts will complete and submit the appropriate California Native Species Field Survey Form to the CNDDB (Attachment A).

Step 5 – Prepare, Format, and Quality Assurance/Quality Control Data. Following field surveys, the Districts will develop GIS maps depicting special-status species occurrences, potential habitat, project facilities and features, and other information collected during the study. Field data will then be subject to QA/QC procedures, including spot-checks of transcription and comparison of GIS maps with field notes.

Step 6 – Prepare Report. The Districts will prepare a report that includes the following sections: (1) Study Goals and Objectives; (2) Methods and Analysis; (3) Results; (4) Discussion; and (5) Description of Variances from the FERC-approved study plan, if any. At a minimum, the following summaries/data presentations will be provided in the report with the supporting data (in Excel spreadsheet and GIS layers, as appropriate):

- Presence/absence of each special-status species by survey period (e.g., spring, summer), sample reach tributary, and river.
- Abundance of FYLF egg masses by survey period and location.
- Abundance of FYLF tadpoles/tadpole groups by survey period and location.
- Abundance of FYLF young-of-the-year (metamorphs), subadults, and adults by survey period and location.
- Descriptive summaries of FYLF egg mass and tadpole habitat characteristics (at least n, mean, minimum, maximum, and standard error values) overall and by site.
- Numbers of WPT detections by life stage (e.g., juvenile or adult) in the Project reservoir, Project-affected streams, or other study locations.
- Maps of and descriptive information on the occurrence of potential WPT nesting habitat and its relationship to the study area.

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC issues its Study Determination by December 31, 2011 and the study is not disputed by a mandatory conditioning agency:

- Identify and Map Habitat, and Select Survey Sites (Steps 1-3) .... November 2011 – April 2012
- Conduct Surveys (Step 4).......... May 2012 – September 2012
- Prepare Report (Step 5).......... September 2012 – January 2013
- QA/QC (Step 6).......... November 2012 – January 2013
- Report Issuance .... January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

This study is generally consistent with the goals, objectives, and methods outlined for recent FERC hydroelectric relicensing efforts in California, and uses well-established data from CDFG and other reputable sources for the analysis.

8.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

Alvarez, J.A. 2006. Use of artificial basking substrate to detect and monitor western pond turtles (*Emys marmorata*). Western North American Naturalist 66:129-131.

Ashton, D.T., A.J. Lind, and K.E. Schlick. 1997. Western Pond Turtle (*Clemmys marmorata*). Natural History. USDA Forest Service, Pacific Southwest Research Station, Arcata, California.

Ashton pers. comm. USFS.

California Academy of Sciences. 2010. Herpetology Records. Available online at: <http://www. calacademy.org/research/herpetology/catalog/Index.asp>. Accessed January 25, 2010.

ECORP Consulting, Inc. 2005. Draft results of the 2004 (Year 1) amphibian monitoring program for foothill yellow-legged frog and mountain yellow-legged frog. El Dorado Hydroelectric Project (FERC Project No. 184). Report to El Dorado Irrigation District, May 18, 2005.

Holland, D.C. 1991. A synopsis of the ecology and status of the western pond turtle (*Clemmys marmorata*) in 1991. Prepared for USFWS, National Ecology Research Center, San Simeon Field Station. 141 pp. + appendices.

Jennings, M.R., and M.P. Hayes. 1994. Amphibian and reptile species of special concern in California. Final Report to the California Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California. 225 pp.

Laabs, D.M., S.G. Orloff, and M.L. Allaback. 2002. Chapter 5. Pond and Stream-breeding Amphibians. In: Vollmar, J.A., editor. Wildlife and Rare Plan Ecology of Eastern Merced County's Vernal Pool Grasslands. Vollmar Consulting, Berkley, California.

Lind, A. 2005. Reintroduction of a declining amphibian: determining an ecologically feasible approach for the foothill yellow-legged frog (*Rana boylii*) through analysis of decline factors, genetic structure, and habitat associations. Ph.D. Dissertation, University of California, Davis. 169 pp.

Moyle, P.B. 1973. Effect of introduced bullfrogs, *Rana catesbeiana*, on the native frogs of the San Joaquin Valley, California. Copeia 1973:18-22.

Museum of Vertebrate Zoology. 2010. Herpetological records for Yuba, Sierra, and Nevada, Yuba, and Sierra counties, California. University of California, Berkeley. Available online at: <http://mvzarctos.berkeley.edu/SpecimenSearch.cfm>. Accessed January 25, 2010.

Pacific Gas and Electric Company (PG&E). 2001. Survey protocols, standard operating procedures, and data sheets for amphibian surveys and habitat assessments. May 2001. Unpublished.

PG&E and Nevada Irrigation District (NID). 2008. Study 2.3.9, Special-Status Aquatic Reptiles-Western Pond Turtle. Prepared for the Relicensings of NID's Yuba-Bear Hydroelectric Project (FERC Project No. 2266) and PG&E's Drum-Spaulding Project (FERC Project No. 2310).

_____. 2009. Study 2.3.6. Foothill Yellow-Legged Frog Surveys Study. Revised Study Plan, Drum Spaulding Project and Yuba Bear Hydroelectric Project.

Rathbun, G., N. Siepel, and D. Holland. 1992. Nesting behavior and movements of western pond turtles, *Clemmys marmorata*. The Southwestern Naturalist 37:319-324.

Rathbun, G. B., N. J. Scott, and T. G. Murphey. 2002. Terrestrial habitat use by Pacific pond turtles in a Mediterranean climate. The Southwestern Naturalist 47:225-235.

Reese, D.A. Undated. Western pond turtle survey techniques. 12pp.

Reese D.A. and H.H. Welsh. 1997. Use of terrestrial habitat by western pond turtles, *Clemmys marmorata*: implications for management. In: Proceedings: Conservation, Restoration, and Management of Tortoises and Turtles, pp. 352-357. New York Turtle and Tortoise Society.

Seltenrich, C. and A. Pool. 2002. A Standardized Approach for Habitat Assessments and Visual Encounter Surveys for the Foothill Yellow-Legged Frog (*Rana boylii*). Pacific Gas and Electric Company. Available online at: <http://www.canvamphibs.com/pdf/FYLFMethods052002.pdf>. Accessed July 29, 2010.

U.S. Department of Interior, Fish and Wildlife Service. 2005. Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog. Available online at: <www.fws.gov/sacramento/es/documents/crf_survey_guidance_aug2005.doc>. Accessed November 2007.

U.S. Geological Survey. 2006. USGS western pond turtle (*Emys marmorata*) visual survey protocol for the southcoast ecoregion - Draft. U. S. Geological Survey protocol. San Diego, CA. 56 pp.

Van Wagner, T. 1996. Selected life history and ecological aspects of a population of foothill yellow-legged frogs (*Rana boylii*) from Clear Creek, Nevada City, California. M.S. thesis, California State University Chico. 143 pp.

Vollmar, J.E. (Ed.). 2002. Wildlife and Rare Plant Ecology of Eastern Merced County's Vernal Pool Grasslands. Vollmar Consulting, Berkeley, CA.

ATTACHMENT 1

CALIFORNIA NATIVE SPECIES FIELD SURVEY FORM

STUDY PLAN TR-7

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

ESA-Listed Amphibians - California Red-Legged Frog Study Plan

July 2011

Related Study Requests: USFWS-3

1.0 Project Nexus

The Districts' ongoing operation and maintenance (O&M) of the Don Pedro Project (Project) have a potential to affect the California red-legged frog (CRLF; *Rana draytonii*), a federally threatened species listed under the federal Endangered Species Act (ESA), and potentially occurring in the Project area. These effects could involve activities related to Project operations that impact suitable habitat or to Project-related recreation activities.

2.0 Resource Agency Management Goals

The U.S. Department of Interior (USDOI), Fish and Wildlife Service (USFWS) administers the ESA related to federally listed threatened and endangered species. The ESA prohibits any person from "taking" a listed species. Consultation with USFWS is required to ensure than any federal action is not likely to jeopardize the continued existence of a listed species, or result in the destruction or adverse modification of critical habitat. The Districts are unaware of specific management goals for CRLF specifically relevant to the Project.

The California Department of Fish and Game (CDFG) administers the California Endangered Species Act (CESA). CRLF is currently listed as a species of special concern (CSC). The CESA requires state lead agencies preparing California Environmental Quality Act documents to consult with CDFG regarding potential impacts of projects on state-listed species. If jeopardy is determined for listed species, the state lead agency must consider adopting reasonable and prudent actions as provided by CDFG.

The USDOI, Bureau of Land Management (BLM) administers federal lands in the immediate Project area. BLM's resource management goals regarding special-status species, including special-status amphibians and aquatic reptiles, are to maintain, improve or enhance native populations and the ecosystems upon which they depend; ensure that all BLM management activities and authorizations are consistent with the conservation needs of special-status species; manage special-status species habitat to assist in the recovery of listed species; protect and manage significant and sensitive resources on BLM lands; to maintain and/or improve meadow and wetland habitat and riparian and aquatic habitat for all life stages of special-status species; and to sustain and manage viable populations of the CRLF in the BLM planning area.

3.0 Study Goals

The goal of this study is to provide current and useful information to the relicensing participants concerning CRLF and its relationship to the Don Pedro Project. The specific objectives of this study are as follows:

- Identify, compile, and map known occurrences of CRLF and the distribution of suitable habitats for CRLF.
- Evaluate the likelihood that CRLF currently exists in the Project Boundary using site assessments of habitat suitability and information from historical records.
- Compile incidental observation of CRLF observations from other aquatic studies.
- Through incidental observations, document the presence and provide estimates of number of exotic species (e.g., bullfrogs, non-native crayfish, bass, catfish, or mosquitofish) (USFWS 2002), which may limit the occurrence of CRLF in otherwise suitable habitats.
- Provide information on Project-affected tributary streams to the Don Pedro Reservoir for evaluation of potential Project-related effects on CRLF populations.
- Provide information that can be used to develop a draft Biological Assessment.

4.0 Existing Information and Need for Additional Information

Existing relevant information regarding known or potentially occurring locations of special-status amphibians and reptiles in the Project area is available from California Natural Diversity Database (CNDDB), museum records, and other sources. This information and a life history description of CRLF, included in Section 5.3 of the Districts' Pre-Application Document (PAD), are useful in identifying preferred habitats and documenting where the species have been found to date. Table 4.0-1 summarizes CRLF habitat requirements by life stage, and briefly summarizes historically known occurrences in the Project area.

The historical range of the CRLF includes the west slope foothills of the Sierra Nevada Range, although only about six populations are known to be extant in the Sierra Nevada region, most of which contain few adults (Shaffer et al. 2004; USFWS 2006).

The CRLF occupies a fairly distinct habitat, combining both specific aquatic and riparian components. Aquatic habitat consists of low-gradient freshwater bodies, including ponds, marshes, sag ponds, dune ponds, stock ponds, lagoons, seeps, springs, and backwaters within streams and creeks, where water remains long enough for breeding and development of young to occur (i.e., a minimum of 20 weeks) (Jennings and Hayes 1994; USFWS 2006). While CRLF can occur in either seasonal or perennial streams or ponds, populations generally cannot be sustained in streams in which surface water disappears before metamorphosis (July to September) during most years. The adults require dense, shrubby or emergent riparian vegetation closely associated with deep (2 to 4.5 feet) still or slow moving water, but frogs have been observed in shallow sections of streams and ponds that are devoid of vegetative cover.

Table 4.0-1 California red-legged frog habitat requirements by life stage and summary of records in the Project area.

Egg Masses	Larvae	Juveniles and Adults	Occurrence in Project Area[1]
In ponds or backwater pools of streams, usually attached to emergent vegetation (cattail and bulrush). Sometimes found at sites without emergent vegetation (e.g., some stock ponds). The presence of dense riparian vegetation (particularly willows) is also a positive indicator of suitable breeding habitat. Permanently or seasonally flooded water bodies may be used.	Same habitat as eggs; also in slow-moving, shallow riffle zones, and shallow margins of pools. Larvae spend most time in submergent vegetation or organic debris.	Frogs may stay at breeding sites or move to summer habitats. Emergent and/or riparian vegetation, undercut banks, semi-submerged root masses; open grasslands with seeps or springs with dense growths of woody riparian vegetation, willows; cattail, bulrush, and willow are good indicators for suitable habitat. Associated with deep (<0.7 - 1.5 m), still or slow-moving water. Juveniles prefer open, shallow aquatic habitats with dense submergent vegetation.	No known occurrences in Project area; nearest known recent occurrence is at Piney Creek, where adult CRLF were last observed in 1984 and the species is presumed to be extirpated at this location (USFWS 2002). Piney Creek is within the Merced River drainage and flows into the northwest arm of Lake McClure, 0.97 miles from Don Pedro Reservoir.

1 Records were reviewed from the following sources: CAS 2010; CDFG 2010; MVZ 2010; USFWS 2005.

~~The historical range of the CRLF includes the west slope foothills of the Sierra Nevada Range, although only about six populations are known to be extant in the Sierra Nevada region, most of which contain few adults (Shaffer et al. 2004; USFWS 2006).~~

~~The CRLF occupies a fairly distinct habitat, combining both specific aquatic and riparian components. Aquatic habitat consists of low-gradient freshwater bodies, including ponds, marshes, sag ponds, dune ponds, stock ponds, lagoons, seeps, springs, and backwaters within streams and creeks, where water remains long enough for breeding and development of young to occur (i.e., a minimum of 20 weeks) (Jennings and Hayes 1994; USFWS 2006). While CRLF can occur in either seasonal or perennial streams or ponds, populations generally cannot be sustained in streams in which surface water disappears before metamorphosis (July to September) during most years. The adults require dense, shrubby or emergent riparian vegetation closely associated with deep (2 to 4.5 feet) still or slow moving water, but frogs have been observed in shallow sections of streams and ponds that are devoid of vegetative cover.~~ Locations with the highest densities of CRLF are associated with deep-water pools with dense stands of overhanging willows (*Salix* spp.) and an intermixed fringe of cattails (*Typha* spp.). Well-vegetated terrestrial areas within the riparian corridor may provide important sheltering habitat during winter. Also, the species is known to utilize well-vegetated riparian zones for foraging habitat and facilitating dispersal. During summer, CRLF often disperse from breeding habitat to forage and seek aestivation habitat if water is not available (USFWS 2002).

Telemetry and other detection methods indicate that CRLF utilize small-mammal burrows, moist leaf litter, water troughs, incised streambed channels, and other moist sites as much as 200 feet from riparian areas (Jennings and Hayes 1994; USFWS 2002, 2006, 2008). CRLF has also been found up to 100 feet from water in adjacent dense riparian vegetation. The absence or near-absence of introduced predators such as American bullfrog (*Lithobates catesbeianus*) and predatory fish, particularly centrarchids (i.e., bass and sunfishes), is generally predictive of habitat quality (Hayes and Jennings 1988). However, bullfrogs and CRLF can coexist and persist under certain natural and managed regimes, and nonnative predatory fish can have a significant effect on juvenile CRLF survival in ponds where they co-occur. Freshwater wetlands, plunge pools in intermittent streams, seeps, and springs that are not suitable for breeding may provide habitat for aestivation, shelter, foraging, predator avoidance, and juvenile dispersal. During wet periods, long distance dispersal of up to a mile may occur between aquatic habitats, which may require traversing upland habitats or ephemeral drainages (USFWS 2006).

The Districts have not found any existing information that indicates CRLF presence within the Project Boundary or Project area; however, based on the species elevational range (below 5,000 feet), the Districts acknowledge that the absence of records for the Project area does not preclude the possibility that CRLF is present. However, the robust population of basses and sunfish in Don Pedro Reservoir may be indicative of unsuitable habitat for CRLF.

Information necessary to address the study goals include a site-specific assessment of habitat suitability for CRLF in relation to Project facilities and normal O&M activities that might affect CRLF.

5.0 Study Methods

5.1 Study Area

The study area for the CRLF habitat assessment consists of suitable aquatic habitats within the existing FERC Project Boundary and extends one mile from the Project Boundary.

5.2 General Concepts

The following general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study report.

5.3 Study Methods

The steps below outline the Districts' approach to performing the study:

Step 1 – Site Assessment. Known occurrences of CRLF within the study area will first be identified, based on agency consultation, museum records, and other existing information. Locations of habitats in the study area potentially suitable for CRLF breeding, and adjacent upland habitats, will then be identified and mapped based on review of existing aerial photography or Google Earth, National Wetland Inventory (NWI) maps, on-the-ground photographs, and other pertinent GIS layers as available. Habitat identification and mapping is expected to be at a scale of 1:6,000 (1"=500').

After habitat mapping is completed, field visits to potentially suitable aquatic habitat will be conducted in accordance with *Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog, August 2005* (Guidance; Attachment 1; USFWS 2005). The Districts will select locations in the study area for site evaluations in order to further characterize habitats. A Habitat Site Assessment Data Sheet (Appendix D of USFWS 2005) will be completed at each site that is examined, along with photographs depicting habitat and other notable findings. Areas that do not appear to represent suitable habitat will not be field examined but will instead be characterized from aerial imagery, existing site photographs, and other existing descriptive information. CRLF are typically associated with low gradient streams (Hayes and Jennings 1988), backwaters, and lentic habitat with emergent vegetation. Large, deep backwater pool areas; ponds, and reservoir edges with appropriate vegetation characteristics may constitute suitable habitat for CRLF; other potential habitats as described in USFWS (2005) will also be considered. Locations for site evaluations will be selected as follows:

- All potential breeding locations within the existing Project Boundary.
- Representative breeding locations which are publicly accessible (and private lands where permission to enter can be obtained) within 1 mile of the Project Boundary.

Aquatic and adjacent upland habitats will be mapped and characterized by habitat type (e.g., pond, creeks, or pool), apparent seasonality, dominant vegetation type (e.g., emergent or overhanging shrubs), water depth at the time of the site assessment, bank-full depth, stream gradient (i.e., percent slope), substrate, and description of bank. The presence of fish, non-native crayfish, American bullfrog, and other incidental observations of amphibians and reptiles will be noted. Upland habitats will be characterized based on description of upland vegetation communities, land uses, and any potential barriers to CRLF movement.

Step 2 – Prepare, Format, and Quality Assurance/Quality Control Data. Following field assessment, the Districts will develop GIS maps depicting known CRLF occurrences site assessment locations, potential habitat, Project facilities and features, and other information collected during the study. Field data will then be subject to quality assurance and quality control (QA/QC) procedures, including spot-checks of transcription and comparison of GIS maps with field notes.

Step 3 – Consult with the Districts' Project O&M Staff. Project operations staff will be consulted to identify typical O&M activities of potential CRLF habitat in the study area to identify the potential for Project activities to adversely affect CRLF.

Step 4 – Prepare Report. The Districts will prepare a report that includes the following sections: (1) Study Goals; (2) Methods; (3) Results; (4) Conclusions; and (5) Description of Variances from the FERC-approved study proposal, if any. Confidential information will not be included in the report, but provided to appropriate agencies.

This report will be submitted to USFWS, with submittals to BLM for any site assessments that take place on BLM lands. The report will include the following:

- Copies of data sheets
- Copies of field notes

- GPS data for all field reconnaissance sites
- List of known occurrences of CRLF locations within the study area
- Photographs of the reconnaissance sites including a map of photo locations
- GIS map of potential CRLF habitat
- Summaries of site habitat assessments
- Supporting data in Excel spreadsheet and GIS layers, as appropriate

Step 5 – Consult with USFWS. Districts will consult with USFWS to determine if additional data gathering is needed and to discuss the potential for Project activities to affect CRLF.

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC issues its Study Determination by December 31, 2011 and the study is not disputed by a mandatory conditioning agency:

- Site Assessment (Step 1) .... November 2011 – March 2012
- QA/QC (Step 2) .... March 2012 – April 2012
- Consult with Districts' Project O&M Staff (Step 3) .... May 2012 – June 2012
- Prepare Report (Step 4) .... June 2012 – September 2012
- Consult with USFWS (Step 5) .... September 2012 - January 2013
- Report Issuance .... January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

This study is consistent with the goals, objectives, and methods outlined for most recent FERC hydroelectric relicensing efforts in California where CRLF has a potential to be affected.

8.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

California Academy of Sciences (CAS) Collection Database. 2010. Online Data Request, July 26, 2010. California Academy of Sciences San Francisco, California. Queried Herpetology Collection Database. Available online at: <http://research.calacademy.org/redirect?url=http://researcharchive.calacademy.org/research/herpetology/catalog/index.asp>. Accessed July 26, 2010.

California Department of Fish and Game. 2010. California Natural Diversity Database: A Program that Inventories the Status and Locations of Rare Plants and Animals in California. State of California, Resources Agency, Department of Fish and Game, Sacramento, California. Available online at: <http://www.dfg.ca.gov/biogeodata/cnddb/>. Accessed July 15, 2010.

Hayes, M.P. and M.R. Jennings. 1988. Habitat correlates of distribution of the California red-legged frog. (*Rana aurora draytonii*) and the foothill yellow-legged frog (*Rana boylii*):

Implications for management. Pages 144-158 In: R.C. Szaro, K.E. Severson, and D.R. Patton (technical coordinators), Proceedings of the symposium on the management of amphibians, reptiles, and small mammals in North America. U.S. Department of Agriculture, Forest Service, General Technical Report (RM-166):1-458.

Jennings, M.R. and M.P. Hayes. 1994. Amphibians and Reptiles of Special Concern. California Department of Fish and Game, Inland Fisheries Division.

Museum of Vertebrate Zoology (MVZ). 2010. Herpetological records for Tuolumne River and Tuolumne County. University of California, Berkeley. Available online at: <mvzarctos.berkeley.edu/SpecimenSearch.cfm>. Accessed October 5, 2010.

Shaffer, H. Bradley, G.M. Fellers, S.R. Voss, J.C. Olive and G.B. Pauly. 2004. Species boundaries, phylogeography and conservation genetics of the red-legged frog (*Rana aurora*/*draytonii*) complex. Molecular Ecology 13(9): 2667-2677.

U.S. Department of Interior, Fish and Wildlife Service (USFWS). 2002. Recovery Plan for the California Red-legged Frog (*Rana aurora draytonii*). U.S. Fish and Wildlife Service, Portland, Oregon. viii + 173 pp.

——. 2005. Revised guidance on site assessments and field surveys for California red-legged frog. August 2005.

——. 2006. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the California Red-Legged Frog, and Special Rule Exemption Associated With Final Listing for Existing Routine Ranching Activities; Final Rule. Federal Register 71: 19244-19346.

——. 2008. Species Account. Sacramento Fish and Wildlife Office Species Account California red-legged frog (*Rana aurora draytonii*). Available at: http://www.fws.gov/sacramento/es/animal_spp_acct/ca_red-legged_frog.pdf.

ATTACHMENT 1

REVISED GUIDANCE ON SITE ASSESSMENTS AND FIELD SURVEYS FOR THE CALIFORNIA RED-LEGGED FROG, AUGUST 2005

ATTACHMENT 2

CALIFORNIA NATIVE SPECIES FIELD SURVEY FORM

STUDY PLAN TR-8

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

ESA-Listed Amphibians - California Tiger Salamander Study Plan

July 2011

Related Study Requests: USFWS-09

1.0 Project Nexus

The Districts' ongoing continued operation and maintenance (O&M) of the Don Pedro Project (Project) has the potential to affect the terrestrial and aquatic habitat of the California tiger salamander (CTS; *Ambystoma californiense*). CTS (Central Valley population) is listed as threatened under the federal Endangered Species Act (ESA) and as threatened under the California Endangered Species Act (CESA). Project O&M activities including ground disturbing-activities, vegetation management, and routine maintenance at Project facilities may disrupt CTS habitat.

2.0 Resource Agency Management Goals

The U.S. Fish and Wildlife Service (USFWS) has jurisdiction as CTS are protected under the ESA. Listed threatened and endangered species are protected from take, defined as direct or indirect harm, unless a Section 10 permit is granted to an entity other than a federal agency or a Biological Opinion with incidental take provisions is rendered to a federal lead agency via ESA Section 7 consultation. Pursuant to the requirements of ESA, an agency reviewing a proposed project within its jurisdiction must determine whether any federally listed species may be present in the study area and determine whether the proposed federal action will jeopardize the continued existence of the species. Under ESA, habitat loss is considered to be an adverse effect to a species. In addition, the action agency is required to determine whether its action is likely to jeopardize the continued existence of any species that is proposed for listing under ESA or to result in the destruction or adverse modification of critical habitat proposed to be designated for such species (16 USC 1536[3], [4]).

The California Department of Fish and Game (CDFG) administers the CESA. The CTS (Central Valley population) is listed as a state-threatened species. On August 2, 2010, the Office of Administrative Law approved the Fish and Game Commission determination that CTS should be listed as a state-threatened species; the regulations became effective on August 19, 2010 (CDFG 2011). CESA prohibits the take (interpreted to mean the direct killing) of listed species under CESA (14 CCR Subsection 670.2, 670.5). Under CESA, state agencies are required to consult with CDFG when preparing California Environmental Quality Act documents. Consultation ensures that proposed projects or actions do not have an adverse effect on state-listed species. During consultation, CDFG determines whether take would occur and identifies "reasonable and prudent alternatives" for the project and conservation of special-status species. CDFG can authorize take of a state-listed species if an incidental take permit is issued by the Secretary of the Interior or Commerce in compliance with the federal ESA, or if the director of CDFG issues a permit under Section 2080 in those cases where it is demonstrated that the impacts are minimized and mitigated. Pursuant to the requirements of CESA, a state or local agency reviewing a proposed project within its jurisdiction must determine whether any state-listed species may be present in the project area and determine whether the proposed project will have a potentially significant impact upon such species. If significant impacts to state listed species are identified, the state lead agency must adopt reasonable and prudent alternatives as specified by CDFG to prevent or mitigate for impacts.

Critical habitat under the ESA for CTS was originally designated on August 23, 2005. On December 14, 2005, a portion of this critical habitat was excluded in order to avoid negative impacts on the finalization and implementation of the Santa Rosa Plains Conservation Strategy. The USFWS is currently re-proposing 74,223 acres of the Santa Rosa Plains as critical habitat and must make its final ruling by July 1, 2011 (USFWS 2009). Recovery criteria or a recovery plan has not yet been drafted for the CTS (Central Valley population).

3.0 Study Goals

The specific objectives of this study are to:

- Identify and map known occurrences of CTS and determine, if appropriate, the closest known breeding locality;
- Evaluate the likelihood that CTS currently exist in the study area using habitat assessments and historical records;
- Compile incidental observations of CTS from other relicensing studies; and
- Provide information that can be used to develop a Biological Assessment and support a Biological Opinion.

4.0 Existing Information and Need for Additional Information

Habitat for CTS consists of open terrain with vacant burrows or other refugia, in proximity to vernal pools or other appropriate ponds for breeding. Adult CTS spend little time at breeding sites and are otherwise terrestrial preferring open, rolling terrain or foothills, particularly in areas with ground squirrel or pocket gopher burrows. Although vacant or mammal-occupied burrows are evidently favored, CTS will also reside in crevices, loose soil, or under surface objects (Brode 2003). Adult CTS have been documented dispersing as far as 1.2 miles, although most individuals are believed to remain within about 2,300 feet of breeding sites (USFWS 2004).

Larvae and eggs are usually found in shallow, turbid, vernal, or semi-permanent pools and ponds that fill during winter rains (Alvarez 2004a). Permanent ponds, stock ponds, and rarely intermittent streams or ditches may be used for breeding sites if fish are not present. CTS eggs are laid between December and February in small clusters or singly on submerged stems and leaves. Larvae usually transform in about four months (Behler and King 1979) as water recedes in late spring or summer, but may metamorphose in as little as 10 weeks (Jennings and Hayes 1994) or overwinter in permanent ponds (Alvarez 2004b).

Several occurrences of CTS are recorded in the California Natural Diversity Database (CNDDB) within the Project area quadrangles (La Grange 7.5-minute U.S. Geological Survey [USGS] quadrangle). These occurrences are recorded in the vicinity of La Grange, the Tuolumne River, and south of the Don Pedro Reservoir. The most recent record is from 2007 and is located along Big Creek, between McNulty Ridge and Bonds Flat Road, south of Don Pedro Reservoir. If suitable habitat for CTS occurs within the Project Boundary, CTS has the potential to occur.

Existing information is not adequate to meet the goal of the study. Information necessary to address the study goal includes a site-specific assessment of habitat suitability for CTS in relation to Project facilities and normal O&M activities that might affect CTS.

5.0 Study Methods

5.1 Study Area

The study area for the CTS habitat assessment consists of suitable aquatic and upland habitats within the existing FERC Project Boundary and extends 1.24 miles from the Project Boundary.

5.2 General Concepts

These general concepts apply to the study:

The following general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study report.

5.3 Study Methods

The Districts will perform the following five-step approach to completing the study plan:

<u>Step 1 – Site Assessments and Site Assessment Report.</u> The Districts will review available databases, including museum records, and consult with agencies to determine the nearest known occurrences of CTS to the study area. As required by the Interim Guidance on Site Assessment and Field Surveys for Determining *Presence* or a *Negative* Finding of the California Tiger Salamander (Guidance; USFWS 2003; Attachment 1), CTS occurrences within 3.1 miles of the Project Boundary and the closest CTS occurrence to the Project Boundary will be determined. Communications with the CDFG CNDDB and the Endangered Species Office of the USFWS will be documented.

Potential CTS breeding habitats within the Project Boundary and within 1.2 miles of the Project Boundary will be identified, characterized, and mapped based on review of existing aerial photography, National Wetland Inventory maps, and other pertinent resource agency GIS layers as available. Using available information, these aquatic habitat sites will be characterized by habitat type (e.g., natural seasonal pond, stock pond, or creek), surface area, depth, seasonality, topography, and types of associated aquatic or emergent vegetation. Habitat identification and mapping is expected to be at a scale of 1:6,000 (1"=500').

Field visits to verify habitat characterizations and collect additional information described below will be performed at sites selected as follows:

- All potential breeding locations within the Project Boundary.
- Representative potential breeding locations that are ~~publically accessible~~publicly accessible (and private lands for which access permission can be obtained) within 1.24 miles of the Project Boundary.

Information to be collected during field visits will include topography; soil type; plant communities; water body presence, location, types, and size; fossorial mammals detected; current land use, and a description of adjacent lands~~.~~, including uplands. Each site will be photographed to depict habitat and other notable findings. The presence of fish, American bullfrogs (*Lithobates catesbeianus*), and other incidental observations of amphibians will be noted. Upland habitats will be characterized based on description of upland vegetation communities, land uses, and any potential barriers to CTS movement.

Step 2 ~~–~~ – Prepare, Format, and Quality Assurance/Quality Control Data. The Districts will develop GIS maps depicting known CTS occurrences, potential habitat, Project facilities and features, and other information collected during the study. Field data will then be subject to quality assurance and quality control (QA/QC) procedures, including spot-checks of transcription and comparison of GIS maps with field notes on locations of any CTS occurrences.

Step 3 ~~–~~ – Consult with the Districts' Project Operations Staff. Operations staff will be consulted to identify typical Project O&M activities in areas of potential CTS habitat in the study area and to identify activities with the potential to adversely affect CTS.

Step 4 ~~–~~ – Prepare Report. The Districts will prepare a report that includes the following sections: (1) Study Goals and Objectives; (2) Methods; (3) Results; (4) Conclusions; and (5) Description of Variances from the FERC-approved study plan, if any. Confidential information will not be included in the report, but provided to appropriate agencies.

The report will be submitted to USFWS, with separate submittals to BLM for any site assessments that take place on BLM lands. The report will include the following:

- Copies of data sheets
- Copies of field notes
- GPS data for all field visit sites
- List of known occurrences of CTS locations within the study area
- Photographs of the field visit sites including a map of photo locations

- GIS map of potential CTS habitat and locations of field visit sites
- Summaries of site habitat assessments
- Supporting data in Excel spreadsheet and GIS layers, as appropriate

Step 5 — Consult with USFSW. The Districts will consult with USFWS to determine if additional data gathering is needed and to discuss the potential Project effects on CTS.

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC issues its Study Determination by December 31, 2011 and the study is not disputed by a mandatory conditioning agency:

- Site Assessment (Step 1) .... November 2011 – March 2012
- QA/QC (Step 2) .... March 2012 – April 2012
- Operations Staff Consultation (Step 3) .... May 2012 – June 2012
- Report Preparation (Step 4) .... June 2012 – September 2012
- USFWS Consultation (Step 5) .... September 2012 – January 2013
- Report Issuance .... January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

This study is consistent with the goals, objectives, and methods outlined for recent FERC hydroelectric relicensing efforts in California, and uses data from the USFWS, BLM, and other reliable sources for the analysis.

8.0 Deliverables

In addition to the reports described above, the study results will be displayed in GIS maps and files that show locations of field site visits, habitat potentially suitable for CTS, and known CTS locations. Incidental observations of amphibians, turtles, and reptiles will also be described.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

Alvarez, J.A. 2004(a). Use of artificial egg laying substrate to detect California tiger salamanders (*Ambystoma californiense*). Herpetological Review 35: 45 - 46.

——. 2004(b). Overwintering California tiger salamander (*Ambystoma californiense*) larvae. Herpetological Review 35: 344.

Brode, J.M. 2003. Survey protocol for California tiger salamander (*Ambystoma californiense*). CDFG Inland Fisheries Informational Leaflet (44): 1-7.

Behler, J.L., and F.W. King. 1979. The Audubon Society field guide to North American reptiles and amphibians. Alfred A. Knopf, New York. 719 pp.

California Department of Fish and Game (CDFG). 2011. State and Federally Listed Endangered and Threatened Animals of California. January 2011. Available online at: <http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/ TEAnimals.pdf. www.dfg.ca.gov/ biogeodata/cnddb/pdfs/TEAnimals.pdf>.

Jennings, M.R., and M.P. Hayes. 1994. Amphibian and reptile species of special concern in California. Final report to the California Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, CA, under Contract (8023).

U.S. Department of Interior, Fish and Wildlife Service (USFWS). 2003. Interim Guidance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander. October 2003.

——. 2004. Endangered and Threatened Wildlife and Plants; Proposed Designation of Critical Habitat for the Santa Barbara County Distinct Population Segment of the California Tiger Salamander. Proposed Rule. Federal Register 69(14): 3064-3094.

——. 2009. Sacramento Fish and Wildlife Office Species Account for California Tiger Salamander (*Ambystoma californiense*). Available online at: <http://www.fws.gov/sacramento/es/animal-spp-acct/california_tiger_salamander.rtf>.

ATTACHMENT 1

INTERIM GUIDANCE ON SITE ASSESSMENT AND FIELD SURVEYS FOR DETERMINING PRESENCE OR A NEGATIVE FINDING OF THE CALIFORNIA TIGER SALAMANDER

OCTOBER 2003

STUDY PLAN TR-9

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Special-Status Wildlife - Bats Study Plan

July 2011

Related Study Requests: None

1.0 Project Nexus

The ongoing operation and maintenance (O&M) of the Don Pedro Project (Project) may potentially affect special-status[1] bats. Specifically, Project features may provide suitable roosting, breeding or hibernating habitat for identified special-status bat species. Recreation facilities and activities may disturb potential habitat. Project O&M activities such as vegetation management (e.g., hazard tree removal) may disturb current habitats used by special-status bats. Project operations could affect riparian habitats that may be used by bats for roosting. This study focuses on the potential for Project O&M activities and recreation activities to affect special-status bat species.

Table 1.0-1 provides the target list of special-status bats for this study, including the following information for each species: special status, general habitat type, and recorded occurrence within the Project Boundary.

2.0 Resource Agency Management Goals

Agencies with management responsibilities related to bats include the U.S. Department of Interior (USDOI), Fish and Wildlife Service (USFWS), USDOI, Bureau of Land Management (BLM) on federal lands managed by BLM; and the California Department of Fish and Game (CDFG).

[1] Special-status wildlife are considered those wildlife species that are: found on BLM land and formally listed by BLM as a Sensitive Species (BLM-S); listed under the federal Endangered Species Act (ESA) as Proposed or a Candidate for listing as endangered or threatened or proposed for delisting; listed under the California Endangered Species Act (CESA) as Proposed or a Candidate for listing as endangered or threatened or proposed for delisting; formally listed by CDFG as a Species of Special Concern (SSC). Species listed as threatened or endangered under the ESA or CESA are addressed separately and not considered special-status for the purpose of the relicensing proceedings. There are no ESA- or CESA-listed bat species expected to occur within the Project Boundary or in the area surrounding the Project Boundary.

Table 1.0-1 Special-status bat species known to occur or likely to occur within the Project Boundary.

Species	Special Status[1]	Suitable Habitat Type	Occurrence in Project Boundary
Yuma myotis *Myotis yumanensis*	BLM-S	Roosts in buildings, mines, caves, and crevices; feeds over water (0 to 10,800 feet) but uncommon to rare above 8,400 feet.	Two CNDDB[2] occurrences: (1) bridge adjacent to Highway 49; and (2) bridge near intersection of Highway 120 and Jacksonville Road.
Long-eared myotis *Myotis evotis*	BLM-S	Roosts in buildings, crevices, and snags; feeds along habitat edges, in open habitats, and over water (0 to 8,800 feet at least).	Potentially occur within suitable habitat.
Fringed myotis *Myotis thysanodes*	BLM-S	Roosts in buildings, mines, caves, snags, and crevices; feeds in open habitats and over water (4,300 to 7,200 feet).	Potentially occur within suitable habitat.
Western small-footed myotis *Myotis ciliolabrum*	BLM-S	Roosts in caves, buildings, mines, crevices, and under bridges; feeds over streams, ponds, and springs (0 to 8,800 feet).	Potentially occur within suitable habitat.
Western red bat *Lasiurus blossevillii*	SSC	Generally associated with edge habitats adjacent to streams, open fields, orchards and occasionally in urban areas. Roosts in tree foliage, and forages in open areas over land or water (sea level up through mixed conifer forests).	CNDDB occurrence southeast of Moccasin, adjacent to Highway 49.
Spotted bat *Euderma maculatum*	BLM-S, SSC	Arid deserts, grasslands, and mixed conifer forests (0 to 9,800 feet).	CNDDB occurrence 2.2 miles southeast of Standard; intersection of Woodham-Carne Road and Yosemite Road.
Townsend's big-eared bat *Corynorhinus townsendii*	BLM-S, SSC	Roosts in buildings, mines, tunnels, and caves; feeds along habitat edges (0 to 10,365 feet).	CNDDB occurrence at mine on Quartz Mountain, 2.1 miles south of Jamestown.
Pallid bat *Antrozous pallidus*	BLM-S, SSC	Roosts in caves, crevices, and buildings; feeds in a variety of open habitats (8,000 feet).	Five CNDDB occurrences: (1) west of Sullivan Creek; (2) Jamestown Mine site near Sonora; (3) Tuolumne River 2.5 miles east southeast of Jacksonville; (4) near intersection of Highway 120 and Jacksonville Road; and (5) southeast of Moccasin, adjacent to Highway 49.
Western mastiff bat *Eumops perotis*	BLM-S, SSC	Open areas with abundant roost locations provided by crevices in rock outcrops and buildings at lower elevations, but as high as 8,700 feet.	Six CNDDB occurrences: (1) one mile southwest of Yosemite Junction, south of Highway 120; (2) ¼ mile northeast of Yosemite Junction, (3) ½ mile southeast of New Melones Lake; (4) mapped at Tuolumne (Town)[3]; (5) southeast of Moccasin adjacent to Highway 49; and (6) near intersection of Highway 120 and Jacksonville Road.

[1] Status: BLM-S: Bureau of Land Management Sensitive Species
SSC: California Department of Fish and Game Species of Special Concern

[2] CNDDB: California Natural Diversity Database.

[3] The CNDDB only provided "Tuolumne (Town)" as the location of this occurrence, and indicated that more information was needed.

The BLM's resource management goals regarding special-status species, including special-status bats, are to maintain, improve, or enhance native populations and the ecosystems upon which they depend; ensure that all BLM management activities and authorizations are consistent with the conservation needs of special-status species; manage special-status species habitat to assist in the recovery of listed species; protect and manage significant and sensitive resources on BLM lands; and to maintain and/or improve meadow and wetland habitat and riparian and aquatic habitat for all life stages of special-status species.

3.0 Study Goals

The goal of this study is to identify Project O&M and/or recreation activities that may adversely affect special-status bat species. The criteria to determine a Project effect includes both of the following:

- A special-status bat species is found to occur (more than incidentally) within the Project Boundary.
- A specific Project O&M or recreation activity has a reasonable possibility of having an adverse effect on the special-status bat species found.

4.0 Existing Information and Need for Additional Information

Existing and relevant information regarding known and potentially occurring special-status bats in the Project Boundary is available from the CDFG's California Wildlife Habitat Relationships (CWHR) program and the California Natural Diversity Data Base (CNDDB). Existing information is too general to meet the goal of the study. Additional information needed to address the study goal is to identify specific locations of any special-status bats in relation to Project facilities and normal Project O&M activities that might affect these special-status species.

5.0 Study Methods

5.1 Study Area

The study area consists of the area within the Project Boundary, including road bridges within the Project Boundary.

Specific sampling sites will be selected based on the results of a reconnaissance survey (see Section 5.3, Study Methods), taking into consideration habitat suitability, accessibility, and the overall objective of sampling a broad range of habitat types and localities within the Project Boundary. Specific target sites will be sampled once in late July or early August, which corresponds to the peak of bat activity; and then again in late September or early October which corresponds to fall migration. Sampling during these two periods increases the likelihood of detecting special-status bats that may be present in a given season.

5.2 General Concepts

The following general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study report.

5.3 Study Methods

The study approach will consist of the following four steps:

Step 1 – Initial Reconnaissance. In February 2012, the Districts will evaluate all recreation facilities, bridges, dams, powerhouses, and adits within the study area. At each location, the Districts will visually inspect the exterior and interior of buildings and the underside of associated supports of bridges for active bat roosts and signs of past use including guano and urine staining. Any observed bat activity will be documented with photographs. The location of the occurrences found during the initial reconnaissance will be recorded by GPS, stored in the Project GIS database, and displayed on Project maps. The Districts will use the information collected during the initial reconnaissance to prioritize locations that will be targeted for focused special-status bat surveys described in Step 2.

The following types of bat roosts will be considered during the assessment:

- **Maternity Roosts** - A maternity roost is a feature that provides protection from the elements and predators, and provides the correct thermal environment for reproduction. Maternity roosts tend to be warmer in temperature because breeding females need to maintain a high metabolism to aid in lactation. Juvenile bats need to keep warm to maintain a metabolic rate that allows for rapid growth. According to Tuttle and Taylor (1998), maternity roost thermal requirements are species-dependent but generally ~~remains~~remain between 70°F and 90°F; however, Townsend's big-eared bat nursery roosts have been discovered in sites where ambient temperatures are as low as 60°F. Species that form large colonies can be found raising young in mines with ambient temperatures as low as 56°F, but often prefer 66°F or higher.
- **Day Roosts** - A day roost is a feature where bats are able to spend the non-active period of the day resting or in torpor, depending on weather conditions. Day roosts provide shelter from the elements and safety from predators.
- **Night Roost** - A night roost is a feature used by bats to rest between foraging bouts, to allow digestion of prey, to escape from predators, as shelter from weather, and possibly for social purposes. Night roosts are typically sites or structures that retain heat to aid the bat in maintaining the higher metabolism necessary for digestion.
- **Winter Hibernacula** - Areas used by bats during colder winter months. During this time, bats enter torpor, receiving nourishment from their fat storage gained during summer months. Many species will awaken for brief periods of time to stretch, but will resume torpor. Bats, such as the Townsends big-eared bat, will hibernate for short periods of time and will often resume feeding behavior during warm winter spells (Tuttle and Taylor 1998). According to Tuttle and Taylor (1998), airflow and temperature are key determinants in use of structures, such as tunnels and adits, as hibernacula. Temperatures within these roost sites are generally below 53°F at the onset of hibernation, and remain between 34°F and 50°F by midwinter. Structures that have a varying temperature regime

allow bats to find suitable temperatures during warm or cold winters (Tuttle and Taylor 1998).

Step 2 – Focused Surveys. The Districts will conduct surveys at locations where evidence of bat activity is found and has a reasonable chance of being affected by Project O&M and/or recreation activities. Surveys will include acoustic and mist netting survey methods. Surveys will be conducted near dusk as bats begin to emerge from their roosts. The Districts will obtain the appropriate CDFG permits and approvals prior to beginning the surveys. Each survey location will be sampled twice during the study: once during the peak reproductive period (July-August); and once during the fall migration (late September or early October). Sampling methods are described below.

- **Acoustic Sampling** - Acoustic sampling will be conducted during peak bat activity using an Anabat SD1 bat detector system (Titley Electronics) to identify bat species. The Anabat system detects bat ultrasonic echolocation calls and converts them into sonograms. Analook computer software uses the sonograms to identify bat species (O'Farrell et al. 1999). Acoustic sampling will be performed in conjunction with mist net sampling.

- **Mist Net Sampling** - Mist net surveys will be conducted from sunset to approximately 1:00 AM. Captured bats will be identified to species level. Additional information including sex, age, reproductive status, forearm measurement, and weight will be recorded.

- **Long-Term Acoustic Monitoring (LTAM**) - At two sites, selected in consultation with the appropriate resource agencies, LTAM will be conducted. LTAM will involve the deployment of Anabat SD1 bat detectors for monitoring of bat activity and species identification over time. The Districts will deploy the LTAM equipment in select areas adjacent to Project facilities such as the dam or powerhouse. Deployment of the LTAM equipment will be from early March through October in order to capture spring migration; young rearing; peak bat activity; and fall migration.

  Inspection of the LTAM equipment and retrieval of acoustic data will occur on a monthly basis. However, in order to ensure that all equipment is functioning properly, the Districts will perform an initial inspection of the equipment and download all data recorded no more than two weeks after initial deployment. The second visit will occur four weeks after initial deployment and if no malfunctions have occurred, all remaining visits will be at four week intervals. If at any time a malfunction occurs, it will be immediately corrected by removal of the equipment currently in service and replacement with proper functioning equipment. For all equipment that requires replacement, the Districts will perform inspections and data downloads at week two and four after deployment, and if no malfunctions have occurred, all remaining visits will be at four week intervals.

  The Anabat SD1 bat detectors will be coupled with an external power source (e.g., 12-volt battery) for long-term deployment, and EME Systems Bat-Hats to aid in acoustic data collection. Additionally, a small solar panel will be used to maintain the charge of the battery to prevent frequent visits to the site for battery replacement. Acoustic data will be saved directly to a compact flash memory card. The LTAM equipment will be programmed to collect data from approximately one hour before sunset until sunrise. The unit will remain off during the daytime. If a unit is stolen or vandalized twice, the Districts will not reinstall the unit.

Step 3 – Quality Assurance/Quality Control Review. The Districts will perform a quality assurance/quality control (QA/QC) review of all data, including maps, recordings, identifications, and sightings ~~will be performed~~. To minimize variation in acoustic data between LTAM sites, each Anabat SD1 detector will be calibrated in accordance with Larson and Hayes (2000). A subset of the acoustic sampling data as well as the LTAM data will go through QA/QC review. After acoustic call files have been identified to species or species groups, 10 percent of the identified files will be randomly selected and subject to a QA/QC review to verify accurate identification. QA/QC of the acoustic data will be qualitative (visual check of call shape against calls from a similar species) and quantitative (comparison of maximum and minimum frequencies, characteristic frequencies, and call duration against known parameters for the identified species). The QA/QC procedure will be performed by a qualified biologist who did not participate in the analysis of acoustic call files. The initial reconnaissance data and mist net sampling data will also be reviewed to verify all data fields have been filled in on the data sheets. All map figures that will be used in study reports will go through a QA/QC review as well. This will include a review of mist netting and LTAM site locations in the Project Boundary. The data collected will be analyzed to assess the potential for specific Project activities to impact any special-status bats.

Step 4 – Prepare Report. The Districts will prepare a report that includes the following sections: (1) Study Goals; (2) Study Methods; (3) Results; (4) Discussion; and (5) Description of Variances from the study plan, if any. The Districts will make the report available to ~~relicensing participants~~Relicensing Participants when completed.

6.0 Schedule

The Districts anticipate the following schedule to complete the study as follows assuming FERC issues its Study Determination by December 31, 2011 and the study is not disputed by a mandatory conditioning agency:

- Planning (Step 1) .... January 2012 − July 2012
- Fieldwork (Step 2) .... March 2012 − October 2012
- QA/QC Review and Data Analyses (Step 3) .... November 2012 − December 2012
- Report Preparation (Step 4) .... January 2013
- Report Issuance .... January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

This study is consistent with the goals, objectives, and methods outlined for recent FERC hydroelectric relicensing efforts in California, and uses well-established methodologies developed in consultation with CDFG on similar projects.

8.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

Larson, J.L. and J.P. Hayes. 2000. Variability in sensitivity of Anabat II bat detectors and a method of calibration. Acta Chiropterologica 2(2): 209-213.

O' Farrell, M., B.W. Miller, and W.L. Gannon. 1999. Qualitative identification of free-flying bats using the Anabat detector. Journal of Mammalogy 80(1): 11-23.

Tuttle, M.D., and D.A.R. Taylor. 1998. Bat and Mines. Bat Conservation International. Resource Publication No. 3, 50pp.

STUDY PLAN W&AR-1

TURLOCK IRRIGATION DISTRICT
AND
MODESTO IRRIGATION DISTRICT

DON PEDRO PROJECT
FERC NO. 2299

Water Quality Assessment Study Plan

July 2011

Related Study Requests: Gardner-1

1.0 Project Nexus

The ongoing operation and maintenance (O&M) of the Don Pedro Project (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). This study investigates the potential Project effects to water quality.

For the purpose of this Study Plan, water quality parameters being analyzed are those listed in Table 1.0-1.

Table 1.0-1 Water quality parameters.

Parameter		Method	Target Reporting Limit µg/L (or other)	Hold Time
Basic Water Quality- Field				
Dissolved Oxygen	DO	SM 4500-O	0.1 mg/L	Field
Specific Conductance	-----	SM 2510 A	0.001 µmhos	Field
pH	-----	SM 4500-H	0.1 su	Field
Turbidity	-----	SM 2130 B	0.1 NTU	Field
Oxidation-reduction potential	-----	SM 2130 B	±20 mV	Field
Basic Water Quality - Laboratory				
Total Organic Carbon[1]	TOC	SM 5310	0.2 mg/L	28 d
Dissolved Organic Carbon	DOC	EPA 415.1 D	0.5/0.1	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	2000	14 d
Hardness (measured value)	-----	EPA 2340 B/SM 2340 C	1 mg/L as CaCO3	
Calcium	Ca	EPA 6010 B	30	180 d
Magnesium	Mg	EPA 6010 B	1	
Potassium	K	EPA 6010 B	500	180 d
Sodium	Na	EPA 6010 B	29	180 d
Chloride	Cl	EPA 300.0	20	28 d
Nutrients				
Nitrate-Nitrite	-----	EPA 300.0	2	28 d <pH 2
Total Ammonia as N	-----	EPA 4500-NH3/SM 4500-NH3	0.02	28 d <pH 2

Parameter		Method	Target Reporting Limit µg/L (or other)	Hold Time
Total Kjeldahl Nitrogen as N	TKN	SM 4500 N	100	28 d <pH 2
Total Phosphorous	TP	SM 4500-P	20	28 d <pH 2
Dissolved Orthophosphate	PO_4	EPA 365.1/EPA 300.0	0.01	48 h at 4°C
Metals (Total and Dissolved)				
Arsenic (total and dissolved)	As	EPA 200.8/1632	53/0.004	180 d
Cadmium (total and dissolved)	Cd	EPA 200.8/1638	3.4/0.003	180 d
Copper (total and dissolved)	Cu	EPA 200.8/1638	5.4/0.01	180 d
Iron (total and dissolved)	Fe	EPA 200.8/1638	6.2/2.2	180 d
Lead (total and dissolved)	Pb	EPA 1638	0.005	180 d
Mercury (total)	Hg	EPA 1631	0.0002	28 d
Methylmercury (total and dissolved)	CH3Hg	EPA 1630	0.00005/0.00002	90 d
Selenium (total)	Se	EPA 200.8/1638	75	180 d
Silver (total and dissolved)	Ag	EPA 200.8/1638	7/0.03	180 d
Zinc (total and dissolved)	Zn	EPA 200.8/1638	1.8/0.3	180 d
Herbicides and Pesticides				
Aldrin	----	EPA 8081A	0.05/0.01	7d
Alpha-BHC (=alpha-HCH)	----	EPA 8081A	0.05/0.01	7d
Beta-BHC (=beta-HCH)	----	EPA 8081A	0.05/0.008	7d
Chlordane	----	EPA 8081A	0.5/0.08	7d
Chlorpyrifos	----	EPA 8141A	0.005/0.0024 mg/L	7d
Delta-BHC (=delta-HCH)	----	EPA 8081A	0.05/0.017	7d
Dieldrin	----	EPA 8081A	0.05/0.01	7d
Diazinon	----	EPA 8141A	0.005/0.0029 mg/L	7d
Endosulfan I	----	EPA 8081A	0.05/0.005	7d
Endosulfan II	----	EPA 8081A	0.05/0.01	7d
Endrin	----	EPA 8081A	0.05/0.0118	7d
Gamma-BHC (=gamma-HCH)	----	EPA 8081A	0.05/0.02	7d
Heptachlor	----	EPA 8081A	0.05/0.007	7d
Heptachlor Epoxide	----	EPA 8081A	0.05/0.02	7d
Toxaphene	----	EPA 8081A	2/0.3	7d
Bacteria				
Total Coliform	----	SM 9221	1.1 MPN	24 h
Fecal Coliform	----	SM 9221	1.1 MPN	24 h
Escherichia coli	*E. coli*	SM 9221	1.1 MPN	24 h
Petroleum Hydrocarbons				
Total Petroleum Hydrocarbons (gasoline range)	TPH-g	EPA SW8015B	50	14 d
Oil & Grease	O&G	Visual Observation	----	----

[1] Total organic carbon data may be used in calculations required to assess conformance with water quality objectives.

In addition, this study addresses the following issues identified in Section 6.0 of the Pre-Application Document (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 temperatures downstream of Don Pedro Reservoir are the subject of an ongoing study required by FERC in its July 2009 order. The Districts' study plan for the conduct of this study was approved by FERC in May 2010 and the study ~~is scheduled for completion~~results were published in March, 2011. This study is entitled: Lower Tuolumne River Water Temperature Model Study ~~Plan.~~(Stillwater 2011).

2.0 Resource Agency Management Goals

The SWRCB is the primary agency with jurisdiction over the Project's water quality. SWRCB's management goals are set forth in the CVRWQCB's ~~*Water Quality Control Plan for the Sacramento River and San Joaquin River Basins*, fourth edition (~~Basin Plan~~)~~,, which was initially adopted in 1998 and most recently revised by the SWRCB in ~~2010~~2009.

The Don Pedro Project and the areas upstream and downstream of the Project fall within three Basin Plan Hydro Units: (1) Hydro Unit 536, which includes the Tuolumne River upstream of the Project; (2) Hydro Unit 536.32, which includes Don Pedro Reservoir; and (3) Hydro Unit 535, which includes the Tuolumne River from Don Pedro Dam to the San Joaquin River. Designated beneficial uses in these three Hydro Units are described in Table 2.0-1.

Table 2.0-1 Beneficial uses of the Tuolumne River in the vicinity of the Don Pedro Project.

Designated Beneficial Use Description from Basin Plan, Section II		Designated Beneficial Use by Hydro Unit (HU~~-~~) from Basin Plan, Table II-1			
		Use	Source to Don Pedro Reservoir HU 536	Don Pedro Reservoir HU 536.32	Don Pedro Dam to San Joaquin River HU 535
Municipal and Domestic Supply (MUN)	Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.	MUNICIPAL AND DOMESTIC SUPPLY	Existing	Potential	Potential
Agricultural Supply (AGR)	Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation (including leaching of salts), stock watering, or support of vegetation for range grazing.	IRRIGATION	Existing	-----	Existing
		STOCK WATERING	Existing	-----	Existing
Industrial Process Supply (PRO)	Uses of water for industrial activities that depend primarily on water quality.	PROCESS	-----	-----	-----
Industrial Service Supply (IND)	Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressuration.	SERVICE SUPPLY	-----	-----	-----
		POWER	Existing	Existing	-----

Designated Beneficial Use Description from Basin Plan, Section II		Designated Beneficial Use by Hydro Unit (HU) from Basin Plan, Table II-1			
		Use	Source to Don Pedro Reservoir HU 536	Don Pedro Reservoir HU 536.32	Don Pedro Dam to San Joaquin River HU 535
Water Contact Recreation (REC-1)	Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.	CONTACT	Existing	Existing	Existing
		CANOEING AND RAFTING[1]	Existing	-----	Existing
Non-Contact Water Recreation (REC-2)	Uses of water for recreational activities involving proximity to water, but where there is generally no body contact with water, nor any likelihood of ingestion of water. These uses include, but are not limited to, picnicking, sunbathing, hiking, beach-combing, camping, boating, tide-pool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.	OTHER NON-CONTACT	Existing	Existing	Existing
Warm Freshwater Habitat (WARM)	Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.	WARM[2]	Existing	Existing	Existing
Cold Freshwater Habitat (COLD)	Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.	COLD[2]	Existing	Existing	Existing
Migration of Aquatic Organisms (MGR)	Uses of water that supports habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.	WARM[3]	-----	-----	-----
		COLD[4]	-----	-----	Existing
Spawning (SPWN)	Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.	WARM[3]	-----	-----	Existing
		COLD[4]	-----	-----	Existing

Designated Beneficial Use Description from Basin Plan, Section II		Designated Beneficial Use by Hydro Unit (HU) from Basin Plan, Table II-1			
		Use	Source to Don Pedro Reservoir	Don Pedro Reservoir	Don Pedro Dam to San Joaquin River
			HU 536	HU 536.32	HU 535
Wildlife Habitat (WILD)	Uses of water that support terrestrial or wetland ecosystems including, but not limited to, preservation or enhancement of terrestrial habitats or wetlands, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, or invertebrates), or wildlife water and food sources.	WILDLIFE HABITAT	Existing	Existing	Existing

1 Shown for streams and rivers only with the implication that certain flows are required for this beneficial use.

2 Resident does not include anadromous. Any hydrologic unit with both WARM and COLD beneficial use designations is considered COLD water bodies by the SWRCB for the application of water quality objectives.

3 Striped bass, sturgeon, and shad.

4 Salmon and steelhead.

In addition, Section 303(d) of the CWA requires that every two years each state submit to the U.S. Environmental Protection Agency (EPA) a list of rivers, lakes, and reservoirs in the state for which pollution control or requirements have failed to meet water quality standards. Based on a review of the SWRCB's 2010 proposed list and its associated TMDL Priority Schedule, Don Pedro Reservoir has been identified as CWA §303(d) state impaired for mercury, and the lower Tuolumne River (Don Pedro Reservoir to San Joaquin River) as state impaired for diazinon, Group A Pesticides, and Unknown Toxicity (~~CRWQCB 2006~~SWRCB 2010). Group A Pesticides consist of aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor epoxide, hexachlorocyclohexanes (including lindane), endosulfan, and toxaphene.

Additionally, the CVRWQB has proposed that Sullivan Creek (Phoenix Reservoir to Don Pedro Reservoir) and Woods Creek (north side of Don Pedro Reservoir to San Joaquin River) be listed as state impaired for *Escherichia coli* (*E. coli*). Dry Creek (tributary to lower Tuolumne River at Modesto) has been proposed as state impaired for chlorpyrifos, diazinon, *E. coli*, and unknown toxicity (SWRCB 2010). However, these constituents have not yet been added to the 303(d) list, and therefore, there are no approved TMDL plans for them.

3.0 Study Goals

The goal of this study is to characterize existing water quality conditions in Don Pedro Reservoir and the lower Tuolumne River as measured at the discharge from the Project. The objective of the study is to determine whether or not Project operations cause a Basin Plan Objective to not be met.

4.0 Existing Information and Need for Additional Information

Existing relevant and reasonably available information for the general Project area is documented in Section 5.2.1 of the PAD. Historic information suggests that water quality in Don Pedro Reservoir meets Basin Plan Water Quality Objectives. ~~A data collection effort is needed to verify the water quality of the Project.~~

Water entering Don Pedro Reservoir from the Wild and Scenic Tuolumne River is well-oxygenated, cold water of high quality with few exceptions. As water flows through the reservoir, there are very few sources of potential water quality degradation, these being the minor tributaries (e.g., Woods, Sullivan, and Moccasin creeks) entering the reservoir and the recreation infrastructure at Don Pedro Reservoir (e.g., campsites and fuel stations). Subsequently, water leaving Don Pedro Reservoir remains of high quality and available data indicate that Basin Plan criteria are met.

Seasonal temperature stratification processes can play an important role in lake water quality conditions. Don Pedro Reservoir becomes thermally stratified in late spring and maintains a separation between the warmer waters of the top layer (i.e., epilimnion) and the cold water pool comprising the bottom layer (i.e., hypolimnion) until fall when turnover begins.

Since Don Pedro Dam was completed in 1971, dissolved oxygen levels in the reservoir's epilimnion have ranged between 7.6 and 8.4 milligrams per liter (mg/L) for August through November 1978 and 1979 (EPA 2010a). In the hypolimnion, dissolved oxygen levels recorded during discrete intermittent sampling ranged between 0.7 and 8.6 mg/L, and temperatures ranged between 2.3 to 14.0°C for the same time period (EPA 2010a).

Existing information provides a recent description of the general water quality of the Tuolumne River upstream and substantially downstream of the Project, while less is known about the water quality within and immediately downstream of the Project. Therefore, additional information regarding water quality in the Project will be gathered during the late summer when reservoir stratification is stable to obtain a data set that is representative of Project conditions and effects.

5.0 Study Methods

Water quality sampling will occur in the Tuolumne River upstream of Don Pedro, Woods Creek, Sullivan Creek, within Don Pedro Reservoir, and in the Tuolumne River immediately downstream of Don Pedro Dam. Bacteria samples will be collected from sites adjacent to recreation areas at Don Pedro Reservoir.

5.1 Study Area

The study area includes the Project Boundary and consists of upstream of Don Pedro Reservoir, within Don Pedro Reservoir, and the Tuolumne River immediately below Don Pedro Dam. Recreation-related facilities and O&M activities that discharge wastewater to the reservoir or the Tuolumne River will also be identified and sampled.

5.2 General Concepts

The following general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. The Districts and their consultants will perform the study in a safe manner.
- Field crews may make minor modifications in the field to adjust to and to accommodate actual field conditions and unforeseeable events. Any modifications made will be documented and reported in the draft study report.

5.3 Study Methods

Study methods are separated into two elements for this Study Plan: Water Chemistry Element and Recreation Activity Element.

5.3.1 Water Chemistry Element

The study approach for the water chemistry element will consist of the following seven steps:

Step 1 – Select Water Quality Sampling Locations. To better understand the dynamics of the water chemistry and physical structure of Don Pedro Reservoir, water quality information will be collected in Woods Creek and Sullivan Creek prior to entering Don Pedro Reservoir; the Tuolumne River upstream of Don Pedro Reservoir; within Don Pedro Reservoir; and in the Tuolumne River immediately below Don Pedro Dam.

Timing of Sampling Events. Water chemistry samples will be collected in the late summer period (late August/Early September).

Sample Locations and Depths. In-reservoir water quality samples will be co-located with reservoir temperature profiles at two sites: one site between Upper and Middle Bays and one near the main dam (Table 5.3-1). At each reservoir location, water chemistry samples will be collected for laboratory analysis at two depths: within one meter above the bottom in the hypolimnion and one meter below the surface in the epilimnion. Field water quality measurements will be made at these same depths with a Hydrolab DataSonde 5 (Hydrolab).[1]

Table 5.3-1 Reservoir and stream reach sample locations.

Reservoir/Stream Reach	Sample Depth	Location
Woods Creek	Just below surface	Just prior to entering Don Pedro Reservoir
Sullivan Creek	Just below surface	Just prior to entering Don Pedro Reservoir
Tuolumne River above Don Pedro Reservoir	Just below surface	Upstream of Wards 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 ~~the~~	Below Don Pedro powerhouse (co-

[1] Or other similar instrument that has the same precision and accuracy.

	surface	located with current TID/MID water quality sonde)

Analytical Parameters. All samples associated with the stream and reservoir sampling will be analyzed for the following parameters:

- Basic Water Chemistry - Field
- Basic Water Chemistry - Laboratory
- Inorganic Ions
- Metals
- Nutrients
- Herbicides and Pesticides

The methods associated with each parameter are listed in Table 1.0-1.

Step 2 – Collect Data and Samples. All data will be collected in accordance with standard quality assurance practices.

As water temperature (±0.1°C), dissolved oxygen (±0.2 mg/L), pH (±0.2 standard unit, or su), specific conductance (±0.001 µmhos/cm), and turbidity (±1 NTU) will be measured in the field using a Hydrolab DataSonde 5 or equivalent to meet the reporting limits in Table 1.0-1. Prior to and after each use, the instrument will be calibrated using manufacturer's recommended calibration methods. Any variances will be noted on the field data sheet and final report and recalibration or repair done as necessary. The Districts will note relevant conditions during each sampling event on the field data sheet (i.e., weather, air temperature, flow, description of location, floating material, and evidence of oil and grease). Sampling equipment will be thoroughly cleaned between sampling sites.

Surface samples will be collected using a grab sampling technique. Hypolimnetic samples will be collected using a Kemmerer bottle or equivalent~~ to meet the reporting limits in Table 1.0-1.~~. Each laboratory sample will be collected using laboratory-supplied clean containers~~.~~, certified to meet the reporting limits in Table 1.0-1. Water samples to be analyzed for metals will be taken using "clean hands-dirty hands" method[2] consistent with the EPA Method 1669 sampling protocol as described in *Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels* (EPA 1996). Samples requiring filtration before analysis will be filtered in accordance with standard protocols in the field.

All sample containers will be labeled with the date and time that the sample is collected, sampling site, or identification label; and handled in a manner consistent with appropriate chain-of-custody protocols. The sample container will be preserved (as appropriate), stored and delivered to a State of California certified water quality laboratory for analyses of the parameters listed in Table 1.0-1 in accordance with maximum holding periods for each parameter. A chain-of-custody record will be maintained with the samples at all times. Each sampling site location

[2] One member of a two-person sampling team is designated as "dirty hands"; the second member is designated as "clean hands." All operations involving contact with the sample bottle and transfer of the sample from the sample collection device to the sample bottle are handled by the individual designated as "clean hands." "Dirty hands" is all other activities that do not involve direct contact with the sample.

will be recorded using a GPS unit and the coordinates will be recorded in a field logbook. ~~Sampling~~Shared sampling equipment will be thoroughly cleaned between sampling sites.

As part of the field quality assurance program, a field blank will be collected every day or every 10 samples, which ever is most frequent; duplicates and equipment rinsates will be collected every 10 samples[3] and submitted to the laboratory for analysis. A field blank is a sample of analyte-free water poured into a container in the field, preserved, and shipped to the laboratory with the samples. A field blank assesses any contamination from field conditions during sampling. A rinsate is a sample of analyte-free water poured over or through decontaminated field sampling equipment prior to the collection of samples. It assesses the adequacy of the decontamination processes. Trip blanks will be collected for every cooler used for ~~samples of~~transporting volatile organics ~~and metals~~samples.

Step 3 – Laboratory Analysis of Water Samples. All laboratory analyses will be conducted using EPA Analytical Methods (EPA ~~2010~~2010b) or Standard Methods (APHA et al. 2010), or an equivalent method sufficiently sensitive to detect and report at levels necessary for evaluation against state and federal water quality standards. A California-certified laboratory will prepare and analyze water samples for the following surface water analytical parameters:

- Basic Water Chemistry - Laboratory
- Inorganic Ions
- Metals
- Nutrients
- Herbicides and Pesticides
- Bacteria
- Petroleum Hydrocarbons

The analytes and target reporting limits associated with each parameter are listed in Table 1.0-1.

Step 4 – Compile Data and Perform Quality Assurance/Quality Control. All data will be verified and/or validated as appropriate. In brief, following field and laboratory analyses, which includes the laboratories' own ~~QA/QC~~quality assurance/quality control (QA/QC) analysis, the Districts will subject all data to QA/QC procedures including, but not limited to: spot-checks of transcription; review of electronic data submissions for completeness; comparison of results to field blank and rinsate results; and, identification of any data that seem inconsistent. If such a datum is found, the Districts will consult with the laboratory to identify any potential sources of error before concluding that the datum is correct.

All verified chemical detections, including data whose results are "J" qualified,[4] will be used for this assessment. Should the laboratory need to re-extract samples and re-run the sample under different calibration conditions, the data identified by the laboratory as the most certain will be used. If field-sampling conditions, as measured by the field blank and the rinsate sample results, indicate that samples have been corrupted, the Districts will qualify the data accordingly.

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[3] Sometimes logistically only one sample is collected a day.

[4] 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.

Step 5 – Determine if Parameters are Consistent with Water Quality Objectives. Table 5.3-2 below shows the benchmark values that will be used to assist with the assessment of sample results and their consistency with the Basin Plan and other water quality objectives. The benchmark values in Table 5.3-2 were taken from the California Toxics Rule (CTR) (EPA 2000); the Basin Plan (CVRWQCB 1998); and bacterial water quality standards for recreational waters from EPA (2003).

Table 5.3-2 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	Marshack 2008	EPA AWQC; 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	----	----
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]

Basin Plan Water Quality Objective (Potentially Affected Beneficial Uses)	Symbol or Abbreviation	Benchmark Values	Reference	Notes
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	See Geology and Soil Resources
Tastes and Odors (MUN)				
Aluminum	Al	0.2 mg/L	CDPH ~~2005~~2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
Chloride	Cl	250 mg/L	CDPH ~~2005~~2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
Copper	Cu	1.3 mg/L	CDPH ~~2005~~2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
Iron	Fe	0.3 mg/L	CDPH ~~2005~~2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
Silver	Ag	0.1 mg/L	CDPH ~~2005~~2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
Specific Conductance	-----	900 umhos	CDPH ~~2005~~2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
Sulfate	SO_4	250 mg/L	CDPH ~~2005~~2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
Total Dissolved Solids	TDS	500 mg/L	CDPH ~~2005~~2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
Zinc	Zn	5 mg/L	CDPH ~~2005~~2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
Temperature (COLD, SPAWN)				
Temperature	-----	20oC (mean daily), T > 3-5oC (min)	Frost and Brown 1967; Elliott 1981	See Water Temperature Study
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
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 $CaCO_3$

Basin Plan Water Quality Objective (Potentially Affected Beneficial Uses)	Symbol or Abbreviation	Benchmark Values	Reference	Notes
		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 uµg/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”)
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	Ambient Water Quality Criteria
Chlordane	----	0.0043 µg/L	Marshack 2008	Ambient Water Quality Criteria
Chlorpyrifos	----	0.014 µg/L	Marshack 2008	Ambient Water Quality Criteria
Diazinon	----	0.05 µg/L[5]	Marshack 2008	Ambient Water Quality Criteria

Basin Plan Water Quality Objective (Potentially Affected Beneficial Uses)	Symbol or Abbreviation	Benchmark Values	Reference	Notes
Dieldrin	----	0.056 µg/L	Marshack 2008	Ambient Water Quality Criteria
Endosulfan	----	0.056 µg/L	Marshack 2008	Ambient Water Quality Criteria
Endrin	----	0.036 µg/L	Marshack 2008	Ambient Water Quality Criteria
Heptachlor	----	0.0038 µg/L	Marshack 2008	Ambient Water Quality Criteria
Heptachlor epoxide	----	0.0038 µg/L	Marshack 2008	Ambient Water Quality Criteria
alpha-Hexachlorocyclohexane	----	0.08 µg/L	Marshack 2008	Ambient Water Quality Criteria
beta-Hexachlorocyclohexane	----	0.08 µg/L[6]	Marshack 2008	Ambient Water Quality Criteria
delta-Hexachlorocyclohexane	----	0.08 µg/L[6]	Marshack 2008	Ambient Water Quality Criteria
gamma-Hexachlorocyclohexane	----	0.08 µg/L	Marshack 2008	Ambient Water Quality Criteria
Toxaphene	----	0.0002 µg/L	Marshack 2008	Ambient Water Quality Criteria
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.

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,[5] the CTR (EPA 2000) will be evaluated. Section 131.38 of 40 California Code of Regulations (CFR) 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 Concentrations (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 values are therefore used as the appropriate criteria to compare against environmental samples.

5 Ammonia, nitrate, and trace metals.

Because of differences in acute and chronic toxicity to aquatic organisms of many elements and compounds in Table 5.3-2 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 four of the metals addressed in this study plan (i.e., cadmium, copper, 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 su.

Step 6 – Consult with Project Operations Staff. If a water quality result suggests Basin Plan objectives are not being met, the Districts will consult with Project operations staff to identify Project O&M activities that typically occur in the area with the potential to adversely affect the parameter.

Step 7 – Prepare Report. As stated in Section 3.0, this sampling plan is intended to inform the Districts and relicensing participants on the potential for Project operations to cause a Basin Plan Objective not to be met. The Districts will prepare a report that includes the following sections: (1) Study Goals; (2) Methods; (3) Results; (4) Conclusions; and (5) Description of Variances from the study plan, if any. A complete water quality data set will be provided as appendices to the report including time and location of each sample collected, sample specific performance ~~(MRL),~~information, as well as electronic copies of laboratory results. The Districts will make the report available to relicensing participants upon completion.

5.3.2 Recreation Activity Element

The study approach for the recreation activity element will consist of the following seven steps:

Step 1 – Select Sampling Locations for Recreation-related Surveys. The condition of existing recreation facilities and dispersed recreation areas may adversely affect water quality at some near-shore locations adjacent to unmanaged and low-managed recreation facilities.

Timing of Sampling Events. In accordance with bacteria sampling protocols, bacteria samples will be collected on five different days within a 30-day period, including either the Independence Day or Labor Day holiday weekend (CVRWQCB 1998). A single petroleum hydrocarbon sample will be collected at each location during the holiday weekend included in the bacteria sampling.

Sample Locations and Depths. Recreation sample locations are listed in Table 5.3-3. At each near-shore sample location, surface water will be collected from the near surface (bacteria) and/or the surface (petroleum hydrocarbons). Samples will be collected either from shore or from a non-motorized boat.

Table 5.3-3 Recreation sample locations on Don Pedro Reservoir.

Recreation Area	Bacteria 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

Analytical Parameters. Water samples associated with the recreation-related sampling will be analyzed for the recreation suite of surface water analytical parameters:

- Bacteria
- Petroleum Hydrocarbons

Visual observations of oil and grease will be recorded in the field notebook.

Steps 2 through 7. As the remaining Steps 2 through 7 will follow the same steps as described in Section 5.3.1 above.

6.0 Schedule

The Districts anticipate the schedule to complete the study as follows assuming FERC's Study Plan Determination is deemed final on December 31, 2011 and the study is not disputed by a mandatory conditioning agency.

- Planning and Laboratory Contracting .... June – July 2012
- Field Work .... August – September 2012
- Laboratory Data Received .... October – November 2012
- Final Checking and QA/QC Review .... November – December 2012
- Produce Final Report .... January 2013
- Report Issuance .... January 2013

7.0 Consistency of Methodology with Generally Accepted Scientific Practices

The methods presented in this study plan also are consistent with those used in recent relicensings in California.

8.0 Deliverables

The Districts plan to prepare an Excel table that will include for each parameter measured the result of all seasons collected, along with sample-specific uncertainty, and sorted by sampling location. The table will be provided on a compact disc (CD) and appended to reports. Data that are greater than the benchmarks provided in Table 5.3-3 will be highlighted.

9.0 Level of Effort and Cost

Study Plan implementation cost will be provided in the Revised Study Plan.

10.0 References

American Public Health Association, American Water Works Association, and Water Environment Federation. 2010. Standard Methods for the Examination of Water and Wastewater. 21st edition. Washington, D.C. Available at: http://www.standard methods.org/.

California Department of Public Health (CDPH). 2010. California Code of Regulations, Title 22, Division 4, Chapter 15, Domestic Water Quality and Monitoring Regulations. Available online at: <http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Lawbook. aspx>.

Central Valley Regional Water Quality Control Board (CVRWQCB). 1998. The Water Quality Control Plan (Basin Plan) for the Sacramento River Basin and the San Joaquin River Basin. 4th ed. California Regional Water Quality Control Board, Central Valley Region. Revised in September 2009 with the Approved Amendments. Available online at: <http://www. waterboards.ca.gov/centralvalley/water_issues/basin_plans/>.

Elliott, J.M. 1981. Some Aspects of Thermal Stress on Freshwater Teleosts, pages 209-245. In A.D. Pickering, editor, Stress and Fish. Academic Press, London.

Frost W.E. and M.E. Brown. 1967. The Trout. New Naturalist Series. Collins, St., James Place, London.

Marshack, J. 2008. A Compilation of Water Quality Goals. California Regional Water Quality Control Board, Central Valley Region, Rancho Cordova, California. Available online at: <http://www.swrcb.ca.gov/centralvalley/water_issues/water_quality_standards_limits/ water_quality_goals/index.html>.

State Water Resources Control Board (SWRCB). 2010. 2010 Integrated Report Clean Water Act Sections 303(d) and 305(b). Approved August 4, 2010. Board Resolution No. 2010-0040. Sacramento, California. Available online at: <http://www.waterboards.ca.gov/ water_issues/programs/tmdl/integrated2010.shtml>

Stillwater Sciences. 2011. Tuolumne River water temperature modeling study. Final Report. Prepared by Stillwater Sciences, Berkeley, California for Turlock Irrigation District and Modesto Irrigation District. March. Available online at: <http://tuolumnerivertac.com>.

U.S. Environmental Protection Agency (EPA). 1996. Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. EPA 821-R-95-034. U.S. Environmental Protection Agency, Washington, DC. July 1996. Available online at: <http://www.ecy.wa.gov/programs/ wq/wastewater/method_1669.pdf>.

——. 2000. Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California. 40 CFR 131, pages 31682-31711. Federal Register May 18. Available online at: <http://www.epa.gov/fedrgstr/EPA-WATER/2000/

May/Day-18/w11106.pdf>.

——. 2003. Bacterial Water Quality Standards for Recreational Waters (Freshwater and Marine Waters). Office of Water Report No. EPA-823-R-03-008. June. Available online at: <http://www.epa.gov/waterscience/beaches/local/sum2.html>.

——. 2010a. STORET database. Available online at: <http://www.epa.gov/storet>.

——. 2010b. Clean Water Act Analytical Methods. Available online at: <http://water.epa.gov/scitech/ swguidance/methods/index.cfm>.