SOUTH SWP HYDROPOWER
FERC PROJECT NO. 2426

FINAL
REVISED STUDY PLAN

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State of California
California Natural Resources Agency
DEPARTMENT OF WATER RESOURCES
Hydropower License Planning and Compliance Office

Los Angeles
DEPARTMENT OF
WATER AND POWER

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COMMONLY USED TERMS, ACRONYMS & ABBREVIATIONS

§	Section
^{o}C	degrees Celsius
µmhos	micro-mhos
µmhos/cm	micro-mhos per centimeter
ABAAS	Architectural Barriers Act Accessibility Standards
ACHP	Advisory Council on Historic Preservation
ADA	Americans with Disabilities Act
aquatic	Living in or near water; plants adapted for a partially or completely submerged life
AIS	aquatic invasive species
ANF	Angeles National Forest
APE	Area of Potential Effect
AW	American Whitewater
bankfull	The water level, or stage, at which a stream, river or lake is at the top of its banks and any further rise would result in water moving into the flood plain.
BCC	Bird of Conservation Concern
bedrock	The solid rock that lies beneath soil and other loose surface materials.
BLAST	Basic Local Alignment Search Tool
BLM	United States Department of the Interior, Bureau of Land Management
BMI	Benthic Macroinvertebrates
C	California candidate species
$CaCO_3$	Calcium carbonate
CalTrout	California Trout, Inc.
CalVeg	USFS Classification and Assessment with Landsat of Visible Ecological Groupings
CDFA	California Department of Food and Agriculture
CDFW	California Department of Fish and Wildlife
CE	California endangered
CESA	California Endangered Species Act
C.F.R.	Code of Federal Regulations

cfs	cubic feet per second
chaparral	A shrubland adapted to summer-dry Mediterranean climate by having shrubs with evergreen, leathery leaves, such as chamise, manzanita, or scrub oak species.
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
Commission	Federal Energy Regulatory Commission
CPUE	catch per unit effort
CRLF	California red-legged frog
CSCI	California Stream Condition Index
CT	California threatened
CWA	Federal Water Pollution Control Act, known as Clean Water Act
CWD	Casitas Water District
CWHR	California Wildlife Habitat Relationships
deposit	Any accumulation of sediment
DLA	Draft Application for a New License
DNA	deoxyribonucleic acid
DO	dissolved oxygen
DOC	dissolved organic carbon
DPS	distinct population segment
drainage	Any channel that carries water
DWR	California Department of Water Resources
eDNA	environmental DNA [deoxyribonucleic acid]
EPA	United States Environmental Protection Agency
epilimnion	The upper layer of water in a stratified lake
ESA	Federal Endangered Species Act
FC	federal candidate
FE	federal endangered
FERC	Federal Energy Regulatory Commission
FLA	Final Application for a New License
flooded	A condition in which the soil surface is temporarily covered with flowing water from any source, such as streams overflowing their banks, runoff from adjacent or surrounding slopes, inflow from high tides, or any combination of sources.

fluvial	Term used to describe river or stream-related features or processes. Fluvial deposits are sediments deposited by the flowing water of a stream.
forest	An area (or vegetation type) in which trees dominate in the overstory where their crowns generally overlap (with greater than 60 percent canopy cover).
Forest Service	United States Department of Agriculture, Forest Service
FP	CDFW fully protected
FPA	Federal Power Act
FR	Federal Register
FSORAG	Forest Service Outdoor Recreation Accessibility Guidelines
FSS	Forest Service Sensitive
FSTAG	Forest Service Trail Accessibility Guidelines
FT	federal threatened
FYLF	foothill yellow-legged frog
GDE	groundwater-dependent ecosystems
GIS	Geographic Information System
GPS	global positioning system
Historic property	Prehistoric or historic archaeological sites, buildings, structures, objects, districts, or locations of traditional religious and cultural importance that are included in, or eligible for inclusion in, the NRHP
HPMP	Historic Properties Management Plan
hypolimnion	The lower layer of water in a stratified lake.
IHA	Indicators of Hydrologic Alteration
ILP	Integrated Licensing Process
Indian Tribe	Used in the NHPA and by FERC to mean an Indian community or group that is recognized by the federal government.
intermittent stream	A stream that has flowing water during certain times of the year, when groundwater provides water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from precipitation is a supplemental source of water for stream flow.
ISR	Initial Study Report
ITA	Indian Trust Assets
KOP	Key Observation Point

LADWP	Los Angeles Department of Water and Power
lake	Permanent natural water bodies or reservoirs greater than 2 surface hectares (5 surface acres)
Licensees	DWR and LADWP
LMP	Southern California Forest Land and Resource Management Plans
LPNF	Los Padres National Forest
LWD	large woody debris
marsh	An ecosystem of more or less continuously waterlogged soil dominated by immersed herbaceous plants, but without a surface accumulation of peat.
MBTA	Migratory Bird Treaty Act
mg/L	milligram per liter
MOU	memorandum of understanding
MWD	Metropolitan Water District of Southern California
Native Americans	Indigenous people who lived in the area prior to the arrival of Europeans. Encompasses all indigenous communities potentially interested in or affected by the relicensing, regardless of federal recognition.
NEPA	National Environmental Policy Act
NFS	National Forest Service
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NMWSE	normal maximum water surface elevation
NNIP	non-native invasive plants
No.	Number
NPDES	National Pollutant Discharge Elimination System
NPS	United States Department of the Interior, National Park Service
NRHP	National Register of Historic Places
NTU	Nephelometric Turbidity Unit
NVUM	National Visitor Use Monitoring
NWI	National Wetlands Inventory
O&M	Operation and Maintenance
OEHHA	California Office of Environmental Health Hazard Assessment

OHP	Office of Historic Preservation
PAD	Pre-Application Document
PFC	proper functioning condition
pH	Numeric scale of 0 to 14 that is used to specify the acidity and alkalinity of an aqueous solution
PHABSIM	Physical Habitat Simulation
plant community	All of the plant populations occurring in a shared habitat or environment.
PM&E	potential protection, mitigation, and enhancement
Privileged	For the purposes of the FERC's filing requirements, material deemed confidential by the Licensees will be filed with FERC as "Privileged." This information includes, but is not limited to, the location of sensitive cultural resources and the location of protected species, such as species listed as threatened or endangered under the federal Endangered Species Act. This includes business-sensitive and critical infrastructure information. Each page containing Privileged information will be so marked. The Licensees will not provide Privileged material to the public. Upon request, the Licensees will provide Privileged material to those agencies and Native American tribes with jurisdiction over the resources related to the Privileged material.
Project	South SWP Hydropower
Project area	This is the area within the FERC Project boundary.
Project vicinity	This is the area within the FERC Project boundary and the area surrounding the Project on the order of a USGS 1:24,000 quadrangle.
PSP	Proposed Study Plan
Pyramid reach	18.4-mile long section of Piru Creek, which extends from the spillway or a low-level outlet from Pyramid Dam to the NMWSE of Lake Piru
QAPP	Quality Assurance Program Plan
QA/QC	Quality Assurance/Quality Control
QPCR	quantitative polymerase chain reaction
relicensing participants	FERC, federal and California State agencies, Native American tribes, local governments, non-governmental organizations, businesses, members of the public, and others interested in the Project relicensing
rootwad	A root systems of an upended tree

RSD	relative stock densities
RTK	Real Time Kinetic
RWB	reach wide benthos
RWQCB	Regional Water Quality Control Board
SAFIT	Southwestern Association of Freshwater Invertebrate Taxonomists
scrub	Vegetation characterized by shrubs; may be classified by habitat type or by characteristic species; shrubland.
SD1	Scoping Document 1
SE	California State endangered
Secchi depth	A measure of the clarity of water
SHPO	State Historic Preservation Officer
shrub	A layer of vegetation composed of woody plants less than 3.0 inches in diameter at breast height but greater than 3.2 feet in height, exclusive of woody vines.
shrub-dominated	Shrub canopy closure exceeds 10 percent. However, tree crown closure never exceeds more than 10 percent of the site.
SIO	Scenic Integrity Objective
SM	Standard Method
SSC	CDFW Species of Special Concern
ST	California State threatened
su	standard unit
relicensing stakeholders	FERC, federal and State agencies, Native American tribes, local governments, non-governmental organizations, businesses, members of the public, and others interested in the Project relicensing
State	State of California
submerged	rooted vascular plants which do not emerge above the water surface
substrate	The base or substance on which an attached species is growing.
surface water	Water present above the substrate or soil surface
SWAMP	Surface Water Ambient Monitoring Program
SWP	State Water Project
SWRCB	State Water Resources Control Board
TCP	traditional cultural properties

TDS	total dissolved solids
TES	Threatened, Endangered and Sensitive
thalweg	A line connecting the lowest points of successive cross-sections along the course of a valley or river.
TOC	total organic carbon
topography	The shape of the land surface.
tree	A woody plant greater than 3.0 inches in diameter at breast height, regardless of height (exclusive of woody vines).
TSS	total suspended solids
UC	University of California
understory	The vegetation layer between the overstory or canopy and the ground-story of a forest community, formed by shade tolerant trees of moderate height.
upland	Any area that does not qualify as a wetland because the associated hydrologic regime is not sufficiently wet to elicit development of vegetation, soils, and/or hydrologic characteristics associated with wetlands. Such areas occurring within floodplains are more appropriately termed non-wetlands.
USB	Universal Serial Bus
USDA	United States Department of Agriculture
USFS	United States Department of Agriculture, Forest Service
USFWS	United States Department of the Interior, Fish and Wildlife Service
USGS	United States Geological Survey
USR	Updated Study Request
UV	ultraviolet
UWCD	United Water Conservation District
VCWPD	Ventura County Watershed Protection District
vegetation	The total plant life or cover in an area; also used as a general term for plant life; the assemblage of plant species in a given area.
viewshed	The geographical area that is visible from a location.
weed	Any plant growing where it is not wanted.
WPT	western pond turtle

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1.0 INTRODUCTION

The California Department of Water Resources (DWR) and Los Angeles Department of Water and Power (LADWP) (Licensees) appreciate the efforts of the Federal Energy Regulatory Commission (FERC or Commission), federal and State of California (State) resource agencies, and other stakeholders in participating in the South SWP Hydropower (FERC Project Number [No.] 2426) Integrated Licensing Process (ILP) to date. Through development of the Pre-Application Document (PAD),[1] FERC's scoping process, the Proposed Study Plan (PSP) [2], and stakeholder comments and recommended study plans summarized below, the Licensees have developed this Revised Study Plan (RSP) which, when implemented, is intended to fully inform FERC and other agencies with regulatory responsibilities in fulfilling their obligations in this relicensing proceeding. The Licensees recognize that this RSP does not adopt all recommended studies, although the RSP does propose in many cases where an entire study is not adopted to incorporate certain elements of the recommended study. As required by Section 5.11(b)(4) of FERC's ILP regulations, the Licensees in this document provide detailed explanations as to why or why not each recommended study or study element is or is not proposed for inclusion in this RSP. The purpose of this Introduction is to provide a general framework and explanation of the Licensees' approach to the study recommendations. Through the PSP meeting on February 8, 2017 and the follow-up Focused Study Plan Meetings on March 1-3, and March 7-8, 2017 held with the agencies and other relicensing participants, the Licensees attempted to resolve the differences between their study proposals and the study requests filed by relicensing stakeholders.

1.1 PURPOSE OF REVISED STUDY PLAN

The purpose of relicensing studies is to supplement existing, relevant, and reasonably available information so that FERC, the Licensees, regulatory agencies, and the public have an adequate record to assess Project effects and to inform proposed requirements in the new license. FERC has stated:

> The purpose of an approved study plan is to bring, to the extent possible, pre-filing finality to the issue of what information gathering and studies will be required by the Commission to provide a sound evidentiary basis on which the Commission and other participants in the process can make recommendations and provide terms and conditions. The study plan is developed in conjunction with NEPA [National Environmental Policy Act] scoping, and the latter inevitably involves judgments about which potential alternatives are reasonable to consider, and which alternatives will be eliminated from detailed

[1] Pre-Application Document of California Department of Water Resources and Los Angeles Department of Water and Power to File an Application for a New License, Project No. 2426-227 (filed Aug. 1, 2016).
[2] Proposed Study Plan of California Department of Water Resources and Los Angeles Department of Water and Power, Project No. 2426-227 (filed Jan. 13, 2017).

> consideration. It therefore follows that the Commission-approved study plan will reflect those determinations.[3]

In addition, the RSP should be consistent with FERC policy and court precedent related to the Federal Power Act (FPA). Thus, the adequacy of the RSP may be determined by reference to the requirements FERC must meet under the FPA and NEPA. FERC's ILP regulations also stipulate that the RSP should include information and studies needed for consultation under Section 7 of the federal Endangered Species Act (ESA), consultation under Section 106 of the National Historic Preservation Act (NHPA), and for state water quality certification under Section 401 of the Federal Water Pollution Control Act, known as the Clean Water Act (CWA).[4]

1.1.1 FPA Requirements

FPA Section 313(b) requires FERC's findings of fact to be "supported by substantial evidence."[5] Substantial evidence has been defined to mean "such relevant evidence as a reasonable mind might find adequate to support a conclusion."[6] This standard "does not require perfect information."[7] To meet the standard, FERC must "examine the relevant data and articulate a satisfactory explanation for its action including a 'rational connection between the facts found and the choice made.'"[8]

In addition, FERC and reviewing courts have held that existing conditions are the proper baseline for environmental analysis in the context of relicensing.[9] Trying to establish what conditions were, or might have been, 50 years ago is unlikely to be accurate or defensible. Attempting to predict what conditions would be today if a project had not been built provides equally uncertain results. Current conditions are, therefore, the baseline under the FPA for comparison of relicensing alternatives.

1.1.2 NEPA Requirements

NEPA requires that federal agencies take a "hard look" at a project.[10] However, NEPA does not require a "crystal ball inquiry."[11] FERC's NEPA document "is required to furnish only such information as appears to be reasonably necessary under the circumstances for evaluation of the project rather than to be so all-encompassing in

[3] Hydroelectric Licensing Under the Federal Power Act, 68 C.F.R. 51,070, 51,078 (Aug. 25, 2003).
[4] 18 C.F.R. § 5.9(a).
[5] 16 United States Code § 825(b).
[6] *Allegheny Elect. Coop. v. FERC*, 922 F.2d 73, 80 (2d Cir. 1990).
[7] *Wis. Power & Light Co. v. FERC*, 363 F.3d 453, 464 (D.C. Cir. 2004).
[8] *Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co*., 463 U.S. 29, 43 (1983) (quoting *Burlington Truck Lines, Inc. v. United States*, 371 U.S. 156, 168 (1962)).
[9] *See, e.g., Pub. Util. Dist. No. 1 of Chelan Cty*., 107 FERC ¶ 61,280 at P 61 (2004) (citing *Am. Rivers v. FERC*, 187 F.3d 1007, *reh'g denied*, 201 F.3d 1186 (9th Cir. 1999)).
[10] *Kleppe v. Sierra Club*, 427 U.S. 390, 410 n.21 (1976).
[11] *Nat. Res. Def. Council v. Morton*, 458 F.2d 827, 837 (D.C. Cir. 1972).

scope that the task of preparing it would become either fruitless or well-nigh impossible."[12]

1.1.3 FERC's Study Criteria

Under FERC's regulations for the ILP, a study request must meet each of the seven required criteria. While some of the commenters on the PSP made an effort to address some or all of FERC's seven criteria, some commenters did not demonstrate how their requested modification to the Licensees' PSP study or requested new study were consistent with each criterion, or addressed one or more of the criteria in only a general way.

FERC's ILP regulations require that a study request must meet the following criteria:[13]

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 requestor is not a resource agency, explain any public interest considerations in regard 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 field season(s) and the 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.

The Licensees determined that a number of the commenters did not meet the seven study criteria under FERC's regulations. These requests fell into the following general categories: (1) request for study of pre-Project conditions (discussed above in Section

[12] *Nat. Res. Def. Council v. Callaway*, 524 F.2d 79, 88 (2d Cir. 1975) (citing *Indian Lookout Alliance v. Volpe*, 484 F.2d 11 (8th Cir. 1973)).
[13] 18 C.F.R. § 5.9(b).

1.1.1); (2) lack of Project nexus; and (3) the study is unlikely to inform license conditions.

1.1.4 Lack of Connection Between Project Operations and an Effect on a Resource

Under FERC's regulations, a study requestor must demonstrate a reasonable connection between project operations and effects on the resource in question.[14] 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. A study request cannot be used as an attempt to search for the existence of a "nexus." If the study request is an attempt to search for a project effect, it does not meet the criteria for a study request. In *City of Centralia v. FERC*, the United States Court of Appeals for the D.C. Circuit found that an applicant could be required "to conduct a study when *there is some evidence of a problem* and a study is necessary to determine the extent of the harm."[15] (Emphasis added) 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."[16]

The United States Department of Agriculture (USDA), Forest Service (USFS or Forest Service), California Department of Fish and Wildlife (CDFW), and State Water Resources Control Board (SWRCB) have requested studies on Project effects in Piru Creek upstream of Pyramid Lake and in Castaic Creek upstream of the Project check-dams. These entities have not provided any "evidence of a problem" related to the Project in these creek sections, but only speculated the existence of a problem. FERC has set the geographic scope of environmental analysis in Piru Creek up to, but not upstream of, Pyramid Lake, and in Castaic Creek from Elderberry Forebay to Castaic Lake because it determined that Project operations may cumulatively affect water quality through these geographic reaches.[17] Project operations have no direct, indirect, or cumulative effects on Piru Creek upstream of Pyramid Lake or in Castaic Creek upstream of the Project check-dam basins. The Licensees have not adopted any study requests or portions of study requests that pertain to these creek sections.

The USFS in its comments on the PSP asserts that it "needs these upstream studies in order to have "control and reference locations and to determine effects of ongoing project operations."[18] However, the USFS offers no specific analysis or evidence why studies of upper Piru Creek would help understand the Project's impacts on the Pyramid reach. Indeed, such information hardly seems needed since DWR has been operating Pyramid Dam essentially to mimic the natural flow regime for at least the past 10 years.

[14] *Id*. § 5.9(b)(5).
[15] *City of Centralia v. FERC*, 213 F.3d 742, 749 (D.C. Cir. 2000).
[16] *Id*. (citing *Bangor Hydro-Elec. Co. v. FERC*, 78 F.3d 659, 663 (D.C. Cir. 1996)).
[17] Scoping Document 1 for the South SWP Hydropower Project § 4.1.2, Project No. 2426-227 (issued Sept. 30, 2016).
[18] Letter to Kimberly D. Bose from Jeffrey Vail (filed April [insert date], 2017) (Vail Letter), at 1.

See infra Section 1.1.5. The basic information about resources in Pyramid reach and Project activities in the reach that could affect these resources is provided in the PAD and will be supplemented by the Licensees' ongoing monitoring in the reach, which is described in Section 1.1.5.1, and through the Licensees' RSP-proposed Study 4.1.3, *Pyramid Reach Fish Populations*; Study 4.1.4, *Special-Status Aquatic Amphibians and Semi-Aquatic Snakes*; Study 4.1.9, *ESA-Listed Amphibians – California Red-Legged Frog*; Study 4.1.11, *Recreation Facilities Demand Analysis and Condition Assessment*; Study 4.1.19, *Whitewater Boating*; and Study 4.1.21, *Pyramid Reach Benthic Macroinvertebrates*.

CDFW states that it is "necessary to sample upstream of Pyramid Lake in order to determine the inflow water quality. By comparing the upstream inflow water quality to the downstream outflow water quality, CDFW will be able to recommend Project license conditions that minimize impacts to downstream fish and wildlife resources."[19] Contrary to CDFW's study request, relicensing studies are to use a current environmental baseline. Attempting to use upper Piru Creek as a reference site for assessment of water quality impacts assumes a pre-Project baseline – and, since the vast majority of water entering Pyramid Lake is supplied by the State Water Project (SWP), it also assumes a pre-SWP baseline.

SWRCB states that "The main disagreements between the Licensees and relicensing participants have centered around one main issue, the incorporation of reference or control sites into Project studies." In general, SWRCB argues for reference/control sites because it says "Virtually, every FERC hydroelectric project in California has used reference or control sites in studies." SWRCB does not expand on this statement, or provide any examples of such projects. The Licensees are very familiar with most recent California relicensing's and understand that few studies included reference sites. Further of the 11 study request made by the SWRCB in its PSP comments, the SWRCB mentions reference or control sites in only three of the 11 requests: Water Quality Assessment, Benthic Macroinvertebrates [BMI], and Pyramid Reach Fish Populations. Each of these is discussed below.

- The SWRCB argues that a site in Pyramid Creek upstream of Pyramid Lake should be monitored for comparison to water quality samples in Piru Creek so that the SWRCB can comply with its anti-degradation policies. While the Licensees do not believe an upstream reference site is needed for water quality, in deference to the SWRCB's expressed need to comply with its anti-degradation policies, the Licensees have added to their Study 4.1.16, *Water Quality and Temperature Study*, a water quality reference site in Pyramid Creek immediately upstream of Pyramid Lake, and the site will be sampled at the same time water quality samples are collected in Piru Creek below Pyramid Dam.

- The SWRCB states that it intended to use other Surface Water Ambient Monitoring Program (SWAMP) sites as a reference for downstream BMI

[19] Letter to Kimberly D. Bose from Edmund Pert (filed April [insert date], 2017), at 4.

samples, but now feels this is not appropriate. The SWRCB provides no rationale for why it believes this, other than a general comment about spatial and temporal differences. The Licensees believe use of SWAMP is appropriate and note that, contrary to the SWRCB's general assertion that reference sites have virtually been used on every FERC hydroelectric project in California, the Licensees' review of recent BMI relicensing studies in California has uncovered very few, if any, in which BMI reference sites were included in the FERC-approved study.

- With regard to Pyramid Reach Fish Populations, the SWRCB's PSP comments provide no evidence to support the need for reference sites, other than the general comment at the beginning of its letter. The Licensees agree that in some cases other Licensees have included sampling fish populations outside the direct affected area, but note that in most cases, parties relied on such data inconsistently. Further, because Piru Creek upstream of Pyramid Lake often goes dry, fish population reference sites would have little value.

1.1.5 Study Request Constitutes Basic Research and/or is not Likely to Inform the Development of License Conditions

FERC's policy and regulations provide that a study requestor must specify how the results of the study will inform the development of license conditions.[20] 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 potential protection, mitigation, and enhancement (PM&E) measures, and not just contribute to general knowledge of a resource.

USFS, CDFW, and SWRCB have requested studies of the flow regime in Pyramid reach (i.e., the 18.4-mile-long section of Piru Creek between Pyramid Dam and the normal maximum water surface elevation [NMWSE] of Piru Lake).[21] These studies are not likely to inform the development of license conditions because of the Licensees' adherence to providing the natural flow regime below Pyramid Dam to avoid take of the federal endangered arroyo toad (*Bufo californicus*). A summary of the background regarding this issue is provided below. Refer to Appendix A of this RSP for a more detailed discussion.

In 2003, the United States Department of the Interior, Fish and Wildlife Service (USFWS) notified DWR that water releases from Pyramid Dam, including minimum flows in the summer months for fish habitat, were resulting in unauthorized incidental take of the federal endangered (FE) arroyo toad.[22] USFWS stated that: "Without

[20] 18 C.F.R. § 5.9(b)(5).
[21] Lake Piru is not part of the South SWP Project. *See Cal. Dep't of Water Res. & City of Los Angeles*, 129 FERC ¶ 62,073 at P 6 n.6 (2009).
[22] Letter to E. Begley, California Department of Water Resources, from B. Fahey, USFWS, Project No. 2426-000 (dated Aug. 20, 2003) (attached to Request for Temporary Waiver or Amendment of License Requirements filed on Feb. 10, 2005).

returning water releases from Pyramid Dam to a more natural flow regime, we believe that take of the endangered arroyo toad would continue to occur."[23] Accordingly, USFWS stipulated that DWR should return Pyramid reach to a year-round natural flow regime and deliver SWP water to United Water Conservation District (UWCD) at Lake Piru during the winter months when the higher flows would not interfere with arroyo toad reproduction.[24]

DWR then engaged in intensive consultations with USFWS, CDFW, USFS, and other interested parties to determine an operating schedule for Pyramid Dam that would avoid incidental take of arroyo toads and comply with the ESA. The new flow regime was based on the natural hydrology, with limited exceptions for emergency flood protection, periodic radial gate and other testing, and delivery of water to the UWCD. The timing of water deliveries to UWCD was changed to November through February, and in dry years there could be times in the summer with no surface water flow in Pyramid reach.[25] DWR completed an environmental review of the proposed flow regime under the California Environmental Quality Act (CEQA), which consisted of public scoping, studies and analysis, consultation with the resource agencies and interested parties, and preparation of a Draft Environmental Impact Report and a Final Environmental Impact Report (EIR).

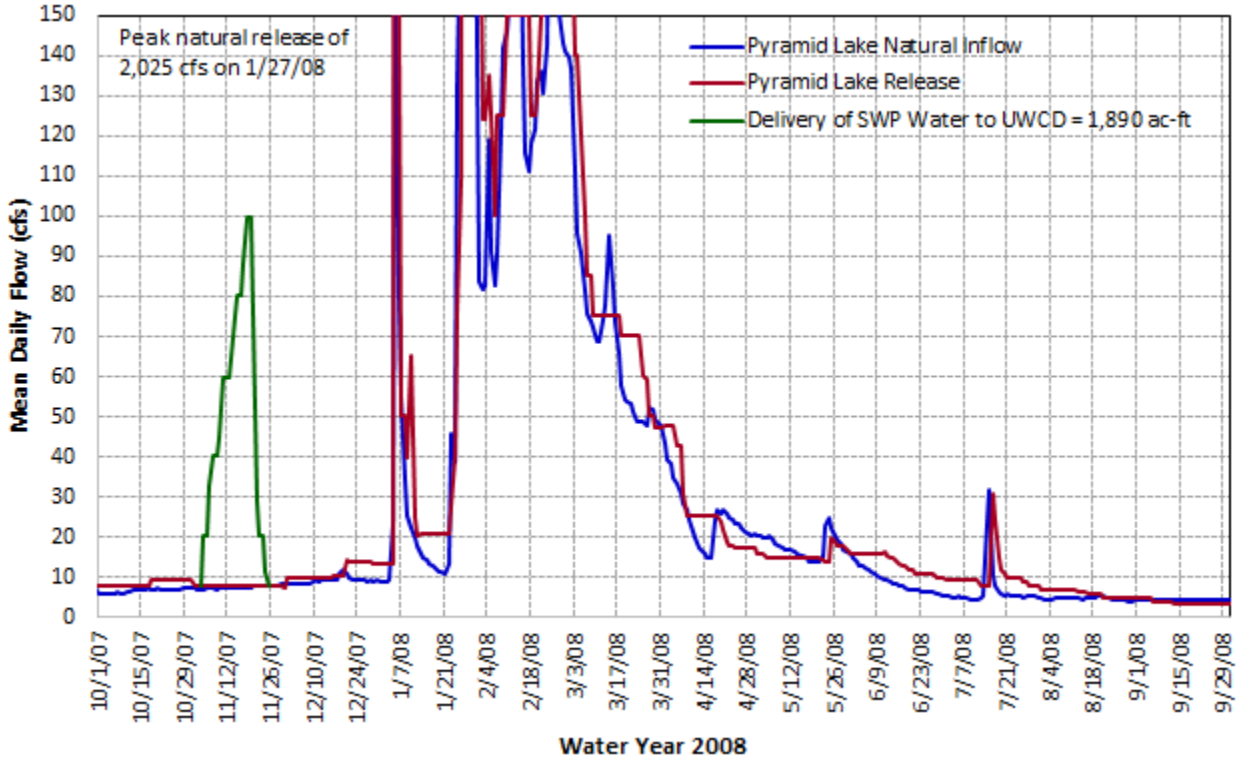
In February 2005, DWR filed a request for temporary waiver of the minimum streamflow requirements and other trout fishery requirements of license Articles 51 and 52.[26] Citing the need to avoid incidental take of arroyo toads, DWR requested that the minimum flow requirements be suspended in lieu of the modified flow regime approved by USFWS, pending FERC's grant of a permanent license amendment. FERC granted the temporary waiver on April 12, 2005, following a public notice and comment period in which no entity objected to the waiver.[27] FERC, in its order, acknowledged that the species most likely to be affected by the new flow regime would be rainbow trout (*Oncorhynchus mykiss*), and that the new summer conditions "may eliminate the majority of trout occurring in middle Piru Creek[28] between July and October."[29] Nonetheless, FERC stated: "If the waiver request were denied, the current flow release schedule *would cause additional losses of arroyo toad* and adversely affect its habitat."[30] (Emphasis added) Therefore, FERC concluded: "[T]he proposed modified natural flow regime would avoid incidental take of the federally listed arroyo toad and provide benefits by controlling non-native plant and animal species."[31]

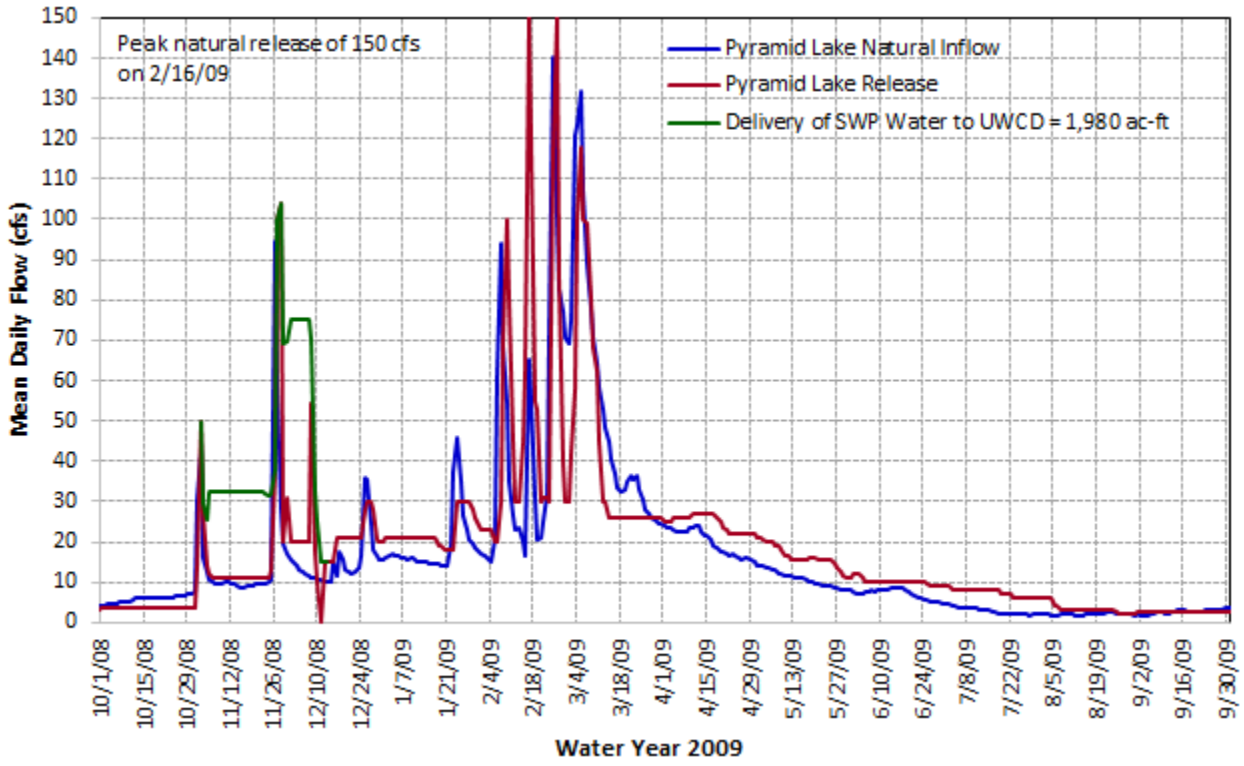
[23] *Id*. at 3.
[24] *Id*. at 2-3.
[25] Natural inflows at Pyramid Lake account for approximately 3 percent of total inflow, and in drier years, there is no inflow at all to Pyramid Lake. Pre-Application Document at 3-24.
[26] Request for Temporary Waiver or Amendment of License Requirements, Project No. 2426 (filed Feb. 10, 2005).
[27] *Cal. Dep't of Water Res. & City of Los Angeles*, 111 FERC ¶ 62,040 (2005).
[28] "middle Piru Creek" and "Pyramid reach" are different names for the same section of Piru Creek.
[29] *Id*. at p. 64,068.
[30] *Id*. at p. 64,068-69.
[31] *Id*. at p. 64,069 (emphasis added).

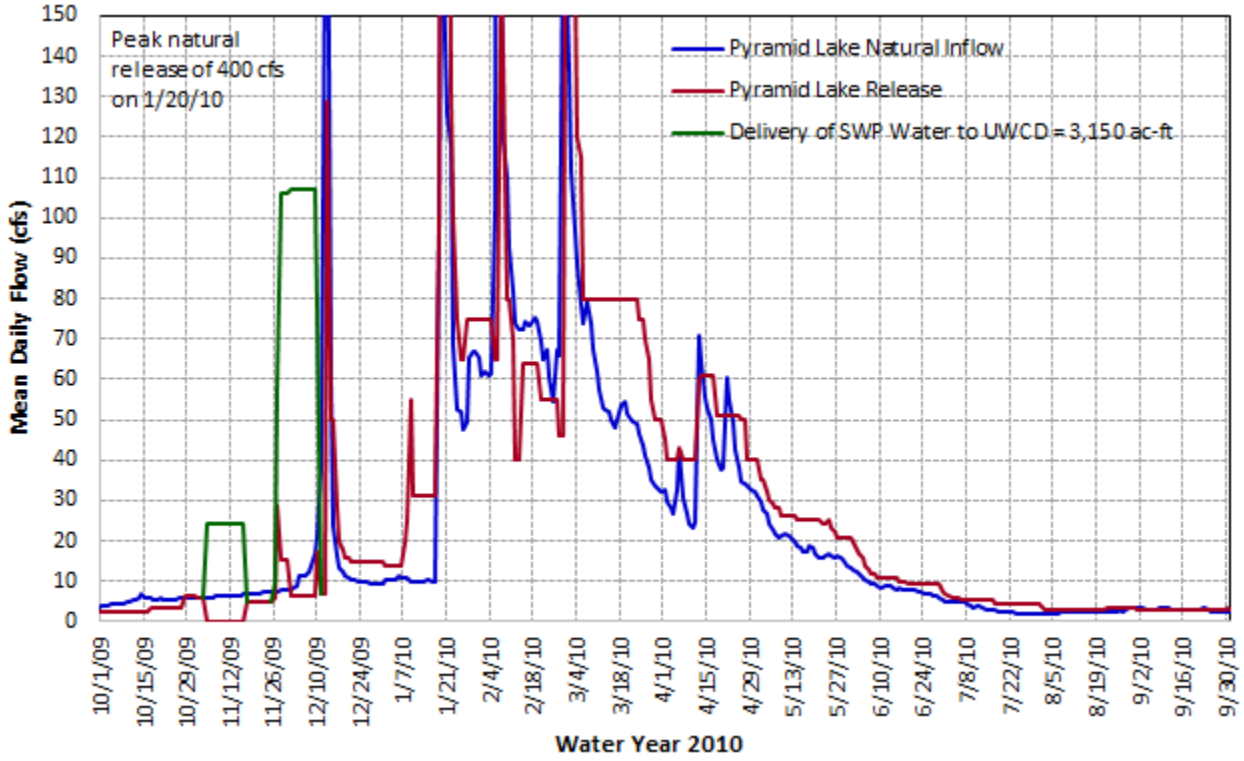
In October 2009, following its issuance of a Draft Environmental Assessment and a Final Environmental Assessment under NEPA and the SWRCB's issuance of water quality certification pursuant to Section 401 of the CWA, FERC granted a permanent license amendment to codify the new flow regime.[32] Based on the extensive record, thorough federal and state level environmental reviews, and the unequivocal position of the USFWS, FERC found that: "Sustained summer flows and attenuated winter storm flows in the project reach have caused the unauthorized take of the arroyo toad and the deterioration of its habitat."[33] Conversely, FERC concluded: "[A]mending the project license consistent with the proposed action would restore habitat for the arroyo toad (*Bufo californicus*) (FE) and improve habitat for other special-status species. The proposed action would benefit arroyo toads by increasing geomorphic processes, providing the scouring needed to reduce riparian and emergent vegetation, increasing stream terraces and sand bars, and providing the natural fluvial process to redistribute sediments."[34] In approving the license amendment, FERC overruled various objections by California Trout, Inc. (CalTrout) and Friends of the River (FOR), including their concerns regarding impacts on rainbow trout. FERC's order as well as the SWRCB's Section 401 certification required the Licensees to conduct monitoring, which is described below in Section 1.1.5.1.

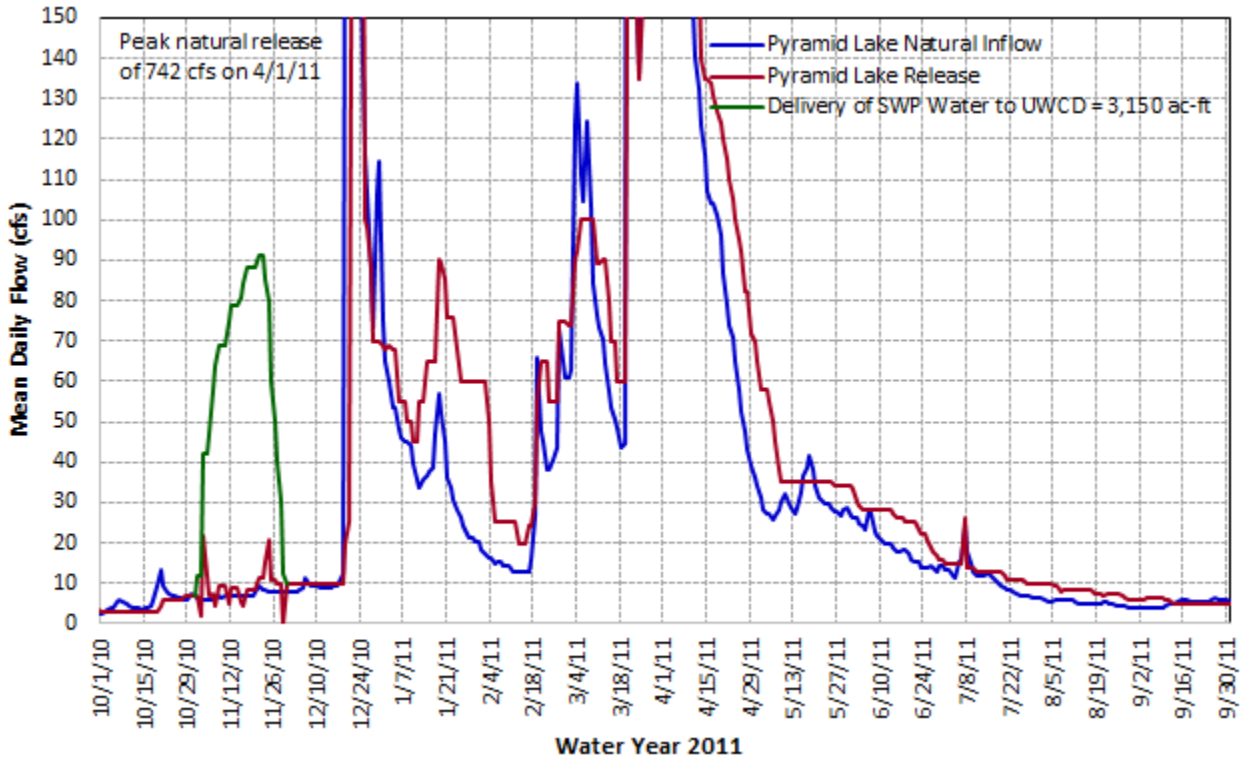
The Licensees have implemented the requirements of Article 52, which has resulted in a year-round natural flow regime in Pyramid reach that mimics, in both shape and volume, the natural inflow into Pyramid reach, except for emergency flood protection, periodic radial gate and other testing, and delivery of water to the UWCD. To demonstrate this mimicking, the Licensees' prepared Figure 1.1-1, which shows the average daily natural inflow into Pyramid Lake and the Licensees' average daily releases into Piru Creek from Water Year (WY) 2008 through WY 2016. Note that besides other things, Article 52 allows that the "instantaneous peak stream releases [into Pyramid reach] may be attenuated." This information will be used in the Licensees' proposed Study 4.1.14, *Indicators of Hydrologic Alteration (IHA)*, which will also use hourly data to compare hourly changes in inflow into Pyramid Lake and the Licensees' hourly releases into Piru Creek during ten storm events.

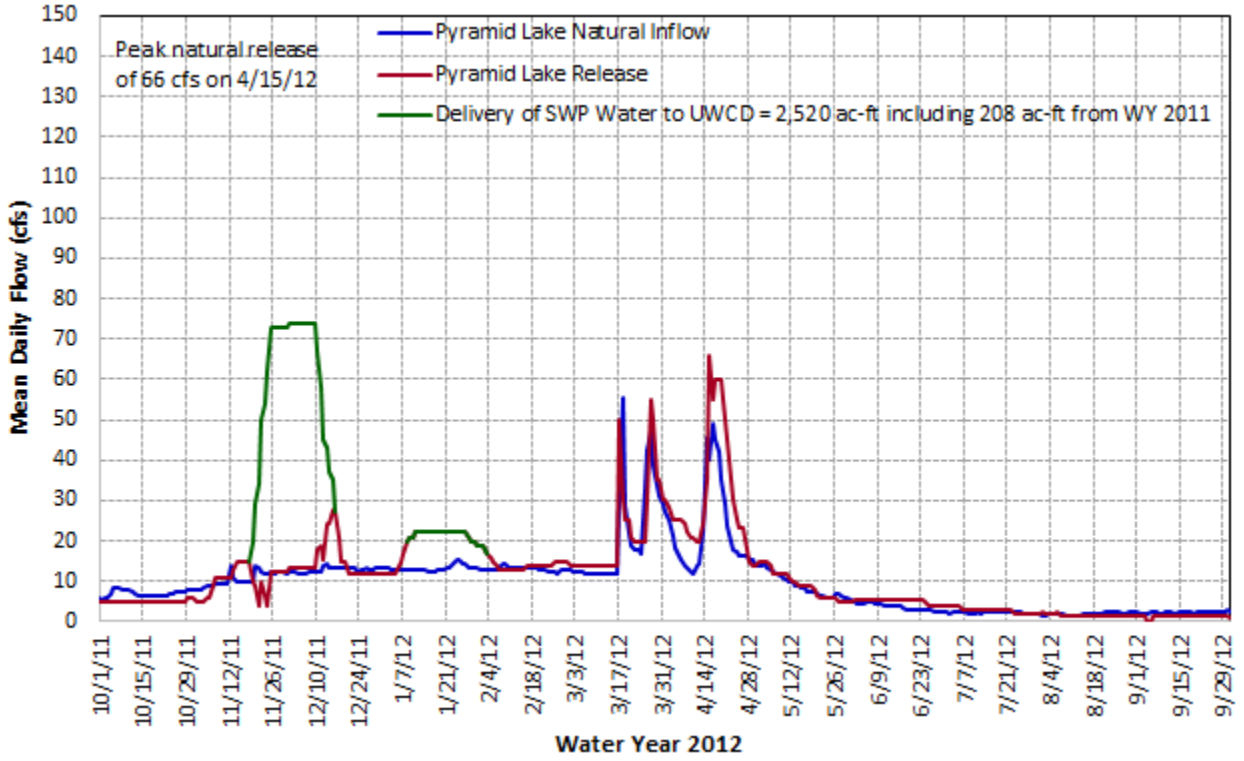
[32] *Cal. Dep't of Water Res. & City of Los Angeles*, 129 FERC ¶ 62,073 at P 56.
[33] *Id*. at P 33.
[34] *Id*. at P 56.

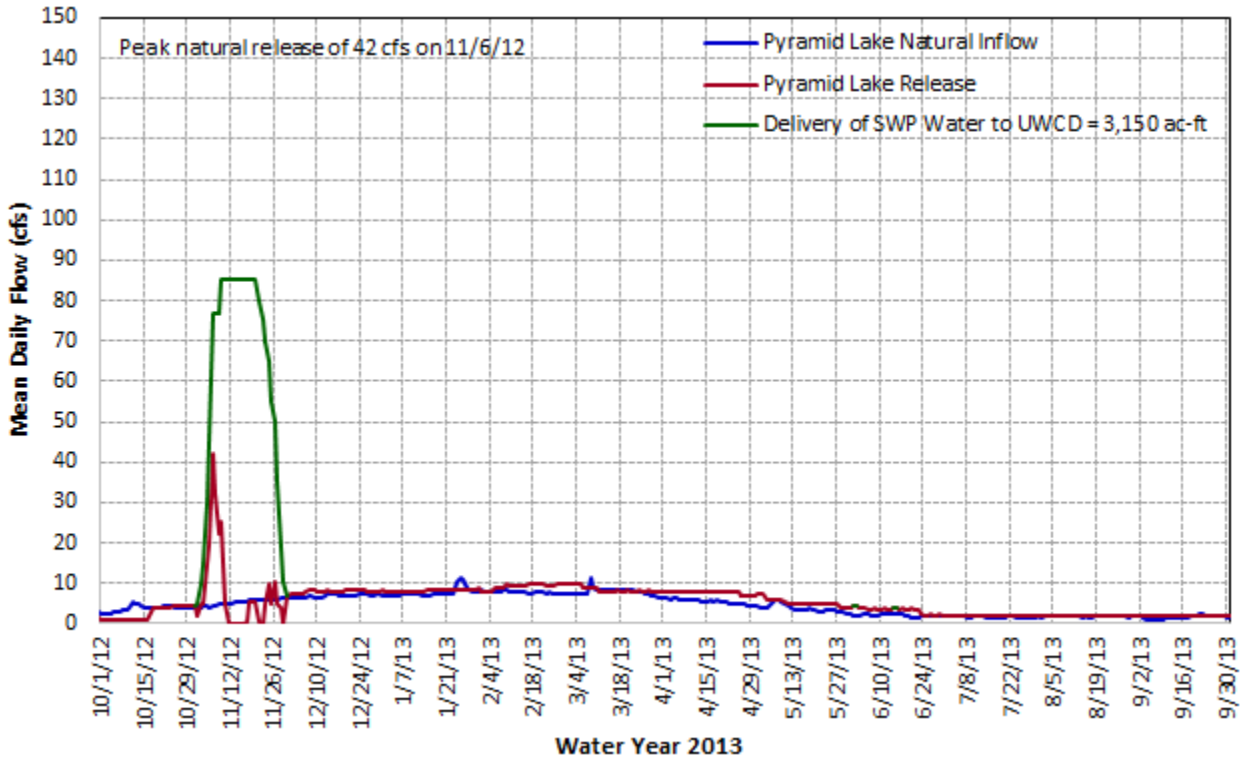

Peak natural release of
2,025 cfs on 1/27/08
Pyramid Lake Natural Inflow
Pyramid Lake Release
Delivery of SWP Water to UWCD = 1,890 ac-ft
Mean Daily Flow (cfs)
Water Year 2008

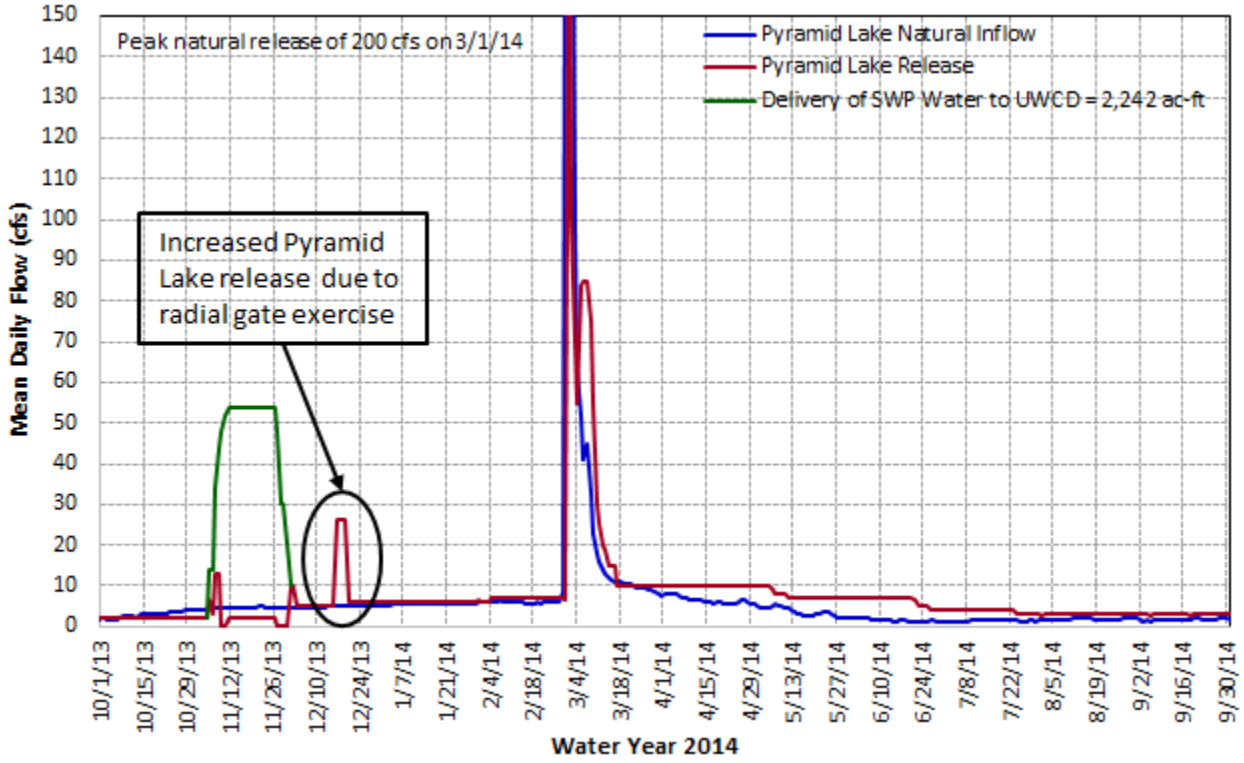

Peak natural release of 150 cfs
on 2/16/09
Pyramid Lake Natural Inflow
Pyramid Lake Release
Delivery of SWP Water to UWCD = 1,980 ac-ft
Mean Daily Flow (cfs)
Water Year 2009

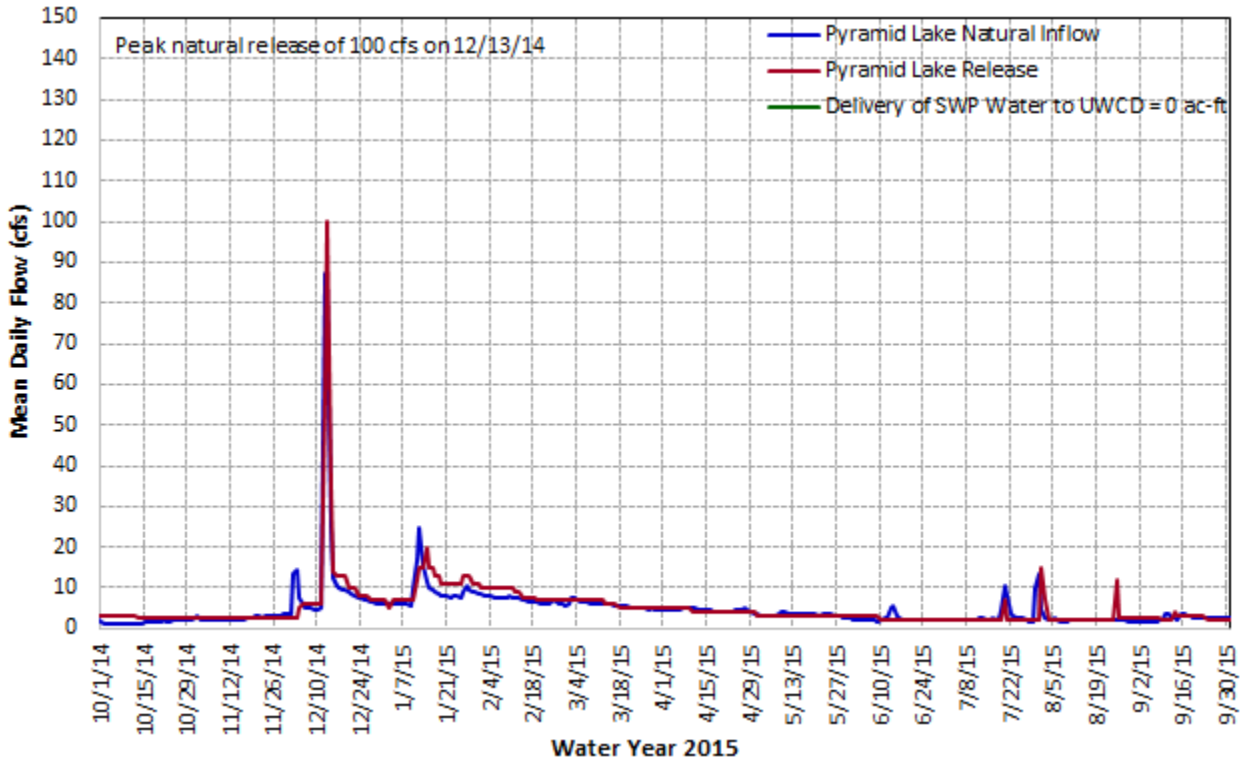

Peak natural release of 400 cfs on 1/20/10
Pyramid Lake Natural Inflow
Pyramid Lake Release
Delivery of SWP Water to UWCD = 3,150 ac-ft
Mean Daily Flow (cfs)
Water Year 2010


Peak natural release of 742 cfs on 4/1/11
Pyramid Lake Natural Inflow
Pyramid Lake Release
Delivery of SWP Water to UWCD = 3,150 ac-ft
Mean Daily Flow (cfs)
Water Year 2011


Peak natural release of 66 cfs on 4/15/12
Pyramid Lake Natural Inflow
Pyramid Lake Release
Delivery of SWP Water to UWCD = 2,520 ac-ft including 208 ac-ft from WY 2011
Mean Daily Flow (cfs)
Water Year 2012


Peak natural release of 42 cfs on 11/6/12
Pyramid Lake Natural Inflow
Pyramid Lake Release
Delivery of SWP Water to UWCD = 3,150 ac-ft
Mean Daily Flow (cfs)
Water Year 2013


Peak natural release of 200 cfs on 3/1/14
Pyramid Lake Natural Inflow
Pyramid Lake Release
Delivery of SWP Water to UWCD = 2,242 ac-ft
Increased Pyramid Lake release due to radial gate exercise
Mean Daily Flow (cfs)
Water Year 2014


Peak natural release of 100 cfs on 12/13/14
Pyramid Lake Natural Inflow
Pyramid Lake Release
Delivery of SWP Water to UWCD = 0 ac-ft
Mean Daily Flow (cfs)
Water Year 2015

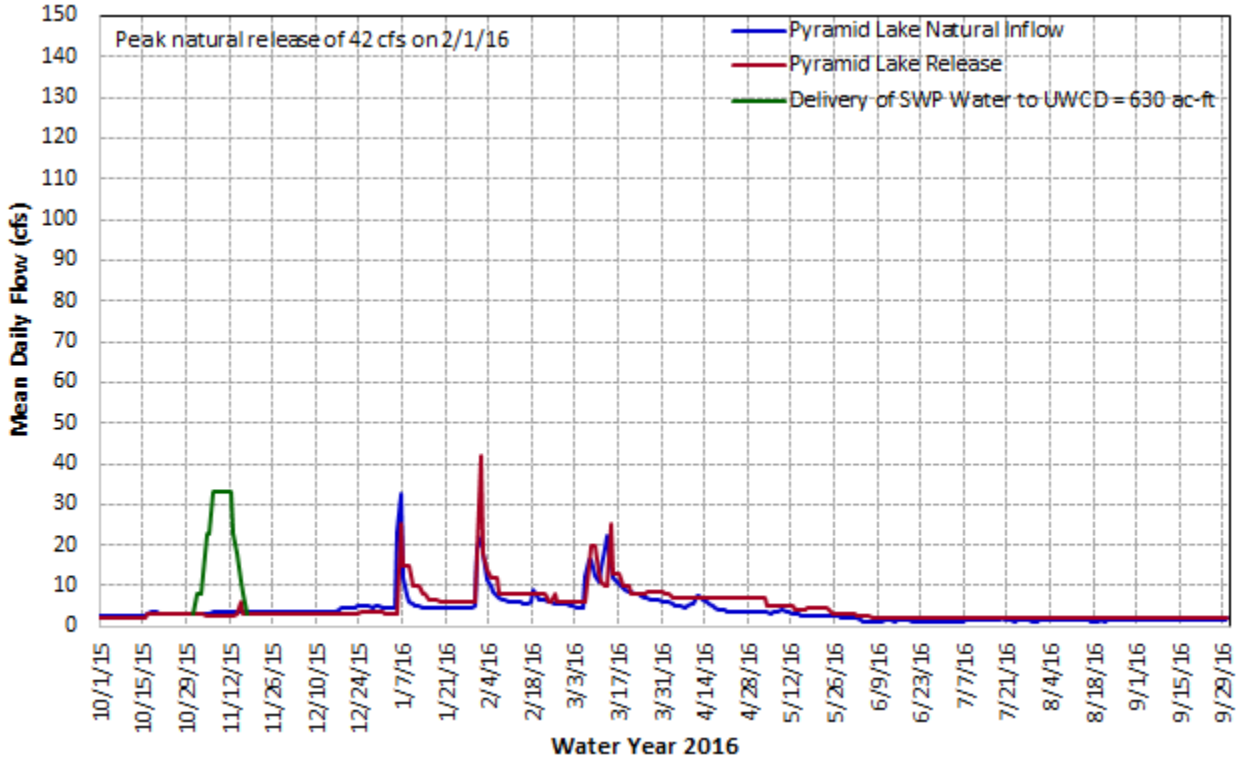


Figure 1.1-1. Comparison of Average Daily Natural Inflow into Pyramid Lake and Licensees' Average Daily Release from Pyramid Dam to Piru Creek from Water Year (WY) 2008 through WY 2016

As shown in Figure 1.1-1, average daily Pyramid Lake natural inflow is the sum of the flows measured at United States Geological Survey (USGS) flow gage 11109375 (*Piru Creek below Buck Creek, near Pyramid Lake, CA*) and USGS flow gage 11109395 (*Canada de Los Alamos above Pyramid Lake, CA*), which together measure the natural runoff from 88.2 percent of the Pyramid Lake drainage area. Figure 1.1-1 also shows the average daily Pyramid Dam release, which includes Pyramid Dam spills, but not dam seepage, from USGS flow gage 11109375 (*Piru Creek below Pyramid Lake, near Gorman, CA*). In Figure 1.1-1 where the red and blue lines overlap, the red line is shown. Average daily deliveries of SWP water in Pyramid Lake to the UWCD, as measured at USGS flow gage 11109375, are shown in Figure 1.1-1 as green, as is the annual delivery volume to UWCD.

Figure 1.1-1 shows the Licensees' delivery of SWP water to UWCD. As context, DWR has a long term water supply contract with the Ventura County Watershed Protection District (VCWPD) that allocates use of a maximum of 20,000 acre feet of SWP water. VCWPD assigned administration of this agreement to Casitas Water District (CWD). The 20,000 acre feet of SWP water has been assigned as follows, 5,000 acre-feet to CWD, 10,000 acre feet to the City of San Buena Ventura and 5,000 acre-feet to UWCD. Thus, UWCD has a contractual right to receive up to 5,000 acre feet of SWP water annually. There is a requirement for up to 1,850 of UWCD's 5,000 acre feet to be released to Port Hueneme through the VCWPD turnout at Castaic Lake. This leaves UWCD with a maximum of 3,150 acre feet of SWP water to be delivered via Piru Creek.

Each year DWR determines the percentage of contract water it has available to deliver to its contractors based on that year's hydrology and other factors. Once that percentage is known, the total volume of water available to be delivered to UWCD can be determined and UWCD schedules delivery of its SWP water. Water delivery has the following limitations, per the requirements of Article 52 of the current P-2426 hydropower license: (1) a seasonal constraint of delivery between November 1st and the end of February, and (2) the delivery flow can either simulate the hydrograph of a typical storm event with ramping of flows to mimic the preceding and receding limbs of a hydrograph or, if needed to avoid high-flow flood damage delivery can be released more gradually over a longer period of time. Additionally, when UWCD schedules delivery of SWP water, the maximum discharge is typically held to less than 200 cfs to allow for private land owners upstream of Lake Piru to have the ability to cross the creek and continue access to their property during the delivery.

Table 1.1-1 provides an annual volumetric summary of the data shown in Figure 1.1-1.

Table 1.1-1. Volumetric summary by Water Year of data shown in Figure 1.1-1

Water Year	Pyramid Lake		Annual Difference Between Natural Inflow and DWR Release		Annual Delivery of SWP Water to UWCD
	Natural Inflow	DWR Release			
	(ac-ft)	(ac-ft)	(ac-ft)	(%)	(ac-ft)
2008	27,735	31,457	3,722	13.4%	1,890
2009	12,102	13,697	1,594	13.2%	1,980
2010	18,493	21,277	2,784	15.1%	3,150
2011	35,777	38,677	2,900	8.1%	3,150
2012	7,212	8,343	1,130	15.7%	2,520
2013	3,352	3,993	641	19.1%	3,150
2014	5,197	5,779	582	11.2%	2,242
2015	3,470	3,713	242	7.0%	0
2016	2,931	3,469	538	18.4%	630
Average	**12,919**	**14,489**	**1,570**	**13.5%**	**2,079**

Key:
ac-ft = acre feet
DWR = Department of Water Resources
SWP = State Water Project
UWCD = United Water Conservation District
% = percent

In sum, the Licensees are required under the ESA to maintain the flow regime approved by FERC in 2009 to prevent unauthorized take of the arroyo toad. The requirement to obtain a new license under the FPA does not change the Licensees' or FERC's ESA obligations to prevent illegal take of arroyo toads. Additional studies of the flow regime in Pyramid reach will not inform the development of license flow requirements, because DWR is doing additional studies as required by Article 52 and the related SWRCB Section 401 certification. These issues were thoroughly vetted in the proceedings

leading to the 2009 license amendment and there have been no significant changes to warrant re-studying them now.

There are no listed anadromous fish species in Pyramid reach, and the United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) has acknowledged it has no jurisdiction to require a change to the flow regime for the protection of listed anadromous fish species.[35] The federal endangered distinct population segment (DPS) of the Southern California steelhead (*O. mykiss*) and its designated critical habitat do not occur in the Project area because the Santa Felicia Dam blocks all upstream steelhead migration into Pyramid reach.[36] The resource agencies and CalTrout have requested studies of the flow regime in Pyramid reach in the event of future reintroduction of steelhead at Santa Felicia Dam.[37] As the Licensees discussed in their comments on FERC's Scoping Document 1 (SD1), studies or analyses of potential Project effects on steelhead passage and habitat—in the event steelhead may someday be introduced upstream of Santa Felicia Dam—would be entirely premature and dependent on the outcome of steelhead passage efforts at Santa Felicia Dam, which are not reasonably certain to occur in the near future.[38]

The USFS states that studies of the Pyramid reach are necessary to determine impacts on the arroyo toad of the current flow regime.[39] As explained in Section 1.1.5.1, DWR has done extensive arroyo toad monitoring under Article 52 and will continue to conduct that monitoring under the current license. The Licensees will include these results in their license application. The USFWS in its comment letter did not describe the need for further arroyo toad studies as part of the RSP.[40]

NMFS asserts additional flow studies "are needed to assess Project effects under the current license and inform recommendations for terms and conditions in the new license . . . current Project operations may need adjustment, but one cannot know without studying current impacts."[41] Although it is possible minor adjustments could be made, assuming such adjustments would not result in harm to arroyo toads, the extent of any adjustments to the flow regime must necessarily be quite small. DWR releases into the Pyramid reach are limited to natural inflows into Pyramid Lake and releases of SWP water for UWCD's use at Santa Felicia Dam, as shown in Figure 1.1-1.

[35] NMFS Comments on Pre-application Document and Scoping Document 1 at Section 3.0, Project No. 2426-227 (filed Nov. 28, 2016).
[36] *Cal. Dep't of Water Res. & City of Los Angeles*, 129 FERC ¶ 62,073 at P 42.
[37] NMFS Comments on Pre-Application Document at Section 3.0; United States Department of Agriculture, Forest Service Comments on Pre-Application Document and Scoping Document 1, Project No. 2426-227 (filed Nov. 28, 2016); California Trout Comments on Pre-Application Document and Scoping Document 1 at 3-4, Project No. 2426-227 (filed Nov. 29, 2016).
[38] Comments of California Department of Water Resources and Los Angeles Department of Water and Power on Scoping Document 1 at 3-6, Project No. 2426-000 (filed Dec. 12, 2016).
[39] USFS PSP Comments attached to Vail Letter, at 4-5.
[40] Letter to Kimberly D. Bose from Stephen P. Henry (filed April [insert date], 2017.
[41] NOAA's NMFS, West Coast Region's Comments on Proposed Study Plan (filed April [insert date], 2017), at 3.

FERC staff similarly states in its comments on the *Whitewater Boating Study* that "the current flow regime is not necessarily the flow regime that would be required under a new license. Therefore, it is premature to rule out elements of a whitewater study based solely on any perceived constraints of the current flow regime."[42] Licensees agree that this may be the case with regard to whitewater boating flows, which could occur in the winter outside the period of protection for arroyo toad, and has some limited discretion in the timing of the UWCD releases, as described above. Accordingly, Licensees are proposing Study 4.1.19, *Whitewater Boating Study*.

In conclusion, Licensees believe the RSP, in addition to existing information and ongoing monitoring under the existing license, will provide adequate information to assess the impacts of the Project on the Pyramid reach including arroyo toads and fishery resources and to inform requirements in the new license.

1.1.5.1 Licensees' Monitoring in Pyramid Reach Under the Existing License

The SWRCB's 2008 Section 401 certification required the Licensees to develop a plan to monitor arroyo toad and other sensitive species in the 4.6-mile long segment of Pyramid reach between Ruby Canyon and Blue Point Campground just above Lake Piru, as well as in a one-mile long segment of Agua Blanca Creek. FERC incorporated the Section 401 certification in its 2009 Order, and required the Licensees to prepare a plan in consultation with USFWS, USFS, SWRCB and CDFW within one year for monitoring arroyo toad, California red-legged frog (*Rana draytonii*) (CRLF), western pond turtle (*Actinemys marmorata*) (WPT) and other sensitive species. DWR submitted the monitoring plan to FERC, and FERC approved the plan in August 2010.

The Licensees implemented the approved plan in 2010, and will continue monitoring until at least their filing of the draft license application. The arroyo toad survey methods follow the 1999 USFWS survey protocol, and incidental sightings of CRLF, WPT and other sensitive species and removal of American bullfrogs (*Lithobates catesbeianus*) are conducted concurrently with the arroyo toad surveys. After the last survey of the season, the Licensees file an annual report with FERC and provide copies of the report to the USFWS, USFS, SWRCB and CDFW. Data on arroyo toad breeding success and historic breeding pool usage in 1991, 1992, 2002, 2003, 2004, and 2005 have been used as a comparison in the annual monitoring reports.

Overall, to date monitoring has shown low breeding success in both Pyramid reach and Agua Blanca Creek, with an increase in 2017. From 2012 through 2016, weather conditions appeared to influence both type and availability of suitable arroyo toad breeding habitat in both Pyramid reach and Agua Blanca Creek. Low rainfall during this drought period resulted in an overall drying of numerous historic breeding pools and vegetation encroached on pools - low to no clutch numbers and reduced pool habitat availability was observed from 2012 to 2016. Preliminary results from 2017 surveys indicate a large rebound of arroyo toad breeding in both Pyramid reach and Agua

[42] Letter to Ted Craddock and Simon Zewdu from Timothy Konnert (April 13, 2017), Schedule A at 10.

Blanca Creek. This is typical of the toad's boom and bust life cycle in southern California, and is very similar to the occurrence in 2005 documented by Sandburg (2006) where a large storm events after dry periods resulted in a large rebound of successful breeding of arroyo toads.

In addition to the annual arroyo toad and sensitive species monitoring, DWR conducts monitoring consistent with a Prevention of Erosion Damage to Infrastructure Plan that requires assessing erosion on downstream facilities in Pyramid reach and implementing any necessary erosion control measures. Also, DWR is implementing a Flood Warning System and Signage Plan that provides public warning and alerts of high stream releases. Those two plans have been approved by FERC and SWRCB consistent with the Section 401 certification provision, and annual reports are provided to these two agencies.

1.2 STAKEHOLDER COMMENTS ON LICENSEES' PAD AND PSP

Between October 20, 2016 and December 5, 2016, nine stakeholders filed comments on the Licensees' PAD. Five of the stakeholder's comment letters included 66 specific study requests. Many of the study requests were similar in purpose and scope.

On April 13, 2017 eight stakeholders and FERC filed comments on the Licensees' PSP. Six stakeholders provided comments on specific study plans included in the Licensees' PSP. Table 1.2-1 shows the PSP study plans that received stakeholder comments, as well as, the commenting agency. Three stakeholders (USFS, CDFW and American Whitewater [AW]) comment letters included resubmission of 53 specific study requests. Many of the study requests were similar in purpose and scope. Table 1.2-1 also provides an overview of the study requests, the stakeholder or stakeholders requesting the studies, and whether the Licensees adopt with modifications, or decline to adopt the study request in the RSP. More detail regarding the Licensees replies to stakeholder comments and study requests is provided in Section 2.0 and Section 3.0 of this RSP. The four stakeholders that filed comments on the PSP and did not include specific study requests were United States Department of the Interior, National Park Service (NPS), USFWS, NMFS, and CalTrout. Of these four agencies, NMFS, supported USFS and other federal and State agency's study requests.

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Table 1.2-1. Stakeholder Requests for Study Modifications and Requests for New Studies

Study Name	FERC	USFS	CDFW	SWRCB	AW	NPS	USFWS	NMFS	CAL Trout	Licensees' Response to Study Modification / New Study Request
Request for Study Modification[2]										
Aquatic Invasive Species Study	X									Adopted with Modification
Quail Lake Fisheries Study	X			X				X		Adopted with Modification
Pyramid Reach Fish Populations Study	X	X	X	X				X		Adopted with Modification
Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study		X	X				X			Not Adopted
Botanical Resources Study	X	X	X							Adopted with Modification
Non-Native Invasive Plants Study		X	X							Not Adopted
Special-Status Terrestrial Wildlife Species – California Wildlife Habitat Relationships Study	X	X	X							Adopted with Modification
ESA-listed Plants Study		X	X							Adopted with Modification
ESA-Listed Amphibians, California Red-legged Frog Study		X	X				X			Adopted with Modification
ESA-Listed Riparian Bird Species - Southwestern Willow Flycatcher, Least Bell's Vireo, and Yellow-billed Cuckoo Riparian Habitat Evaluations Study	X	X	X				X			Adopted with Modification
Recreation Facilities Demand Analysis and Condition Assessment Study	X									Adopted with Modification
Cultural Resources Study	X	X								Adopted with Modification
Tribal Resources Study	X	X								Adopted with Modification
Indicators of Hydrologic Alteration Study	X	X		X				X		Adopted with Modification
Scenic Integrity Study	X									Adopted with Modification
Water Quality and Temperature Study	X	X	X	X				X		Adopted with Modification
Fish Entrainment Risk Assessment Study	X							X		Adopted with Modification
ESA-Listed Terrestrial Wildlife Species – California Wildlife Habitat Relationships Study		X	X							Adopted with Modification
Number of Stakeholder Comments	**13**	**13**	**10**	**4**	**0**	**0**	**3**	**5**	**0**	**48 – Total Stakeholder Comments** **16 – Adopted with Modification** **2 – Not Adopted**

Table 1.2-1. Stakeholder Requests for Study Modifications and Requests for New Studies (continued)

Study Name	FERC	USFS	CDFW	SWRCB	AW	NPS	USFWS	NMFS	CAL Trout	Licensees' Response to Study Modification / New Study Request
Request for New Study[3]										
Bioaccumulation		X[4]	X[4]							Not Adopted (See Section 3.2.1)
Physical Habitat Simulation (PHABSIM) for Fish Populations Downstream of Pyramid Lake		X[4]	X[4]							Not Adopted (See Section 3.2.2)
Algae Upstream, Downstream, and Within Pyramid Lake		X[4]	X[4]							Not Adopted (See Section 3.2.3)
Benthic Macroinvertebrates Upstream and Downstream of Pyramid Lake		X[4]	X[4]							Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Study 4.1.22)
Stream Fish Populations Downstream of Pyramid Dam		X[4]	X[4]							Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Study 4.1.3)
Stream Fish Populations Upstream of Pyramid Dam		X[4]	X[4]							Not Adopted (See Section 3.2.6)
Aquatic Invasive Species		X[4]	Comprehensive Aquatic Invasive Species Survey[6]							Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Study 4.1.1)
Environmental DNA (eDNA) on Upper and Middle Piru and Within Pyramid and Quail Lakes		X[4]								Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Study 4.1.3)
Water Quality		X[4]	X[6]							Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Study 4.1.16)
Channel Morphology		X[4]	X[6]							Not Adopted (See Section 3.2.10)
Hydrologic Alteration / Flow Regime		X[4]	X[6]	X[1]						Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Study 4.1.14)
Fish Passage		X[4]	X[6]							Not Adopted (See Section 3.2.12)
Wildlife Study Plan: Bats		X[4]	Wildlife (Bats)[6]							Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Study 4.1.7)

Table 1.2-1. Stakeholder Requests for Study Modifications and Requests for New Studies (continued)

Study Name	FERC	USFS	CDFW	SWRCB	AW	NPS	USFWS	NMFS	CAL Trout	Licensees' Response to Study Modification / New Study Request
Wildlife Study Plan: Large Mammal Movement		X[4]	Wildlife Study Plan - Large Mammal Movement[6]							Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Study 4.1.7)
Wildlife Study Plan: Raptors Species		X[4]								Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Study 4.1.20)
Wildlife Study Plan: ESA Terrestrial Species		X[4]	Special-status Species - Special-status Terrestrial Species (Avian, Mammal, Invertebrate)[6]							Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Study 4.1.18)
Wildlife Study Plan: TES Reptiles and Amphibians		X[4]	Special-status Species - Reptile and Amphibian[6]							Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Study 4.1.18)
Wildlife Study Plan: Migratory Bird Act Treaty Protected Bird Species, Forest Service Sensitive Species, CDFW Fully Protected and Species of Special Concern		X[4]								Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Studies 4.1.7 and 4.1.18)
Botanical Resources		X[4]	X[6]							Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Study 4.1.5)
Invasive Noxious Weeds		X[4]	Comprehensive Non-native Plant Survey (Aquatic and Terrestrial)[6]							Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Study 4.1.6)
Engineering		X[4]								Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Study 4.1.11)
Large Woody Debris		X[4]	X[6]							Not Adopted (See Section 3.2.22)
Groundwater			X[6]							Not Adopted (See Section 3.2.23)
Groundwater and Groundwater Dependent Ecosystems (GDE)		X[4]	X[6]							Not Adopted (See Section 3.2.24)
Scenery Integrity Objective Study		X[4]								Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Study 4.1.15)

Table 1.2-1. Stakeholder Requests for Study Modifications and Requests for New Studies (continued)

Study Name	FERC	USFS	CDFW	SWRCB	AW	NPS	USFWS	NMFS	CAL Trout	Licensees' Response to Study Modification / New Study Request
Assess Projected Recreation Use and Demand in the Project Area		X[4]								Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Study 4.1.11)
Assess Recreation Carrying Capacity of the Project Area		X[4]								Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Study 4.1.11)
Assess Regional Uniqueness and Significance of the Project Area's Primary Recreation Opportunities		X[4]								Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Study 3.1.11)
Assess Fire Hazards from Project-Induced Recreation		X[4]								Not Adopted (See Section 3.2.29)
Whitewater Boating Study	X[5]	X[4]			X	X[1]				Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Study 4.1.19)
Water Temperature Monitoring and Development of Water Temperature Model		X[4]								Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Study 4.1.16)
Water Balance / Operations Model				X[1]						Not Adopted (See Section 3.2.32)
Fish Entrainment Risk Assessment			X[6]							Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Study 4.1.17)
Argentine Ant			Comprehensive Argentine Ant Survey[6]							Not Adopted (See Section 3.2.34)
Herbicide / Pesticide / Rodenticide			Herbicide, Pesticide and Rodenticide Effects on Vegetation and Wildlife[6]							Not Adopted (See Section 3.2.35)
Pyramid Lake Tributaries Fish Passage Barriers Assessment	X[5]									Adopted with Modification (while the requested new study was not adopted, components of it were adopted with modifications into Licensees' Study 4.1.22)
	Requested Studies – 2	**Requested Studies – 30**	**Requested Studies – 23**	**Requested Studies – 2**	**Requested Studies – 1**	**Requested Studies – 1**	**Requested Studies – 0**	**Requested Studies – 0**	**Requested Studies – 0**	**59 – Total Requested Studies** **23 – Adopted with Modification** **13 – Not Adopted**

Key:
[1]No study request provided in PSP comments. Commented on a previous study request with no detailed study plan provided as part of the PSP comments. Only included for comments that require a response or are not addressed under a study request.
[2]Study numbers and names correspond to those study numbers and names in the Licensees' PSP.
[3]In most cases where a detailed new study was requested by multiple commenters, the study name was the same and the majority of the study content was the same. In this table, the study name for new study requests numbers 1 through 30 use the study name provided by USFS in its detailed new study request, and if a commenter provided a different name for its detailed study request that is similar to the new study request by USFS, that name is shown in the table.
[4]The commenter included a detailed study plan for this request in its PSP comment letter.

[5]FERC did not request this study, but suggested clarifications to the study should the Licensees include the study in its RSP.
[6]The commenter noted in their PSP comment letter that this request is a resubmission of their PAD study request and was not included in their PSP comment letter.
AW = American Whitewater
CDFW = California Department of Fish and Wildlife
ESA = Federal Endangered Species Act
eDNA = environmental deoxyribonucleic acid
NPS = United States Department of the Interior, National Park Service
PHABSIM = Physical Habitat Simulation
SWRCB = State Water Resources Control Board
TES = Threatened, Endangered and Sensitive
USFS = United States Department of Agriculture, Forest Service

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2.0 REPLY TO FERC COMMENTS ON PSP

In a letter dated April 13, 2017, FERC provided comments on 13 of the 18 studies proposed by the Licensees in their PSP. FERC also commented on two draft method sections put forward by the Licensees during the Focused Study Plan Meetings in an effort by the Licensees to resolve study differences. (Table 1.2-1.) Licensees' replies to these study modifications are provided below by study.

Request Elements	Licensees' Reply
Aquatic Invasive Species (Study 4.1.1)	**ADOPTED**. The Licensees modified *the Aquatic Invasive Species Study* that was in the PSP to describe the rationale for the Licensees' survey approach of conducting focused surveys for aquatic invasive snails and clams at nine locations on Pyramid Lake, two locations on Quail Lake, and all safely accessible areas of Elderberry Forebay. The study was modified to better describe the location of the 320-foot transects, verify the locations of the shoreline and offshore samples, and provide the reference point for the 33-foot offshore samples. In addition, the study was modified to state that surveys would be limited to Pyramid Lake, to better describe the location and number of survey transects in Pyramid Lake, and to describe the schedule for surveys, including the frequency and duration per week/month. **ADOPTED WITH MODIFICATION**. The location and frequency of quagga mussel surveys resulting from the recent discovery of the mussels in the Angeles Tunnel are not known at this time since the location and frequency are under discussion with the Licensees and CDFW. These discussions are outside of relicensing and in conformance with state regulations that require the operator of a reservoir in which dreissenid mussels are found, consult with CDFW on a monitoring and treatment plan. The Licensees modified the *Aquatic Invasive Species Study* that was in the PSP to state that the Licensees would advise FERC of these locations and frequency when the dreissenid monitoring and treatment plan is approved by CDFW. The Licensees will include the results from the plan in its application for new license.
Quail Lake Fisheries Assessment Study (Study 4.1.2)	**ADOPTED**. The Licensees modified the *Quail Lake Fisheries Assessment Study* that was in the PSP to add Reynolds and Temple (1996) to the reference section, and changed the boat electrofishing methodology for sampling small standing water bodies, such as Quail Lake. In addition, the Licensees modified the study to add that the aquatic habitat sampled would be recorded (i.e., maximum depth [full extent of electrical field], average depth, primary substrate, secondary substrate, cover, adjacent shoreline characteristics, level of public use, and average bed slope) for each site, and representative photographs of each site would be included in the final report. Survey time for creel surveys was adjusted in the study to capture peak fishing times (i.e., 7:00 to 10:00 a.m. and 3:00 to 6:00 p.m.). Lastly, the study was modified to describe that catch per unit effort (CPUE) for fishing would be calculated by taking the total number of fish caught and dividing by the total number of angling hours to yield fish caught per hour of angling effort.

Pyramid Reach Fish Populations Study (Study 4.1.3)	**ADOPTED**. The Licensees modified the *Pyramid Reach Fish Populations Study* that was in the PSP to describe the target flow condition under which habitat mapping would occur in Pyramid reach. The study was modified to describe under which flow conditions environmental deoxyribonucleic acid (eDNA) sampling would occur and the description of how eDNA samples would be processed in the laboratory was expanded. In addition, the study was modified to describe the spatial extent of the stream segments to be sampled, to state that block nets would be set up prior to inspecting the site for sensitive species, to state that the relative stock densities (RSD) would only be performed for game fish, and to describe how scale data would be used in estimating length-age frequency. Lastly, the study was modified to describe how individual, population and community fish health would be assessed.
Botanical Resources Study (Study 4.1.5)	**ADOPTED**. The Licensees modified the *Botanical Resources Study* that was in the PSP to follow CDFW protocol for botanical surveys, and to include the surveys dates indicated by FERC. **ADOPTED WITH MODIFICATION**. The Licensees do not propose to include the development of an updated vegetation map in the *Botanical Resources Study Plan*. However, Study 4.1.7, *Special-Status Terrestrial Wildlife Species – California Wildlife Habitat Relationships (CWHR) Study,* in the RSP is specifically designed to ground-truth vegetation communities to the extent needed to develop an updated map of wildlife communities, which will be produced as part of the *Botanical Resources Study* results, and determine potential effects of Project operation and maintenance (O&M) on special-status wildlife species and sensitive natural communities. Outside of those survey site selections outlined in the Licensees' proposed Study 4.1.10, ESA-Listed Birds, no other survey site selections for wildlife will be chosen as part of the *Botanical Resources Study*, with the exception of wetland and riparian areas, which will be assessed as part of the Proper Functioning Condition (PFC) protocol within the *Botanical Resources Study*.
Special-Status Terrestrial Wildlife Species – California Wildlife Habitat Relationships Study (Study 4.1.7)	**ADOPTED**. The Licensees modified the *Special-Status Terrestrial Wildlife Species – California Wildlife Habitat Relationships Study that was* in the PSP to state that the study would include generating a map showing the location of Project features (e.g., roads, fences, transmission line corridors, developed recreation sites, maintenance areas, parking lots and proposed construction/staging areas) that could act as potential barriers to wildlife movement and the updated vegetation communities/habitat map.
ESA-Listed Riparian Bird Species (Study 4.1.10)	**ADOPTED WITH MODIFICATION**. FERC staff recommended that the RSP should include protocol-level presence/absence surveys for yellow-billed cuckoo and that surveys be conducted during the June-August period (i.e., peak of breeding activity) to increase the probability of detection. In addition, FERC staff recommended that surveys and analyses should be conducted to determine where suitable habitat occurs throughout the entire study area including both upstream and downstream of Pyramid Lake. The Licensees modified the *Special-Status Terrestrial Wildlife Species – CWHR Study* that was in the PSP to include presence/absence surveys for yellow-billed

	cuckoo in areas that are identified by the study as representing potential breeding habitat. The surveys would follow the latest accepted protocols for yellow-billed cuckoo, as described in Halterman et al. (2016). The surveys would be performed within the proposed Project boundary. The Licensees did not expand the study area to include the area downstream of Pyramid Lake for the reasons detailed in Section 1.1.5 of this RSP.
Recreation Facilities Demand Analysis and Condition Assessment Study (Study 4.1.11)	**ADOPTED**. The Licensees modified the *Recreation Facilities Demand Analysis and Condition Assessment Study* that was in the PSP to reference the latest FERC guidance on recreation facilities documentation for established form in which data would be collected and reported, and also to clarify that all amenities at each recreation facility would be inventoried. In addition, the study was modified to extend the study area downstream of Pyramid Dam to Frenchman's Flat area for all study components. Lastly, the study was updated to elaborate on frequency of surveys, clarify trail mapping standards, evaluation of recreationist vehicles queuing onto entrance roadways, and survey instruments and languages used in implementing the survey area consistent with USFS recommendations and recommended aspects of the National Visitor Monitoring Program.
Cultural Resources Study (Study 4.1.12)	**ADOPTED**. Licensees modified the *Cultural Resources Study* that was in the PSP to state that the Licensees would document all Section 106 consultation with participating tribes, land managing agencies, and SHPO in a log, and the log would be appended to the Cultural Resources Study report provided as part of the study and to the Historic Properties Management Plan (HPMP) that will be developed outside the study and included in the Licensees' Draft Application for a New License (DLA). In addition, the study was modified to define the APE, and to state that, at this time, the Licensees anticipate all locations within the APE would be accessible. Consultation with tribes, land managing agencies, and SHPO concurrence on the APE is currently in progress and will be completed prior to the start of archival research and fieldwork described in the study. The study was updated to include the protocols to be followed in the event that human remains are inadvertently discovered during the fieldwork, and an approach to the curation of artifacts should the fieldwork result in the need to collect archaeological materials. Lastly, the study was modified to state that the cultural resources reporting would include a description of the National Register status of each identified resource, a description of Project-related effects to all resources, and an appendix that contains documentation of section 106 consultation conducted during study implementation, with copies of all related correspondence. **ADOPTED WITH MODIFICATION**. The Licensees modified the study to state that Section 106 consultation with tribes, land managing agencies, and the SHPO would be conducted throughout the study and relicensing process. The study was revised to provide for the expansion/modification of the APE following SHPO's concurrence, should the results of the studies identify potential Project-related effects outside of the APE. The APE modifications would be conducted in consultation with tribes

	and land managing agencies and SHPO concurrence. The Licensees included in the study a plan to consult with participating tribes, land managing agencies, and SHPO regarding National Register of Historic Places (NRHP) evaluations of cultural resources that can be evaluated during the field survey without further studies. The study further includes consultation for cultural resources found during the field survey where Project-related effects from O&M are identified, but additional archival and or fieldwork would be required. Because it is not possible to predict prior to the field survey the number or types of cultural resources in the APE or the number of resources with Project-related effects, the Licensees would consult on the need for additional NRHP evaluations and develop an evaluation schedule with participating tribes, land managing agencies, and the SHPO during the study. At a minimum, this consultation and the schedule for additional NRHP evaluations would be provided in the cultural resources report and DLA, **NOT ADOPTED**. FERC staff recommended developing a Cultural Resources Working Group to meet throughout the licensing process to discuss study status and cultural resources recommendations. The Licensees have included in the *Cultural Resources Study* in the RSP consultation with participating tribes, land managing agencies, and SHPO throughout the study and licensing process. Notifications of fieldwork, cultural resources documents, inclusive of resource information and proposed management recommendations, and other potential information related to the study will be submitted to the consulting parties for their consideration, comment, and consultation by way of email, United States Postal Service, courier, or telephone, as may be appropriate or determined to be the most effective approach for consultation. All consulting parties will have The Licensees' contact information and may communicate with Licensees throughout the study and licensing process. Therefore, the Licensees do not believe that formation of a formal group is necessary, nor is it required under either the ILP or Section 106. The HPMP will be developed in consultation with participating tribes, land managing agencies, and SHPO as part of the DLA preparation and submittal. Therefore, study schedule has not been revised to include this task. Nor has the study schedule been revised to address NRHP evaluations because it is not possible to predict prior to the field survey, the number or types of cultural resources in the APE, or the number of resources with Project-related effects. The Licensees will consult with participating tribes, land managing agencies, and the SHPO on the need for additional NRHP evaluations and to develop an evaluation schedule.
Tribal Resources (Study 4.1.13)	**ADOPTED**. The Licensees modified the *Tribal Resources Study* that was in the PSP to state that "Places of tribal interest" would be mapped, and that documentation would include descriptions of the resources, the sources of tribal information, NRHP eligibility status, any Project-related effects, and any correlations to archaeological sites identified in Licensees' Study 3.1.12, *Cultural Resources.* In addition, the study was modified to include reporting on NRHP evaluations, an assessment of Project-related effects, and an appendix with the history of consultation and any related

	correspondence. **ADOPTED WITH MODIFICATION**. The Licensees modified the study to state that Section 106 consultation with tribes, land managing agencies, and the SHPO would be conducted throughout the study and relicensing process, and the APE will be expanded if potential Project effects are identified outside of the APE. **NOT ADOPTED**. FERC staff recommended that the RSP include a task to develop site-specific and general management measures in the HPMP to avoid, lessen, or mitigate potential adverse effects to eligible or potentially eligible traditional cultural properties (TCPs). The HPMP will be prepared outside of the study and included in the Licensees' DLA - not as part of the *Tribal Resources Study*. Therefore, neither site-specific and general resource management measures nor the HPMP development are included in the study. In addition, FERC staff recommends revising the study schedule to include time for the preparation of a draft HPMP. As stated above, the Licensees will prepare the draft HPMP outside of the study and include it in the DLA.
Indicators of Hydraulic Alteration Study (Study 4.1.14)	**ADOPTED**. The Licensees modified the *IHA Study* that was in the PSP to remove USGS gage 11109398. The gage is not needed to perform the IHA analysis since the analysis focuses on the natural flow in Piru Creek and not on water imported from the SWP.
Scenic Integrity Study (Study 4.1.15)	**ADOPTED.** The Licensees renamed the *Visual Quality Study* that was in the PSP to the *Scenic Integrity Study* and included it in the RSP. In the *Scenic Integrity Stud*y, the Licensees clarify that the study includes both National Forest Service (NFS) lands and non-NFS lands within the proposed Project boundary.
Water Quality and Temperature Study (Study 4.1.16)	**ADOPTED**. The Licensees modified the *Water Quality and Temperature Study* that was in the PSP to describe the sample locations in Pyramid reach and to show their locations on a map. In addition, the study was modified to describe how the *in situ* water quality samples would be collected and their frequency, and to state that water quality samples would be taken in four consecutive quarters, and when the samples would be taken in each quarter. The schedule was corrected.
Fish Entrainment Study (Study 4.1.17)	**ADOPTED**. The Licensees modified the *Fish Entrainment Study* that was in the PSP to clearly describe which fish species and lifestages would be assessed in the study and why they were selected. The study was modified to describe that the physical habitat and water quality on a seasonal basis in the characterization of the each outlet would be described as part of the study, and to state that, as part of the study, the Licensees would describe the fish species and lifestage size range, habitat requirements. Lastly, the study was modified to describe the time periods the entrainment assessments would be made and under what conditions, and to reference the appropriate literature to support the statement.
Whitewater Boating Study	**ADOPTED**. The Licensees included in the RSP a new study that was

(discussion draft methods section)	not included in the PSP: *Whitewater Boating Study.* The study would evaluate the whitewater boating resource in Pyramid reach. The study states the Level 1 and level 2 Whittaker, Shelby, and Gangemi (2005) procedures would be generally followed, and none of the alternations are due to a lack of necessary detail in the relevant gages. Lastly, the study includes consultation with USFWS prior to the proposed field reconnaissance.
Pyramid Lake Tributaries Fish Passage Barriers Study (discussion draft methods section)	**ADOPTED**. The Licensees included in the RSP a new study that was not included in the PSP: *Pyramid Lake Tributaries Fish Passage Barriers Study.* The study describes what type of potential fish barriers would be assessed, how a potential barrier would be identified in the field, and how barriers would be surveyed and evaluated. The study includes an assessment of water surface fluctuations of Pyramid Lake, where within the channel bed elevations would be recorded, at what interval, and what vertical datum would be used.

3.0 REPLY TO STAKEHOLDER COMMENTS ON PSP

The Licensees' replies to comments on the PSP provided by FERC have been addressed in Section 2.0. The remaining stakeholder comments including study modifications and study requests are addressed in Sections 3.1 and 3.2, respectively. The Licensees' have only addressed specific requests for modifications to the Licensees' proposed study and new study requests. Lack of a reply to any comment does not imply that the Licensees agree with the comment. The Licensees reserve the right to reply to all comments at the appropriate time in this relicensing.

3.1 REPLY TO STAKEHOLDER REQUESTS FOR STUDY MODIFICATIONS

In their PSP letters, the commenters noted that the Licensees and relicensing participants reached agreement on one (i.e., *Quail Lake Fisheries*) of the 18 studies proposed by the Licensees in their PSP, did not specifically comment on three of the studies proposed by the Licensees in their PSP, and requested specific modifications to 13 of the studies proposed by the Licensees in their PSP (Table 1.2-1). Provided below are the Licensees' replies to stakeholder specific requests for study modifications. Similar elements of study modifications requested by multiple stakeholders are addressed together. In addition, for each study, the Licensees note if the study in the PSP was modified in this RSP to address FERC comments (Section 2) or to incorporate elements of new studies requested by relicensing participants (Section 3.2).

3.1.1 Aquatic Invasive Species

The Licensees found no specific request to modify this proposed study. However, the study plan that was in the PSP has been modified to address FERC's comments (see Section 2) and to incorporate elements from two requested new studies (see Sections 3.2.7 and 3.2.19). The revised study plan is included in Section 4.1.1.

3.1.2 Quail Lake Fisheries Study (*SWRCB*)

The Licensees included a study named *Quail Lake Fish Populations* in its PSP and have modified and renamed the study as *Quail Lake Fisheries* in its RSP.

The SWRCB's PSP comments state that "The Relicensing participants and the Licensees have come to consensus on the Quail Lake Fish Populations and the Indicators of Alterations study plans." (SWRCB, Attachment A, p. 11).

In its PSP comments, the NMFS did not submit a study request related to Quail Lake fishes, but stated "NMFS supports USFS/SWRCB-35 Fish Populations in Reservoirs study." (NMFS, p. 10). Since the USFS did not submit a Fish Populations in Reservoirs Study request in its PSP comments and the SWRCB is in agreement with the Licensees' study (Section 4.0), the Licensees believe the SWRCB and NMFS concur with the Licensees' *Quail Lake Fisheries Study*.

The Licensees modified the study to address FERC's comments (see Section 2). The revised study plan is included in Section 4.1.2.

3.1.3 Pyramid Reach Fish Populations (*USFS, CDFW, SWRCB and NMFS*)

USFS requested the study be modified to include: (1) additional sampling sites in Pyramid reach, (2) an analysis of the genetics of Santa Ana sucker, and (3) addition of reference sites in Fish Creek and Agua Blanca Creek (USFS, p. 3). The latter request is addressed in Section 1.1.4 of this RSP, and the former two comments are addressed below.

CDFW requested the study be modified to add an analysis of the genetics of Santa Ana sucker (CDFW, p. 10), which is addressed below.

SWRCB requested modifications to the study including: (1) additional sampling sites in Pyramid reach, (2) an analysis of fry emergence, and (3) addition of reference sites (SWRCB, p.9). SWRCB's requested study modifications are addressed below.

NMFS requested the study be modified to include: (1) additional sampling sites in Pyramid reach, and (2) sampling in three tributaries to the Pyramid reach (NMFS, p.6). The latter request is addressed in Section 1.1.4 of this RSP, and the former two comments are addressed below.

The Licensees' replies to these study modification requests are provided below. In addition, the Licensees modified the study to address FERC's comments (see Section 2) and to incorporate elements from two requested new studies (see Sections 3.2.6 and 3.2.8). The revised study plan is included in Section 4.1.3.

Request Modification Elements	Licensees' Reply
Request Element #1 – Additional sampling sites in Pyramid reach *(USFS, SWRCB and NMFS)*	**ADOPTED WITH MODIFICATION.** USFS and CDFW requested the Licensees add six sampling sites to the three proposed by the Licensees in its *Pyramid Reach Fish Populations Study.* The agencies justify the request by stating that number is required to describe the full range of abiotic and biotic variables that may occur over the spatial and temporal extent of the reach. The Licensees disagree with USFS and CDFW given the relatively homogeneous nature of the reach and FERC precedent. The Licensees' study plan includes habitat mapping and placement of the sampling sites in representative mesohabitats, consistent with sampling protocols. Further, there is precedent in other recent California relicensings for three or less sampling locations in long reaches (Criterion 7). For instance, in South Feather Water and Power Agency's South Feather Power Project relicensing, FERC ordered one fish sampling site in the 9.4-mile-long South Fork Feather Diversion Dam Reach and two sites in the 9.1-mile-long Little Grass Valley Diversion Dam. In Nevada Irrigation District's Yuba-Bear Project relicensing, FERC ordered three fish population monitoring sites in the 32-mile-long Milton Diversion Reach and two sites in the 10.4-mile-long Bear River Canal Diversion Dam Reach. Additionally, the Licensees have proposed eDNA sampling over the entire length of the Pyramid reach of Piru Creek for two specific purposes. First, eDNA data will provide data on fish distributions over

	a far larger area than could be covered by three pass depletion surveys using electrofishing, with the added benefit of not risking harm to fish or other wildlife resources. Second, eDNA has been shown (Wilcox et al 2013, and Wilcox et al. 2016) to be more sensitive at detecting rare, cryptic, and elusive fauna than conventional direct methods of sampling.
Request Element # 2 – Conduct genetic analysis of Santa Ana sucker *(USFS and CDFW)*	**ADOPTED WITH MODIFICATION.** USFS and CDFW request the Licensees add an analysis of the genetics of Santa Ana sucker to determine the genetic origins of the resident population. The Licensees are not responsible for determining the genetic origins of species for ESA coverage (Criterion 5). The current literature on Santa Ana sucker indicates that the population in Piru Creek was introduced. The Licensees acknowledge that this may change in time as new research becomes available and will act accordingly if the understanding of this species status changes. In addition, the Licensees' *Pyramid Reach Fish Population Study* proposes to conduct eDNA sampling at 1,640 foot intervals over the entire Pyramid reach of Piru Creek. The proposed task includes the development of a genetic barcode and assay for detecting Santa Ana sucker which currently does not exist. The results of this study will provide valuable data regarding the presence and distribution of Santa Ana sucker in the Pyramid reach. While the samples collected from eDNA sampling will not be adequate for genetic sequencing of individual species, the data will narrow the geographic scope of future efforts to locate these species for genetic testing. If the Licensees are granted the appropriate scientific collecting permits to collect Santa Ana sucker, and individuals are found during field sampling, tissue samples will be collected and turned over to CDFW for analysis.
Request element #3 – Conduct Fry Emergence Sampling *(SWRCB)*	**NOT ADOPTED.** The Licensees did not adopt the fry emergence sampling requested by the SWRCB because the agency did not adequately describe the Project nexus (Criterion 5) for Fish Creek and Agua Blanca Creek. The Licensees perform no work and do not control flows in these creeks. The Licensees did not adopt the SWRCB's requested fry emergence survey in Pyramid reach because the agency did not describe how these data would inform license requirements (Criterion 5). The SWRCB refers to its requested study *Fish Populations (Streams)* (SWRCB, PAD comments section 1b) stating that *"staff believe it is premature to determine that the existing flow regime is protective of the COLD beneficial uses. Determining fry emergence timing is essential to understand the requirements of a flow regime protective of the fishery resource during critical life stages."* The SWRCB proposed study *Fish Populations (Streams)* (SWRCB comments on the PAD, Attachment B, p. 34) only suggests fry emergence sampling in Fish Creek and Agua Blanca Creek. "*Fish Creek and Agua Blanca Creek may be considered as reference sites for this study. The study areas for the fry emergence data gathering will extend no more than 2 miles from the confluence with Piru Creek."* The requested study says nothing more in regard to sampling in Piru Creek. As stated above, the Licensee has no impact on these streams and cannot influence flows or water temperatures in them

	and cannot be responsible for the influence of these tributaries on conditions in the Pyramid reach. Further, the SWRCB's statement that the timing of fry emergence "*is an area of interest to better define fry periodicity in the study area*" (SWRCB comments on the PAD, Attachment B, p. 34) infers this is a research study, and therefore a study that is not needed to inform license requirements as described in Section 1.1.5 of this PSP.

3.1.4 Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study (*USFS, CDFW, and USFWS*)

CDFW (CDFW, p. 10) commented that the study area of Licensees' proposed *Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study* should include Project-affected reaches in the vicinity of the Project, and within one mile of the Project area. CDFW states that "TES reptiles and amphibians known to occur or potentially occurring in the project area have both aquatic and terrestrial phases...Suitable upland habitats contiguous with aquatic habitats are subject to use by TES reptiles and amphibians and need to be included in surveys."

The USFS also provided comparable comments generally applicable to wildlife studies requesting the inclusion of areas outside of the Project boundary upstream and downstream of the Project, and surrounding the Project.

Comments from USFWS (USFWS, p. 3) pertaining to the need for more information on arroyo toad (an ESA-listed species) were directed to this study and similar comments received from USFS (USFS, p. 6) and CDFW (CDFW, p. 6) state that annual monitoring surveys for arroyo performed by the Licensees collect insufficient data and are not "meaningful monitoring." This study requests is therefore addressed herein.

The Licensees' replies to these study modification requests are provided below. In addition, the Licensees modified the study to address FERC's comments (see Section 2) and to incorporate elements from one requested new study (see Section 3.2.17). The revised study plan is included in Section 4.1.4.

Request Modification Elements	Licensees' Reply
Request Element #1 – Expand the study area to include reaches upstream and downstream of the Project and other areas within one mile outside of the Project area *(USFS, CDFW and USFWS)*	**NOT ADOPTED.** The Licensees did not adopt these requests for reasons detailed in Section 1.1.4 and 1.1.5 of the RSP. The agencies provided no evidence to indicate there is a Project effect (nexus) within those areas and therefore the information would not inform license requirements (Criterion 5). The Licensees perform no Project O&M outside the proposed Project boundary. A one-mile radius study area around the Project is arbitrary, unrelated to potential for Project effects, and has not been explained or justified by CDFW or USFS. The seasonal use of certain habitats by species does not necessarily mean that survey methods are applicable to these habitats. CDFW has not indicated how species residing outside of the Project boundary may be affected by normal Project O&M and how the necessary intensive surveys which would be required to document each of the target species is justified in the development of license

	conditions.
Request Element #2 – Include arroyo toad in the Study Plans	**NOT ADOPTED.** The Licensees did not adopt the Request Element for reasons detailed in Section 1.1.5. Licensees believe the RSP, in addition to existing information, will provide adequate information to assess the impacts of the Project on the arroyo toads.

3.1.5 Botanical Resources (*USFS and CDFW*)

CDFW commented on the Licensee's proposed *Botanical Resources Study* (CDFW, p. 11). Generally, the comments state that the proposed study area is insufficient to "…adequately reflect impacts…"

The USFS provided essentially the same comments as CDFW on a need for a buffer around the study area for botanical surveys (USFS, p. 11).

The Licensees' replies to these study modification requests are provided below. In addition, the Licensees modified the study to address FERC's comments (see Section 2) and to incorporate elements from one requested new study (see Section 3.2.17). The revised study plan is included in Section 4.1.4.

Request Modification Elements	Licensees' Reply
Request Element #1 – Addition of at least a 100-foot buffer to the study area *(USFS and CDFW)*	**ADOPTED WITH MODIFICATION.** The Licensees did not adopt the USFS's and CDFW's requests for a minimum of a 100-foot buffer around the study area because the agencies provided no evidence to suggest there is a Project effect (nexus) within that area and, therefore, the information would not inform license requirements (Criterion 5). The Licensees perform no Project O&M outside the proposed study area. However, the Licensees added to the study that Licensees would estimate the extent of an ESA-listed plant species occurrence outside of the study area for those occurrences that are partially within and partially outside of the study area.

3.1.6 Non-Native Invasive Plants Study (*USFS and CDFW*)

CDFW commented on the Licensee's proposed *Non-Native Invasive Plants Study* (CDFW, p. 11). Generally, the comments state that the proposed study area is insufficient to "…adequately reflect impacts…"

The USFS provided essentially the same comments on a need for a buffer around the study area for botanical surveys (USFS, p. 11).

The Licensees' reply to this study modification request is provided below. In addition, the Licensees modified the study to incorporate elements from one requested new study (see Section 3.2.20). The revised study plan is included in Section 4.1.6.

Request Modification Elements	Licensees' Reply
Request Element #1 – Addition of at least a 100-foot buffer to the study area *(USFS and CDFW)*	**ADOPTED WITH MODIFICATION.** The Licensees did not adopt the USFS's and CDFW's requests for a minimum of a 100-foot buffer around the study area because the agencies provided no evidence to suggest there is a Project effect (nexus) within that area and, therefore, the information would not inform license requirements (Criterion 5). The Licensees perform no Project O&M outside the proposed study area. However, the Licensees added to the study that Licensees would estimate the extent of a non-native invasive plant (NNIP) occurrence outside of the study area for those occurrences that are partially within and partially outside of the study area.

3.1.7 Special-Status Terrestrial Wildlife Species – California Wildlife Habitat Relationships Study (*USFS and CDFW*)

The CDFW commented on the Licensees' Special-Status *Terrestrial Wildlife Species-California Wildlife Habitat Relations Study* under four different sections, Wildlife Study Plan - *Large Mammal Movement* (CDFW, pp.4 through 5), Wildlife (*Bats) Study Plan* (CDFW, pp. 5 through 6), and *Special-status Terrestrial Species Study Plan* (CDFW pp. 7 through 10). In general, the comments note that the Licensees' study will not "include protocol or focused surveys for many of the species potentially present within the project area."

Similarly, the USFS comments on the study were included in multiple sections of its comment letter, *Insufficient Data Regarding Species Occurrences and Distribution* (USFS, pp. 7 through 8), and *Licensees Fail to Include a Study Plan for Migratory Birds and Areas of Importance within the Project Area* (USFS, p. 9). In general, the USFS also noted that Licensees' study will not include "focused or protocol surveys … for … migratory birds, special status terrestrial species, bats, raptors (outside of bald/golden eagle and burrowing owl) and aquatic species (outside of California red-legged frog, foothill yellow-legged frogs and spadefoot toad)…" (USFS, pp. 7 through 8).

The Licensees' replies to these study modification requests are provided below. In addition, the Licensees modified the study to address FERC's comments (see Section 2) and to incorporate elements from five requested new studies (see Section 3.2.13, 3.2.14, 3.2.15, 3.2.16 and 3.2.18). The revised study plan is included in Section 4.1.7.

Request Modification Elements	Licensees' Reply
Request Element #1 – Large Mammal Movement – Include identification of potential Project barriers to wildlife movement *(CDFW)*	**ADOPTED.** The Licensees will generate a map showing the location of Project features (roads, fences, transmission line corridors, developed recreation sites, maintenance areas, parking lots, and proposed construction/staging areas) that could act as potential barriers to wildlife movement as part of the study.
Request Element #2 – Bat Study Plan – Include an	**NOT ADOPTED.** The Licensees did not adopt this request element because the Licensees intend to propose in their DLA and Final

evaluation of natural roost sites and Project related structures within the study area *(CDFW)*	Application for a New License (FLA) a measure to manage bats. The first action under the Bat Management measure would be to document bat roosts within Project facilities after the license is issued. The measure would contain the same requirement whether information on bat roosts was gathered during relicensing study or not. Therefore, the information from the sampling proposed by CDFW would not inform the requirements of the Licensees' proposed measure (Criterion 5). Licensees note that such a measure is consistent in recent California relicensings, such as for the Yuba River Development Project, FERC Project No. 2246; Yuba-Bear Hydroelectric Project, FERC Project No. 2266; Drum-Spaulding Project, FERC Project No. 2310; and Merced River Hydroelectric Project, FERC Project No. 2179.
Request Element #3 – Bat Study Plan – Add focused surveys, including acoustic sampling, mist net sampling, and winter hibernacula evaluation *(CDFW)*	**NOT ADOPTED.** The Licensees did not adopt this request element for the reasons described in the Licensees' reply to Request Element #2.
Request Element #4 – Study Plan for Migratory Birds - Perform the study within the FERC Project Boundary and Project affected stream reaches in the vicinity of the Project dams (e.g., within 5.0 miles or all suitable habitat contiguous in the immediate vicinity of the Project area) *(CDFW)*	**NOT ADOPTED.** The Licensee's *Special-status Raptors* and *Special-status Terrestrial Wildlife Species – CWHR Study* are designed to assess potential Project effects on wildlife within a reasonable area of Project activities, including buffers as needed. The request for a 5-mile buffer for all bird surveys well exceeds the precedents of other recent relicensings in California, including Camp Far West Hydroelectric Project (FERC Project No. 2997), Yuba-Bear Hydroelectric Project (FERC Project No. 2266), Upper American River Project (FERC Project No. 2101), Yuba River Development Project (FERC Project No. 2246), Don Pedro Project (FERC Project No. 2299), and South Feather Power Project (FERC Project No. 2088).
Request Element #5 – Conduct Field Surveys using established protocol surveys, where one exists *(CDFW)*	**NOT ADOPTED.** The Licensees did not adopt this requested element for two reasons. CDFW's Request Element (p. 10) does not just request protocol surveys, but also "…where protocol surveys do not exist, focused surveys should be conducted…" Licensees would be responsible to determine where and how these 'focused surveys' would occur using "…a review of the species life history…" (p. 10), essentially requiring Licensees to develop their own protocols for surveying of species lacking protocol surveys. CDFW does not provide enough detail as to how these focused surveys should be developed or implemented to determine if their request "…is consistent with generally accepted practice in the scientific community…" (Criterion 6) or what the cost would be to develop and implement these 'focused surveys' (Criterion 7). Second, the proposed approach for special-status wildlife studies for the Project, with focused surveys for a specific subset of potentially occurring wildlife species and a CWHR based study for all others has been used on multiple relicensings in California, including the Yuba-Bear Hydroelectric Project (FERC Project No. 2266), Drum-Spaulding Project (FERC No. 2310), French Meadows Transmission Line Project (FERC Project No. 2479), and the Upper American River

	Project (FERC Project No. 2101), for mesocarnivores, with the approval of FERC (and in consultation with the CDFW and USFS, when NFS lands present). Licensees also note that a similar approach was recently proposed for the Camp Far West Transmission Line (FERC Project No. 10821), and the CDFW did not provide any specific comments on the CWHR study plan methodology. Multiple other relicensings, including the Yuba River Development Project (FERC Project No. 2246), Don Pedro Project (FERC Project No. 2299), South Feather Power Project (FERC Project No. 2088), Narrows No. 2 Transmission Line (FERC Project No. 2678), and the Donnells-Curtis Transmission Line (FERC Project No. 2118) surveyed only for a specific subset of potential wildlife species and did not conduct any additional studies for special-status wildlife (including a CWHR study), also with the approval of FERC (and in consultation with CDFW and USFS, when NFS lands present). All of these projects, with the exception of the Camp Far West Transmission Line, have completed their studies and license applications, with license conditions (including for wildlife), and several have been issued new licenses by FERC. There are nearly 60 species of special-status wildlife with the potential to occur on the Project, most of them occupying multiple habitats. Many of these species lack survey protocols, and for those that have one, a single year (or two) of surveys is considered insufficient to determine presence or absence on the Project, based on agency comments and results from other relicensings. Therefore, their presence would ultimately be presumed anyway. The proposed study protocol would ground truth habitat types, increasing information about where species might occur on the Project and correcting errors (such as the less than one percent of the Project acres that were identified as juniper) in the CWHR/CalVEG types. Incidental sightings will add to this information with specific locations for any special-status wildlife seen during other studies. Per other relicensings, all Project activities will be assessed for their potential impacts to wildlife based on the habitat the activity occurs in and the wildlife that could inhabit the area, as well as the particulars of each activity. Therefore, the proposed CWHR study, incidental sightings and specific protocol surveys for a subset of wildlife species conforms to other relicensings successfully completed in California and will provide sufficient information for FERC and all relevant agencies to develop necessary license conditions (Criterion 5).
Request Element #6 – Provide additional data regarding species occurrences and distribution *(USFS)*	**NOT ADOPTED.** See discussion under Request Elements #3 and #4.
Request Element #7 – Add migratory birds and areas of importance within the Project area *(USFS)*	**NOT ADOPTED.** See discussion under Request Elements #3 and #4.

3.1.8 ESA-Listed Plants (*USFS and CDFW*)

CDFW commented on the Licensees' proposed *Botanical Resources Study* with comments that are also germane to the Licensees' proposed *ESA-listed Plants Study* (CDFW, pp. 11). Generally, the comments state that the proposed study area is insufficient to "…adequately reflect impacts…"

USFS provided essentially the same comments on a need for a buffer around the study area for botanical surveys (USFS, pp. 11).

CDFW's and USFS' comments on surveys in Piru Creek and above Pyramid Lake are addressed in Section 1.1.4 of the RSP.

The Licensees' reply to this study modification request is provided below. The revised study plan is included in Section 4.1.8.

Request Modification Elements	Licensees' Reply
Requested Element #1 – Expand the study area to include a buffer of a minimum 100 feet *(CDFW and USFS)*	**ADOPTED WITH MODIFICATION.** The Licensees did not adopt the CDFW's and USFS' requests for a buffer because the agencies provided no evidence to suggest there is a Project effect (nexus) within that area and therefore the information would not inform license requirements (Criterion 5). The Licensees perform no Project O&M outside the proposed Project boundary. Licensees added to the study that the Licensees would estimate the extent of an ESA-listed plant species occurrence outside of the study area for those occurrences that are partially within and partially outside of the study area.

3.1.9 ESA-Listed Amphibians – California Red-legged Frog Study (*USFS, CDFW and USFWS*)

USFS and CDFW commented that the RSP should include CRLF protocol surveys "in all areas potentially impacted by Project activities." USFS (USFS, p. 9) and CDFW (CDFW, p. 7) include the same comments that "since Sandburg conducted surveys in 2006, no focused or protocol surveys have been conducted for CRLF in the Project area...The surveys conducted for the arroyo toad have not included protocol CRLF surveys...[which] require visit intervals and frequencies not achieved during the arroyo toad surveys."

USFWS (USFWS, p. 2) noted that terrestrial habitats adjacent to aquatic areas used by CRLF are essential in maintaining CRLF populations and that USFWS (2005) provides guidance of assessment of these terrestrial habitats.

The Licensees' replies to these study modification requests are provided below. In addition, the Licensees modified the study to incorporate elements from one requested new study (see Section 3.2.17). The revised study plan is included in Section 4.1.9.

Request Modification Elements	Licensees' Reply
Request Element #1 – Include protocol, presence/absence surveys for CRLF in all areas potentially affected by the Project *(USFS and CDFW)*	**NOT ADOPTED.** The Licensees did not adopt the requests to conduct protocol surveys for CRLF. The geographic scope of the study request is the Project boundary and areas extending one mile from the Project. With regard to Criterion 5, Project nexus and development of license requirements, USFS and CDFW have not adequately explained the nexus between Project O&M and Project effects that justify the study request, specifically in regards to the need for surveys, as opposed to the proposed habitat assessments, or the geographic scope of the request, or indicated how the information would be used to develop license requirements. The Licensees' reasons for not adopting the request for surveys upstream and downstream of the Project are detailed in Section 1.1.4 and 1.1.5 of the RSP. The Licensees perform no Project O&M outside the proposed Project boundary. A one-mile radius study area around the Project is arbitrary, unrelated to potential for Project effects, and has not been explained or justified by USFS and CDFW. The Licensees also question the value of CRLF surveys for relicensing because surveys that do not document the presence of CRLF at a site are only considered valid for two years (USFWS 2005). This suggests that regardless of survey results, an effects determination would have a limited "shelf-life" much shorter than the relicensing process and the resulting FERC license term. In addition, protocol surveys would require that all potentially suitable habitat within one mile of the Project must be surveyed (USFS 2005), including private lands where survey access is likely to be denied. Failure to survey any site within one mile of the Project would require USFWS to assume CRLF presence at those sites, the same result as exists if no surveys were performed.
Request Element #2 – Add text indicating to the use of riparian and upland habitats by CRLF *(USFWS)*	**ADOPTED.** The comments are noted and additional text regarding terrestrial habitats was included in the study.

3.1.10 ESA-Listed Riparian Bird Species – Southwestern Willow Flycatcher, Least Bell's Vireo, and Yellow-billed Cuckoo Riparian Habitat Evaluations Study (*USFS, CDFW and USFWS*)

USFWS requested the study be modified to include protocol level surveys for yellow-billed cuckoo if suitable habitat is present in areas affected by the Project (USFWS, p. 3). CDFW (CDFW, pp. 9 through 10) and USFS (USFS, pp. 7 through 8) also requested surveys for this species.

In addition, USFS and CDFW requested the inclusion of areas outside of the Project boundary upstream and downstream of the Project, and surrounding the Project.

The Licensees' replies to these study modification requests are provided below. In addition, the Licensees modified the study to address FERC's comments (see Section

2) and to incorporate elements from two requested new studies (see Sections 3.2.16 and 3.2.17). The revised study plan is included in Section 4.1.10.

Request Modification Elements	Licensees' Reply
Request Element #1 – Conduct protocol surveys for yellow-billed cuckoo if suitable habitat is present in areas affected by the Project *(USFWS)*	**ADOPTED WITH MODIFICATION.** The study plan was modified to include protocol presence/absence surveys for yellow-billed cuckoo in areas that are identified by the study as representing potential breeding habitat. The surveys would follow the latest, accepted protocols for yellow-billed cuckoo as described in Halterman et al. (2016). These surveys would be performed within the proposed Project boundary.
Request Element #2 – Include areas outside of the proposed Project boundary upstream and downstream of the Project and surrounding the Project in the study area *(USFS and CDFW)*	**NOT ADOPTED**. The Licensees did not adopt these requests for reasons detailed in Section 1.1.4 and 1.1.5 of the RSP. The agencies provided no evidence to indicate there is a Project effect (nexus) within those areas and therefore the information would not inform license requirements (Criterion 5). The Licensees perform no Project O&M outside the proposed Project boundary.

3.1.11 Recreation Facilities Demand Analysis and Condition Assessment Study

The Licensees found no specific request to modify this proposed study. However, the study plan that was in the PSP has been modified to address FERC's comments (see Section 2) and to incorporate elements from four requested new studies (see Sections 3.2.21, 3.2.26, 3.2.27 and 3.2.28). The revised study plan is included in Section 4.1.11.

3.1.12 Cultural Resources Study (*USFS*)

The USFS provided two comments on the Licensees *Cultural Resources Study* (USFS, p. 376).

The Licensees' replies to these study modification requests are provided below. In addition, the Licensees modified the study to address FERC's comments (see Section 2). The revised study plan is included in Section 4.1.12.

Request Modification Elements	Licensees' Reply
Request Element #1 – Include ridgelines and knobs in study area *(USFS)*	**ADOPTED.** The Licensees adopted the requested change to the *Cultural Resources Study* by adding the following sentence to the study: "All topographical features encountered in moderate areas and considered to be sensitive for cultural resources (e.g., springs, benches, terraces, ridgelines, knobs, and drainages) will be thoroughly inspected."
Request Element #2 – Include; the land managing agency *(USFS)*	**ADOPTED.** The Licensees adopted the requested change to the *Cultural Resources Study* by adding the following sentence to the study: "Additional fieldwork and evaluation procedures may be required based on coordination with Native American tribes, FERC, land managing agencies, and SHPO."

3.1.13 Tribal Resources Study (*USFS*)

The USFS provided two comments on the Licensees' *Tribal Resources Study* (USFS, p. 385 and p. 387).

The Licensees' replies to these study modification requests are provided below. In addition, the Licensees modified the study to address FERC's comments (see Section 2). The revised study plan is included in Section 4.1.13.

Request Modification Elements	Licensees' Reply
Request Element #1 – Add… "in addition, the study will also consult with the appropriate land manager, Angeles National Forest (ANF), Southern California Forest Land and Resource Management Plans (LMP), United States Department of the Interior, Bureau of Land Management (BLM), etc., in an effort to identify potential local Native American contacts and informants that could provide significant information to the study that are not represented on the Native American Heritage Commission Contact List *(USFS)*	**ADOPTED.** The Licensees adopted the requested change in the Tribal *Resources Study*.
Request Element #2 – Add…And if tribal resources are identified on federal lands, the final report will be provided to the appropriate land managing agency (ANF, Los Padres National Forest [LPNF], BLM) *(USFS)*	**ADOPTED.** The Licensees adopted the requested change in the *Tribal Resources Study*.

3.1.14 Indicators of Hydrologic Alteration Study (*USFS, SWRCB, and NMFS*)

The SWRCB's PSP comment states that "the Relicensing participants and the Licensees have come to consensus on the Quail Lake Fish Populations and the Indicators of Alterations study plans. (SWRCB, Attachment A, p. 11), and the USFS' PSP comments state "Provided the study plan presented in the revised PSP meets the needs of the SWRCB, the Forest Service believes the information collected will be sufficient for use in setting 4(e) conditions that protect reservation resources (USFS, p. 141). In addition, in its PSP comments, NMFS did not submit a hydrologic alteration study request, but stated it supported the USFS' and SWRCB's study requests. The Licensees have included in this RSP the collaboratively-agreed to study plan, with minor clarifications to address FERC staffs' comments (see Section 2.0). Therefore, the

Licensees believe the USFS, SWRCB and NMFS concur with the Licensees' *IHA Study* in this RSP.

However, CDFW re-submitted in its PSP comments the *IHA Study* that was in its PAD comments. This study is now wholly consistent with the study agreed to by the Licensees, SWRCB, USFS and NMFS.

The Licensees modified the study to address FERC's comments (see Section 2) and to incorporate elements from CDFW's requested new study (see Section 3.2.11). The revised study plan is included in Section 4.1.14.

3.1.15 Scenic Integrity Study

The Licensees found no specific request to modify this proposed study. However, the study plan that was in the PSP has been modified to address FERC's comments (see Section 2) and to incorporate elements from one requested new study (see Section 3.2.25). The revised study plan is included in Section 4.1.15.

3.1.16 Water Quality and Temperature Study (*USFS, CDFW, NMFS, and SWRCB*)

CDFW and USFS provided nearly identical comments on the Licensees' *Water Quality and Temperature Study* (CDFW, p. 4, and USFS, p. 10). In general, the comments state that the Licensees' PSP is not adequate to assess potential impacts by the Project.

In its PSP comments, NMFS did not submit a study request related to Water Quality and Temperature, but stated its support for USFS/SWRCB-9, Water Quality and USFS/SWRCB-32, Water Temperature Model.

SWRCB commented on the Licensees' *Water Quality and Temperature Study* (SWRCB, Attachment A, pp. 5 through 8). In general, the comments are similar to the USFS and CDFW with a few exceptions.

The Licensees' replies to these study modification requests are provided below. In addition, the Licensees modified the study to address FERC's comments (see Section 2) and to incorporate elements from two requested new studies (see Sections 3.2.9 and 3.2.31). The revised study plan is included in Section 4.1.16.

Request Modification Elements	Licensees' Reply
Request Element #1 – Determine if water quality is affecting reproductive success of WPT *(USFS and CDFW)*	**NOT ADOPTED.** The Licensees did not adopt CDFW's and USFS' request to study if water quality is affecting reproductive success of WPT. CDFW and USFS did not provide any evidence to suggest that there is a Project-related problem with WPT in the Pyramid reach. As stated in Section 1.1.4 of this RSP, "If the study request is an attempt to search for a project effect, it does not meet the criteria for a study request."

Request Element #2 – Expand study area to upstream of Pyramid Lake *(CDFW, USFS and SWRCB)*	**NOT ADOPTED**. The Licensees did not adopt SWRCB's, CDFW's and USFS' request for water quality sampling upstream of Pyramid Lake for the reasons stated in Section 1.1.4 of this RSP. The Project has no effects on upstream water quality and thus there is no Project nexus for the study (Criterion 5).
Request Element #3 – Add a second year of sampling *(CDFW)*	**NOT ADOPTED.** The Licensees did not adopt the request for a second year of sampling because the ILP provides a process to modify a study if a second year of studies is needed, so there is no need to include such a provision in the study. Specifically, the ILP requires that an applicant produce an Initial Study Report (ISR) that includes the results of the first year of studies, and that if stakeholders believe the first-year studies warrant additional study, the party may request that the study be modified to include an additional data collection.
Request Element #4 – Add sampling for recreation-related activities *(SWRCB and CDFW)*	**NOT ADOPTED.** The Licensees did not adopt sampling for total coliform, fecal coliform, *Escherichia coli* and petroleum hydrocarbons. SWRCB did not provide any evidence to suggest that any of these parameters are an issue within the proposed Project boundary, especially Quail Lake that supports non-contact recreation and in Pyramid reach, where there are no Project recreation facilities (Criterion 5). Further SWRCB and CDFW do not provide any evidence to suggest that there is a Project-related problem with these constituents in Pyramid Lake or Pyramid reach. As stated in Section 1.1.4, "If the study request is an attempt to search for a project effect, it does not meet the criteria for a study request."
Request Element #5 – Install and maintain local meteorological stations *(SWRCB)*	**NOT ADOPTED**. SWRCB requested the Licensees establish and maintain as part of the study local meteorological stations. In particular, the SWRCB states that the stations are needed to determine the degree to which the Project effects water temperature in Pyramid reach and that such stations are "common practice" in FERC relicensings. The SWRCB does not describe why the stations are needed given that existing meteorological stations occur in the area, and the SWRCB does not describe how the data collected by such stations would be used to determine how the Project effects water temperature. Further, meteorological station data have only been used in recent FERC relicensings in California if a water temperature model was being developed (which it is not in this relicensing), and then new stations were only required if it was clearly demonstrated that existing meteorological stations did not provide adequate data for the modeling.
Request Element #6 – Monitor for pesticides in Pyramid Lake *(SWRCB and CDFW)*	**ADOPTED WITH MODIFICATION.** The Licensees *Water Quality and Temperature Study* includes sampling for two pesticides; chlorpyrifos and diazinon. Pesticides or other compounds in the water originating from outside of the Project are not the responsibility of the Licensees and Project operations have no way to affect these compounds. Additionally, the Licensees' PAD described the uses of pesticides on the Project. Pesticide use at the Project by the Licensees is governed by well-known recommended application practices that are deemed to be best practices for protecting the environment.

3.1.17 Fish Entrainment Risk Assessment Study (*NMFS*)

NMFS made a single, limited comment on the Licensees' proposed *Fish Entrainment Risk Assessment Study*. NMFS commented on a lack of scope, but did not elaborate as to how the scope might be expanded.

The Licensee cannot address this comment due to the general lack of content. The Licensees modified the study to address FERC's comments (see Section 2) and to incorporate elements from one requested new study (see Section 3.2.33). The revised study plan is included in Section 4.1.17.

3.1.18 ESA-Listed Terrestrial Wildlife Species – California Wildlife Habitat Relationships Study (*USFS and CDFW*)

The CDFW provided specific comments on the Licensees' *ESA-listed Terrestrial Wildlife Species - California Wildlife Habitat Relationships Study* (CDFW, p. 10). In general, the comments pertained to the need for protocol or 'focused' surveys for all species in all areas with suitable habitat.

The USFS made similar comments pertaining to all special-status wildlife species, including ESA-listed, about the protocol proposed in the study (USFS, pp. 7 through 8).

The Licensees' replies to these study modification requests are provided below. In addition, the Licensees modified the study to incorporate elements from two requested new studies (see Sections 3.2.16 and 3.2.17). The revised study plan is included in Section 4.1.18.

Request Modification Elements	Licensees' Reply
Request Element #1 – Perform the study within the FERC Project Boundary and Project affected stream reaches in the vicinity of the Project dams (e.g., within 1.0 miles or all suitable habitat contiguous in the immediate vicinity of the Project area) *(CDFW)*	**NOT ADOPTED.** The Licensees' *ESA-listed Terrestrial Wildlife Species- CWHR Study* is designed to assess potential Project effects on wildlife within a reasonable area of Project activities, including buffers as needed. The request for a 1-mile buffer for all species is arbitrary, unrelated to potential for Project effects, and has not been explained or justified by CDFW or USFS.
Request Element #2 – Conduct Field Surveys - Conduct established protocol surveys, where one exists *(CDFW)*	**NOT ADOPTED.** CDFW's Request Element (p. 9-10) does not just request protocol surveys, but also "…where protocol surveys do not exist, focused surveys should be conducted…" Licensees would be responsible to determine where and how these 'focused surveys' would occur using "…a review of the species life history…" (p. 10), essentially requiring Licensees to develop their own protocols for surveying of species lacking protocol surveys. CDFW does not provide enough detail as to how these focused surveys should be developed or implemented to determine if their request "…is consistent with generally accepted practice in the scientific community…" (Criterion 6) or what the cost would be to develop and implement these 'focused surveys' (Criterion 7).

	Inexplicably, given the scope of the requested study, CDFW states that "Licensees surveyors will conduct established protocol surveys, where one exists" without specifying any specific protocols. The proposed approach for ESA-listed wildlife studies for the Project, with focused surveys for a specific subset of potentially occurring wildlife species and a CWHR based study for all others has been used on multiple relicensings in California, including the Yuba-Bear Hydroelectric Project (FERC Project No. 2266), Drum-Spaulding Project (FERC No. 2310), French Meadows Transmission Line Project (FERC Project No. 2479), and the Upper American River Project (FERC Project No. 2101), for mesocarnivores, with the approval of FERC (and in consultation with the CDFW and USFS, when NFS lands present). Licensees also note that a similar approach was recently proposed for the Camp Far West Transmission Line (FERC Project No. 10821), and the CDFW did not provide any specific comments on the CWHR study plan methodology. Multiple other relicensings, including the Yuba River Development Project (FERC Project No. 2246), Don Pedro Project (FERC Project No. 2299), South Feather Power Project (FERC Project No. 2088), Narrows No. 2 Transmission Line (FERC Project No. 2678), and the Donnells-Curtis Transmission Line (FERC Project No. 2118) surveyed only for a specific subset of potential wildlife species and did not conduct any additional studies for special-status wildlife (including a CWHR study), also with the approval of FERC (and in consultation with CDFW and USFS, when NFS lands present). All of these projects, with the exception of the Camp Far West Transmission Line, have completed their studies and license applications, with license conditions (including for wildlife), and several have been issued new licenses by FERC. Many species lack survey protocols, and for those that have one, a single year (or two) of surveys is considered insufficient to determine presence or absence on the Project, based on agency comments and results from other relicensings. Therefore, their presence would ultimately be presumed anyway. The proposed study protocol would ground truth habitat types, increasing information about where species might occur on the Project and correcting errors (such as the less than one percent of the Project acres that were identified as juniper) in the CWHR/CalVEG types. Incidental sightings will add to this information with specific locations for any ESA-listed wildlife seen during other studies. Per other relicensings, all Project activities will be assessed for their potential impacts to wildlife based on the habitat the activity occurs in and the wildlife that could inhabit the area, as well as the particulars of each activity. Therefore, the proposed CWHR study, incidental sightings and specific protocol surveys for a subset of wildlife species conforms to other relicensings successfully completed in California and will provide sufficient information for FERC and all relevant agencies to develop necessary license conditions (Criterion 5).
Request Element #3 – Insufficient Data Regarding Species Occurrences and Distribution (USFS)	**NOT ADOPTED.** See discussion under Request Element #2.

3.2 REPLY TO STAKEHOLDER STUDY REQUESTS

In their PSP letters, the commenters requested 36 new studies. The Licensees adopted with modification four of the requested new studies and included them as new studies in this RSP through the study name might have been modified to be more descriptive of the study scope. The Licensees incorporated elements of 19 of the requested new studies into the Licensees' proposed studies, and did not adopt any elements of 13 of the requested new studies. Provided below are the Licensees' replies to stakeholder new study requests. Similar elements of study requested by multiple stakeholders are addressed together.

Based on the commenters' estimates, implementation of the 36 new requested studies would cost between approximately $4.6 and $6.3 million. However, the Licensees believe in many cases that the commenters significantly underestimated the costs of their requested new studies. The Licensees estimate that implementation of the new requested studies would cost between $9.4 and $13.7 million. In comparison, the Licensees' proposed studies are estimated to cost between $3.2 and $4.4 million, and, with existing information and information being collected by the Licensees under the existing license, would provide an adequate record to assess Project effects and to inform proposed requirements in the new license.

3.2.1 Bioaccumulation Study Request (*USFS and CDFW*)

USFS requested a study named *Bioaccumulation* in its PAD comments and has resubmitted it with a minor change to the study goals in its PSP comments (USFS, pp. 3 through 14). In general, the goal of the requested study has been changed to provide the USFS "with the information needed to develop 4(e) conditions for the protection of targeted species such as Forest Service special status species, piscivorous raptors (Ospreys, Bald eagles, California Condors, etc.) as well as piscivorous and zooplanktivorous fish. " (USFS, p. 3). The study area would include Pyramid Lake and Quail Lake. USFS estimated the cost to complete its requested study between $100,000 and $120,000.

The CDFW requested a study named *Bioaccumulation* (CDFW, pp. 17 through 27) in its PSP comments. The CDFW's study goals are similar to the USFS' study goals. The CDFW states the goal of its study is to provide the California Office of Environmental Health Hazard Assessment (OEHHA) with the "information needed, if any, to develop consumption recommendations for targeted species." (CDFW, p. 17). The CDFW estimated the cost to complete its requested study between $100,000 and $120,000.

As described below, the Licensees have not adopted the study requests.

Request Elements	Licensees' Reply
Request Element #1 – Conduct a bioaccumulation study	**NOT ADOPTED.** The Licensees have not adopted the USFS', CDFW's and SWRCB's request for a *Bioaccumulation Study* for three reasons. First, the Commission previously rejected a request for a bioaccumulation study for the agencies under similar circumstances. In its September 14, 2009 Study Plan Determination for the Merced

	River Hydroelectric Project (FERC Project No. 2179), the Commission stated, "but because MID [Merced Irrigation District, the applicant] is not proposing to alter project operations to increase water fluctuations or mobilize substrates, we find the study is not necessary. In their August filing, the Resource Agencies and Conservation Groups suggest that the existence of Project impoundments provides a nexus between the Project and mercury bioaccumulation. We note that the baseline for the NEPA analysis of the Project is existing conditions, not the original construction of the Project reservoirs. Due to the lack of a nexus between Project operation and the resource to be studied, and because the proposed study would not inform the development of license requirements (Criterion 5), we do not adopt this requested study." Thus, the Commission itself declined to require a similar requested study because it did not have a Project nexus and would not inform license requirements, and should draw the same conclusion here (Criterion 5). As in the Merced Project, there is no nexus between Project operations and their effect on bioaccumulation. The USFS states: "The California Department of Water Resources (DWR) and the Los Angeles Department of Water and Power (LADWP) (Licensees) continued O&M of the existing South SWP Hydropower Project (Project) has a potential to increase methyl mercury, arsenic, cadmium, copper, selenium, silver, polychlorinated biphenyls, legacy pesticides, polybrominated diphenyl ethers, dioxins, dibenzofurans, organophosphates, polycyclic aromatic hydrocarbons, tributyltin, microcystin, Omega-3 fatty acids, and other emerging contaminants in the system, making it available for bioaccumulation through various trophic levels of the aquatic ecosystem," but offers no explanation as to the mechanism through which Project O&M would do this. Similarly, the SWRCB's request states: "Impoundment of water (including accumulation of sediment) and operation of Project facilities have the potential to increase the bioavailability of chemicals of concern, particularly mercury." While the disturbance of sediments in reservoirs can promote the mobilization of mercury, Pyramid Lake is operated under strict limitations on the levels to which water surface elevations can fluctuate. Quail Lake is operated as a forebay to the William E. Warne Powerplant and, as such, does not experience significant fluctuations in water surface elevation. Further, the Licensees do not propose to alter operations in a manner that would change these minor reservoir fluctuations or in any way disturb sediment in the reservoirs. Nor does the Project use any of the chemicals described by the SWRCB. In short, neither the USFS nor SWRCB has established a reasonable Project nexus. (Criterion 5) Second, both the CDFW and SWRCB base their study requests on their stated need for information for OEHHA. However, the Licensees note that OEHHA, the California agency with jurisdiction to collect such information and to limit recreational fishing at Quail Lake and Pyramid Lake, has not expressed any need for the information. Nor does CDFW or the SWRCB state that OEHHA advised them that a need exists. (Criterion 4) Third, neither the CDFW nor the SWRCB have provided any evidence regarding why the information on which OEHHA established

	health advisory guidelines for eating fish from Pyramid Lake in 2013 is no longer adequate (Criterion 4). Given this explanation, the Licensees have not addressed in this reply the various elements in the USFS', CDFS's and SWRCB's study requests.

3.2.2 Physical Habitat Simulation (PHABSIM) for Fish Populations Downstream of Pyramid Lake Study Request *(USFS)* and Physical Habitat Simulation (PHABSIM) for Fish Populations Upstream and Downstream of Pyramid Lake Study Request *(CDFW)*

USFS initially requested a study named *Physical Habitat Simulation (PHABSIM) for Fish Populations Upstream and Downstream of Pyramid Lake* in its PAD comments and has resubmitted it updated in its PSP comments and titled *Physical Habitat Simulation (PHABSIM) for Fish Populations Downstream of Pyramid Lake* (USFS, pp. 15 through 24). In general, the goal of the requested study is "to quantify fish habitat as a function of stream flow" (USFS, p. 15). The requested study would include selecting final study sites and transect locations in the study reaches in consultation with resource agencies. The plan states that PHABSIM modeling would focus on rainbow trout (*O. mykiss*), arroyo chub (*Gila orcutti*), Santa Ana sucker (*Catostomus santaanae*) and arroyo toad (*Catostomus santaanae*). The USFS states that the results of the PHABSIM study would be used in setting an appropriate flow regime (i.e., magnitude, timing, and duration) in order to ensure the long-term viability of aquatic species downstream of Pyramid Lake (USFS, p. 15). USFS estimated the cost to complete its requested study between $180,000 and $250,000.

The CDFW requested a new study named *Physical Habitat Simulation (PHABSIM) for Fish Populations Upstream and Downstream of Pyramid Lake,* in its PAD comments and has resubmitted it updated in its PSP comments (CDFW, Appendix A, pp 12 through 20). The CDFW request in its PSP comments is essentially identical to its request in its PAD comments and is identical to the USFS' requested study in their initial PAD comments. Section 6.1 (Study Area) of the study request states that the study would be conducted in six reaches but then only identifies two: (1) Pyramid reach, including the 18-mile-long section from Pyramid Dam to the Blue Point Campground; and (2) Castaic Reach, including the five-mile long section from Elderberry Forebay to the confluence of Dry Creek. CDFW's study does not identify a study reach upstream of Pyramid Lake though CDFW's study plan title suggests otherwise. CDFW estimated the cost to complete its requested study between $180,000 and $250,000.

The Licensees note that NMFS stated its support for the other federal and State agencies' requests regarding habitat and flow (PHABSIM) modeling of salmonid life stages and barrier assessment in Pyramid reach in its PAD comments and its PSP comments, but NMFS did not request any specific studies. NMFS states that the agencies' requests would inform how the Project could potentially affect *O. mykiss*, and that these fish will play an important role in the recovery of the endangered Southern California steelhead population.

As described below, the Licensees did not adopt the USFS' and CDFW's, requested studies. The Licensees do not agree that the requests would inform how the Project could potentially affect *O. mykiss*, for the reasons stated in Section 1.1.5 of this RSP. Further, the Licensees have not addressed a PHABSIM study upstream of Pyramid Lake because, besides in their study requests title, neither USFS' nor CDFW's study request mention such a study upstream of Pyramid Lake.

Request Elements	Licensees' Reply
Request Element #1 – Conduct a PHABSIM study in Pyramid reach	**NOT ADOPTED**. The Licensees did not adopt the USFS' and CDFW's request for a PHABSIM study in Pyramid reach for the reasons stated in Section 1.1.5 of this RSP. Because the current flow regime is required by the ESA to prevent unauthorized take of arroyo toads, a study of impacts of alternative flow regimes on fish habitat (and arroyo toad habitat in the case of the USFS request) is not likely to inform development of new license conditions. In addition, the current flow regime mimics the natural hydrograph in both volume and timing with limited exceptions such as the addition of up to 3,150 acre-feet of water delivery in the winter months in association with a natural runoff event. The requesting agencies have not demonstrated a biological need to further examine and model species specific flow-habitat relationships nor have they provided documentation that the current flow regime is not protective of arroyo toad (Criterion 5). Given this explanation, the Licensees have not addressed in this reply the elements in the USFS' and CDFW's request that are specifically related to the development of a PHABSIM model and subsequent analysis in Pyramid reach.
Request Element #2 – Conduct a PHABSIM study upstream of Elderberry Forebay on 5 miles of Castaic Creek	**NOT ADOPTED.** The Licensees did not adopt the CDFW request for a PHABSIM study in Castaic Creek upstream of check-dam basins for reasons stated in Section 1.1.4 of this RSP. The Project has no effects on upstream fish habitat and thus there is no Project nexus for the study. Further, it is not clear if the study request provided in CDFW's PSP comments is updated as it appears to be identical to the original USFS study request which was updated in their PSP comment with only the Pyramid reach being identified for the PHABSIM study. Given this explanation, the Licensees have not addressed in this reply the elements in the CDFW's request that are specifically related to the development of a PHABSIM model and subsequent analysis in Castaic Creek upstream of check-dam basins.

3.2.3 Algae Upstream, Downstream and Within Pyramid Lake Study Request (*USFS and CDFW)*

USFS requested a study named *Algae Upstream, Downstream and Within Pyramid Lake* in its PAD comments and has resubmitted it unchanged with the exception of estimated cost to complete in its PSP comments (USFS, pp. 25 through 43). In general, the goal of the requested study is "to characterize algal assemblages within Project-affected reaches upstream (control), downstream and within Pyramid Dam using the

Surface Water Ambient Monitoring Program (SWAMP) protocols…" (USFS, p. 25). The study area would include areas of Piru Creek and tributaries above Pyramid Lake, Pyramid Dam, and Pyramid reach and tributaries. Pyramid Dam would be sampled for floating and suspended algae. USFS estimated the cost to complete its requested study between $250,000 and $350,000.

The CDFW requested a new study named *Algae Upstream, Downstream and Within Pyramid Lake* (CDFW, Appendix A, pp. 21 through 39) in its PSP comments. The CDFW's study goals are similar to the USFS' study goals. The CDFW states the goal of its study is "to characterize algal assemblages within Project-affected reaches upstream (control), downstream and within Pyramid Dam using the Surface Water Ambient Monitoring Program (SWAMP) protocols…" (CDFW, Appendix A, pp. 37). The CDFW estimated the cost to complete its requested study between $250,000 and $350,000.

As described below, the Licensees have not adopted the study requests.

Request Elements	Licensees' Reply
Request Element #1 – Conduct algae sampling in Piru Creek upstream of Pyramid Lake	**NOT ADOPTED.** The Licensees did not adopt the USFS' and CDFW's requests for an algae study in Piru Creek upstream of Pyramid Lake for the reasons stated in Section 1.1.4 of this RSP. The Project has no effects on upstream water quality and thus there is no Project nexus for the study (Criterion 5). Given this explanation, the Licensees have not addressed in this reply the elements in the USFS' and CDFW's request that are specifically related to an algae study in Piru Creek upstream of Pyramid Lake.
Request Element #2 – Conduct algae sampling in Pyramid reach	**NOT ADOPTED.** The Licensees did not adopt this element of the requested study because USFS and CDFW did not adequately describe the need for the information or establish a Project nexus. First, USFS and CDFW provided no information to suggest that algae are currently an issue in Pyramid reach (Criterion 4). As described in Section 1.1.4 of this RSP, 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." Second, USFS and CDFW did not adequately describe a nexus between Project operations and algae in Pyramid reach. The Licensees perform no work in the reach, and do not introduce any chemicals or substances (e.g., organics) that would introduce or spread algae in Pyramid reach (Criterion 5). Given this explanation, the Licensees have not addressed in this reply the elements in the USFS' and CDFW's request that are specifically related to an algae study in Pyramid reach. However, incidental observations of algae will be recorded during relicensing studies.
Request Element #3 – Conduct algae sampling in Pyramid Lake	**NOT ADOPTED.** The Licensees did not adopt this element of the requested study because USFS and CDFW did not describe why the existing information and the information the Licensees routinely

	collect regarding algae in Pyramid Lake are not adequate. As described in the Licensees' PAD, the Licensees detected algal blooms in Pyramid Lake during sampling events in 2013, 2014, and 2015. Species that dominated microcystin-producing algal blooms in the Lake include *Microcysti*s spp., *Woronichinia naegeliana*, *Gloeotrichia* sp., *Limnoraphis birgei*, *Aphanizomenon* spp., *Dolichospermum* sp., and *Planktothrix* sp. Based on this information, the Licensees obtained a National Pollutant Discharge Elimination System (NPDES) permit to periodically treat Pyramid Lake for algae. This existing information and any additional data collected by the Licensees during the implementation of the NPDES permit and treatment of algae in Pyramid Lake will be included in the Licensees' DLA and FLA, and is adequate for the development of license requirements (Criterion 5). Given this explanation, the Licensees have not addressed in this reply the elements in the USFS' and CDFW's request that are specifically related to an algae study in Pyramid Lake.

3.2.4 Benthic Macroinvertebrates Upstream and Downstream of Pyramid Lake Study Request *(USFS and CDFW)*

USFS requested a study named *Benthic Macroinvertebrates Upstream and Downstream of Pyramid Lake* in its PAD comments and has resubmitted it unchanged with the exception of the estimated cost to complete in its PSP comments (USFS, pp. 44 through 57). In general, the goal of the requested study is "to characterize benthic macroinvertebrate (BMI) taxonomical, biomass, and density assemblages as well as habitat within Project-affected reaches". The USFS states "Instream flow requirements" as the only potential license condition that the requested study would inform. The study area would include Piru Creek and its tributaries upstream and downstream of Pyramid Dam. The requested study would include conducting SWAMP data collection at three sites in ten reaches. USFS estimated the cost to complete its requested study between $200,000 and $250,000.

CDFW requested a study named *Benthic Macroinvertebrates Upstream and Downstream of Pyramid Lake* in its PAD comments and has resubmitted it updated in its PSP comments (CDFW, Appendix A, pp 40 through 53). The CDFW request is essentially identical to USFS' requested study. CDFW does not make any statements about how the results of the requested study would be used. CDFW estimated the cost to complete its requested study between $200,000 and $250,000.

In reference to Criterion 7, the Licensees believe that the USFS and CDFW have significantly underestimated the cost to implement their requested new study. The Licensees estimate that implementation of the study would cost between $600,000 and $650,000 for the following reason and assumption: The commenters proposed 3 sites in 10 reaches over two sampling periods or seasons resulting in a possible 60 sites total in the Project area. Based on the Licensee's experience, a BMI and habitat survey at each site using the SWAMP protocol and full laboratory analysis, costs approximately $10,000 per site plus additional time for report preparation.

In its PSP comments, the NMFS did not request a BMI study, but stated it supported USFS' request.

The Licensees have proposed a new study, *Pyramid Reach Benthic Macroinvertebrates*, which incorporates some of the requests from USFS' and CDFW's requested studies. The Licensees agree to use the SWAMP protocol in their new study; however, their Licensees have not entirely adopted the agencies recommendations for timing or sampling locations.

Request Elements	Licensees' Reply
Request Element #1 – Conduct BMI surveys in Piru Creek upstream of Pyramid Lake, and in Buck Creek, and Snowy Creek, tributaries to Piru Creek	**NOT ADOPTED.** The Licensees did not adopt the USFS' and CDFW's requests for BMI surveys in Piru Creek and some of its tributaries upstream of Pyramid Lake for the reasons stated in Section 1.1.4 of this RSP. The Project has no effects on upstream aquatic habitat and thus there is no Project nexus for the study (Criterion 5). Given this explanation, the Licensees have not addressed in this reply the elements in the USFS' request that are specifically related to BMI surveys in Piru Creek upstream of Pyramid Lake.
Request Element #2 – Conduct BMI surveys in Pyramid reach, and in Fish Creek and Agua Blanca Creek, tributaries to Pyramid reach	**ADOPTED WITH MODIFICATION.** The Licensees' new study, *Pyramid Reach Benthic Macroinvertebrates*, includes BMI sampling at three locations in Pyramid reach. Licensees feel the distribution of these sampling sites will describe the BMI communities in Pyramid reach and fill the identified data gap. Licensees did not adopt the agencies request to sample in the tributaries of Pyramid reach because the Project has no effects on these tributary aquatic habitats and, thus, there is no Project nexus for the study (Criterion 5). Further, neither USFS nor CDFW provide any evidence to suggest that there is a Project-related problem with BMI in Pyramid reach tributaries. As stated in Section 1.1.4, If the study request is an attempt to search for a project effect, it does not meet the criteria for a study request. The Licensees adopted the USFS' and CDFW's request to use the SWAMP protocol for BMI and physical habitat data collection. They also adopted the agencies request to calculate the BMI metrics described by Rehn et al. (2007) and Rehn (2009). Licensees have proposed a single sampling event in the May – July timeframe as recommended in the SWAMP protocol for Southern California. One sampling event has been acceptable in most recent FERC relicensings in California (Criterion 6) and the USFS' and CDFW's requests provide no rationale for two sampling events to justify the additional cost and level of effort (Criterion 7).

3.2.5 Stream Fish Populations Downstream of Pyramid Dam Study Request *(USFS and CDFW)*

USFS requested a study named *Stream Fish Populations Downstream of Pyramid Dam* in its PAD comments and has resubmitted it with minor changes in its PSP comments

(USFS, pp. 58 through 74). In general, the goal of the requested study is "to provide current information on fish in Project-affected streams" (USFS, p.58). USFS has removed the fry emergence task from its original version of the proposed methods. The study area would include Piru Creek downstream of Pyramid Dam and its tributaries. USFS estimated the cost to complete its requested study between $140,000 and $200,000.

CDFW's requested a study named *Stream Fish Populations Downstream of Pyramid Dam* in its PAD comments and has resubmitted it updated in its PSP comments (CDFW, Appendix A, pp 70 through 85). The study plan is unchanged from the original with one exception; sampling sites in the North Fork of Fish Creek have been removed. CDFW and USFS have taken differing positions on the fry emergence task and CDFW has included it in its current requested study. Although the scopes are different, CDFW's estimated cost to complete its requested study is the same as USFWS' estimated cost between $140,000 and $200,000.

In reference to Criterion 7, the Licensees believe that the USFS and CDFW have significantly underestimated the cost to implement their requested new study. The Licensees estimate that implementation of the new study would cost between $225,000 and $300,000 for the following reasons and assumptions: (1) CDFW now requires a minimum of 4 staff for a basic electrofishing crew, per new requirements included in recently obtained Scientific Collecting Permits; (2) sampling sites in Piru Creek between Frenchman's Flat and Fish Creek, in Fish Creek, and between Fish Creek and Agua Blanca Creek in Piru Creek, all involve significant and expensive logistics to access the sites, which would add costs for either in labor or helicopter services; and (3) lodging and travel costs for 15 days of work, including multiple trips to the Project area due to up to six weeks of sampling spread over two years would add significant costs to the study.

In its PSP comments, the NMFS did not request a stream fish populations study, but stated it supported USFS' request.

As described below, the Licensees' proposed *Pyramid Reach Fish Populations Study* in Section 4.1.3 of this RSP adopts some, but not all, of the elements in USFS' and CDFW's requested studies.

Request Elements	Licensees' Reply
Request Element #1 – Select fish sampling sites	**ADOPTED WITH MODIFICATION.** The Licensees' proposed *Pyramid Reach Fish Populations Study* includes three study sites in the 18.1-mile-long reach between Pyramid Dam and the NMWSE of Lake Piru. The USFS and CDFW requested nine sites, with the rational that this number of sites is required to describe the full range of abiotic and biotic variables that may occur over the spatial and temporal extent of the reach. The Licensees disagree with USFS and CDFW given the relatively homogeneous nature of the reach and FERC precedent. The Licensees' study plan includes habitat mapping and placement of the sampling sites in representative mesohabitats, consistent with

	sampling protocols. Further, there is precedent in other recent California relicensings for three or less sampling locations in long reaches. For instance, in South Feather Water Power's South Feather Power Project relicensing, FERC ordered one fish sampling site in the 9.4-mile-long South Fork Feather Diversion Dam Reach and two sites in the 9.1-mile-long Little Grass Valley Diversion Dam. In Nevada Irrigation District's Yuba-Bear Project relicensing, FERC ordered three fish population monitoring sites in the 32-mile-long Milton Diversion Reach and two sites in the 10.4-mile-long Bear River Canal Diversion Dam Reach. Additionally, the Licensees have proposed eDNA sampling over the entire length of the Pyramid reach of Piru Creek for two specific purposes. First, eDNA data will provide data on fish distributions over a far larger area than could be covered by three pass depletion surveys using electrofishing, with the added benefit of not risking harm to fish or other wildlife resources. Second, eDNA has been shown (Wilcox et al 2013, and Wilcox et al. 2016[43]) to be more sensitive at detecting rare, cryptic, and elusive fauna than conventional direct methods of sampling.
Request Element #2 – Collect fish population data using electrofishing	**ADOPTED.** The Licensees adopted USFS' and CDFW's request to use electrofishing to collect fish population information, with snorkeling as an alternative method.
Request Element #3 – Collect fry emergence data	**NOT ADOPTED.** The Licensees did not adopt the fry emergence sampling requested by the CDFW because the agencies did not adequately describe the Project nexus (Criterion 5) for Fish Creek and Agua Blanca Creek. The Licensees perform no work and do not control flows in these creeks.
Request Element #4 – Collect fish population data in two consecutive years	**ADOPTED WITH MODIFICATION.** The Licensees' proposed *Pyramid Reach Fish Populations Study* will be conducted in one year. The Licensees did not adopt USFS' and CDFW's request for a second year of data because the agencies did not justify the need for two years of data. Further, the ILP provides a process under which a stakeholder may request a modification to a study after the data from the first year are reviewed. The Licensees will include the results of its fish sampling in its ISR, and if any interested relicensing stakeholders believe that additional data are required to accomplish study objectives, the stakeholder may request, with adequate justification, that FERC direct the Licensees to modify the study to collect a second year of data. There is no justification or need to require two years of data at this time.

[43] Wilcox, T.M.; McKelvey, K.S.; Young, M.K.; Jane, S.F.; Lowe, W.H.; Whiteley, A.R.; Schwartz, M.K. 2013. Robust detection of rare species using environmental DNA: The importance of primer specificity. PLoS One. 8: e59520. doi: 10.1371/journal.pone.0059520. Wilcox, T.M.; McKelvey, K.S.; Young, M.K.; Sepulveda, A.J.; Shepard, B.B.; Jane, S.F.; Whiteley, A.R.; Lowe, W.H.; Schwartz, M.K. 2016. Understanding environmental DNA detection probabilities: A case study using a stream-dwelling char *Salvelinus fontinalis*. Biological Conservation. 194: 209–216

Request Element #5 – Conduct Quality Assurance/Quality Control (QA/QC) analysis and analyze data	**ADOPTED WITH MODIFICATION.** The Licensees' proposed *Pyramid Reach Fish Populations Study* and the USFS' and CDFW's study requests are essentially identical in their proposed QA/QC and analyses of data.
Request Element #6 – Provide a report	**ADOPTED WITH MODIFICATION.** A separate study report is not required by FERC's ILP regulations. Available information will be provided to interested parties in the ISR, Updated Study Request (USR), DLA, and FLA. See Section 5.0 for additional information on reporting of study results.

3.2.6 Stream Fish Populations Upstream of Pyramid Dam Study Request (*USFS and CDFW*)

USFS requested a study named *Stream Fish Populations Upstream of Pyramid Dam* in its PAD comments and has resubmitted it unchanged in its PSP comments (USFS, pp. 75 through 90). In general, the goal of the requested study is "to provide current information on fish in Project-affected streams" (USFS, p. 75). The study area would include Piru Creek upstream of Pyramid Dam and Buck Creek. USFS estimated the cost to complete its requested study between $140,000 and $200,000.

CDFW's requested study named *Stream Fish Populations Upstream of Pyramid Dam* in its PAD comments and has resubmitted it updated in its PSP comments (CDFW, Appendix A, pp 86 through 101). The CDFW request is very similar to USFS' requested study, with some notable exceptions. The goal of CDFW's proposed study is "to provide current information on fish in Project-affected streams *and* to provide baseline information of fish populations in the upper portions of the Piru Creek watershed as reference sites for comparison to fish populations in Project-affected stream areas." The study area has been reduced from 27 sampling sites to 15 and now matches that proposed by USFS. CDFW estimates the cost to complete the study between $140,000 and $200,000.

In reference to Criterion 7, the Licensees believe that the USFS and CDFW have significantly underestimated the cost to implement their requested new study. The Licensees estimate that implementation of the new study would cost between $225,000 and $300,000 for the following reasons and assumptions: (1) CDFW now requires a minimum of 4 staff for a basic electrofishing crew, per new requirements included in recently obtained Scientific Collecting Permits; and (2) lodging and travel costs for 15 days of work, including multiple trips to the Project area due to up to six weeks of sampling spread over two years.

In its PSP comments, the NMFS did not request a stream fish populations study upstream of Pyramid Lake, but stated it supported USFS' request.

As described below, the Licensees did not adopt USFS' and CDFW's study requests.

Request Elements	Licensees' Reply
Request Element #1 – Conduct fish population study in Piru Creek upstream of Pyramid Lake	**NOT ADOPTED.** The Licensees did not adopt the USFS' and CDFW's request for a fish populations study in Piru Creek upstream of Pyramid Lake for the reasons stated in Section 1.1.4 of this RSP. The Project has no effects on upstream fish populations and, thus, there is no Project nexus for the study (Criterion 5). Given this explanation, the Licensees have not addressed in this reply the specific elements in USFS' and CDFW's requests.

3.2.7 Aquatic Invasive Species Study Request *(USFS)* and Comprehensive Aquatic Invasive Species Survey Study Request *(CDFW)*

USFS requested a study named *Aquatic Invasive Species* in its PAD comments and has resubmitted it unchanged in its PSP comments (USFS, pp. 91 through 100). In general, the goal of the requested study is to "document presence and distribution of aquatic invasive species within the study area and project related facilities, specifically waterways and lakes…" (USFS, p. 91). The study area would include all Project facilities, "and project-affected stream reaches in the vicinity of project dams (e.g., within about ¼ mile)…" and developed recreation sites. The requested study did not include detailed elements, instead stating, "The Licensees would select sample site locations in consultation with [agencies]…" for Step 1 – Initial Reconnaissance and Study Site Selection, and provided no details for Step 2 – Focused Surveys. USFS did not describe study methods. USFS estimated the cost to complete its requested study between $120,000 and $145,000.

CDFW did not resubmit their *Comprehensive Aquatic Invasive Species Survey Study Request.* However, the CDFW stated in its PSP comments that "those [study requests] that are not resubmitted are still considered to be CDFW requests for needed study plans" (CDFW pp. 17). With the exception of limiting the study area to all Project facilities, Pyramid reach, and Castaic Creek at Elderberry Forebay and developed recreation sites, CDFW's requested study named *Comprehensive Aquatic Invasive Species Survey Study Request* submitted in its PAD comments is essentially identical to USFS' PSP requested study. CDFW's cost estimate to perform its study is the same as USFS', even though the USFS' study would have a much larger study area.

In reference to Criterion 7, the Licensees believe that USFS and CDFW have significantly underestimated the cost to implement their respective requested new studies. The Licensees estimate that implementation of the new study would cost between $200,000 and $300,000, assuming the following for details not included in the requested study: (1) all potential AIS would require survey; (2) all areas of the Project would require survey; and (3) survey protocols for species without accepted protocols would need to be developed.

As described below, the Licensees' proposed *Aquatic Invasive Species (AIS) Study* in Section 4.1.1 of this RSP adopts some of USFS' and CDFW's requested studies.

Request Elements	Licensees' Reply
Request Element #1 – Conduct AIS surveys in Pyramid reach	**NOT ADOPTED.** The Licensees rarely perform Project O&M work in Pyramid reach, and when the work occurs, all clean equipment protocols are followed. Nor are there any Project recreation facilities in the reach. Therefore, the Project would not introduce AIS directly into the reach. Given this explanation, the Licensees have not addressed in this reply the elements in the USFS' request that are specifically related to AIS surveys in Pyramid reach. However, incidental observations of AIS will be recorded during relicensing studies. In December 2016, the Licensees found quagga mussels in the Angeles Tunnel during a routine tunnel inspection. Mussels were removed and the observation reported to CDFW as required by State regulations. Licensee will be expanding their monitoring per established regulations for the management of quagga and zebra mussels, including implementing DWR's *Quagga and Zebra Mussel Rapid Response Plan* for the SWP and developing a containment plan. Information gathered during monitoring will be provided in the DLA and FLA.
Request Element #2 – Conduct AIS surveys in Castaic Creek upstream of Elderberry Forebay	**NOT ADOPTED.** The Licensees did not adopt the USFS' request for AIS surveys in Castaic Creek upstream of check-dam basins for the reasons stated in Section 1.1.4 of this RSP. Given this explanation, the Licensees have not addressed in this reply the elements in the USFS' request that are specifically related to AIS surveys in Castaic Creek upstream of check-dam basins.
Request Element #3 – Conduct AIS surveys in stream reaches within 0.25 mile of the Project	**NOT ADOPTED.** The Licensees did not adopt the USFS' request for AIS surveys in stream reaches within 0.25 mile of the Project for two reasons. First, USFS provides no indication that there are Project-related AIS impacts in stream reaches 0.25 mile away from the Project, so the need for the information has not been established (Criterion 4). Second, USFS does not describe the nexus to the Project (Criterion 5). There is no Project O&M in tributaries a quarter mile upstream of the Project; therefore, Project O&M would not introduce AIS in these upstream tributaries.
Request Element #4 – Perform AIS surveys in Pyramid Lake at sites to be determined in consultation with agencies	**ADOPTED WITH MODIFICATION.** The Licensees have not adopted USFS' and CDFW's request that AIS survey sites in Pyramid Lake be selected in consultation with agencies because there is no need to delay specifying the locations. The Licensees' proposed *AIS Study* lists nine locations in Pyramid Lake where AIS surveys will be performed. In addition, the Licensees' proposed *AIS Study* includes surveys for AIS clams and snails at one location in Elderberry Forebay and two locations in Quail Lake.
Request Element #5 – Determine study methods in consultation with agencies	**ADOPTED WITH MODIFICATION.** The proposed *AIS Study* describes the methods the Licensees would employ.
Request Element #6 – QA/QC data	**ADOPTED.** The Licensees' proposed *AIS Study* includes QA/QC of all data.

Request Element #7 – Prepare study report	**ADOPTED WITH MODIFICATION.** A separate study report is not required by FERC's ILP regulations. Available information will be provided to interested parties in the ISR, USR, DLA, and FLA. See Section 4.0 for additional information on reporting of study results.

3.2.8 Environmental DNA (eDNA) on Upper and Middle Piru and Within Pyramid and Quail Lakes Study Request *(USFS)*

USFS requested a study named *Environmental DNA (eDNA) on Upper and Middle Piru and within Pyramid and Quail Lakes* in its PAD comments and has resubmitted it unchanged in its PSP comments (USFS, pp. 101 through 110). In general, the goal of the requested study is "to qualify the taxonomical assemblages of all aquatic biota within Project affected reaches upstream, within, and downstream of Pyramid Dam, and Quail Lake, using environmental DNA (eDNA)" (USFS, p. 101). The study area would include Piru Creek upstream of Pyramid Dam, Buck Creek, Snowy Creek, Pyramid Lake, the Pyramid reach of Piru Creek, Fish Creek, Agua Blanca Creek, and Quail Lake. USFS estimated the cost to complete its requested study between $80,000 and $110,000.

In reference to Criterion 7, the Licensees believe that the USFS significantly underestimated the cost to implement its requested new study. The Licensees estimate that implementation of the new study would cost between $125,000 and $180,000 for the following reasons: (1) 72 samples would be analyzed with both meta-barcode (sequence) and qPCR analysis (the requested study does not specify which analytical method to use); (2) two weeks of fieldwork for two staff would be required for sample collection; and (3) the requested study does not specify the species or number of species that would be targeted by qPCR analysis.

As described below, the Licensees' proposed *Pyramid Reach Fish Populations Study* in Section 4.1.3 of this RSP adopts some, but not all, of the elements in USFS' requested study.

Request Elements	Licensees' Reply
Request Element #1 – Conduct eDNA sampling in Piru Creek upstream of Pyramid Lake, including in Bucks Creek and Snowy Creek	**NOT ADOPTED.** The Licensees did not adopt the USFS' request for eDNA sampling in Piru Creek upstream of Pyramid Lake for the reasons stated in Section 1.1.4 of this RSP. The Project has no effects on upstream aquatic habitat and thus there is no Project nexus for the study (Criterion 5). Given this explanation, the Licensees have not addressed in this reply the request elements in the USFS' requests regarding eDNA sampling in Piru Creek upstream of Pyramid Lake.
Request Element #2 – Conduct eDNA sampling in Pyramid reach tributaries (Fish Creek and Agua Blanca Creek)	**NOT ADOPTED.** The Licensees did not adopt the USFS' request for eDNA sampling in Fish Creek and Agua Blanca Creek, tributaries to Pyramid reach. USFS has not established a Project nexus to these tributaries: the Licensees perform no work and do not control flow in the tributaries (Criterion 5.) Further, since the Project does not affect flow in the creeks and no Project O&M occurs in the creeks, the

	information would not inform license requirements (Criterion 5). Given this explanation, the Licensees have not addressed in this reply the elements in the USFS' requests regarding eDNA sampling in Pyramid reach tributaries.
Request Element #3 – Conduct eDNA sampling in spring and fall of the same year	**NOT ADOPTED.** The Licensees did not adopt the USFS' request for eDNA sampling in spring and fall of the same year. The Licensees have chosen to target native species that are not migratory, and seasonal sampling would not yield additional information. Sampling would be conducted in the spring at the tail end of winter runoff to take advantage of higher flows that are more capable of transporting deoxyribonucleic acid (DNA) over greater distances.
Request Element #4 – Perform eDNA sampling in Pyramid reach at sites selected in consultation with agencies	**ADOPTED WITH MODIFICATION.** The Licensees' *Pyramid Reach Fish Populations Study* includes a task for eDNA collection in Pyramid reach. The Licensees' study proposes eDNA sampling would be performed at regular intervals (1,640 feet) over the entire length of the reach from Pyramid Dam downstream to the NMWSE of Piru Lake.
Request Element #5 – eDNA sampling methods	**ADOPTED WITH MODIFICATION.** The Licensees essentially adopted USFS' request for eDNA sampling methods. The Licensees' proposed *Pyramid Reach Fish Populations Study* states the Licensees would follow the USFWS' Protocol for Collecting Environmental DNA Samples From Streams (Carim et al. 2016).
Request Element #6 – Collect physical habitat and water quality data	**ADOPTED.** The Licensees' proposed *Pyramid Reach Fish Populations Study* targets fish species, and results would be reported in relation to the habitat mapping and water quality data collected as part of the Licensees' proposed *Pyramid Reach Fish Populations Study*.
Request Element #7 – Analyze data	**ADOPTED WITH MODIFICATION.** The samples collected by the Licensees would be processed with a species targeted quantitative polymerase chain reaction (QPCR) approach for Santa Ana sucker (ESA Threatened), arroyo chub (Species of Special Concern [SSC]), and rainbow trout. The analysis requested by the USFS was unclear and mixed descriptions for both a QPCR approach, which targets one or more specific species, and a generalized sequencing approach, which sorts the identified DNA fragments into taxonomic groups and identifies individual species through a probabilistic strategy. The former approach is relatively inexpensive ($150 per sample), while the latter is much more expensive ($15,000 to $20,000 per sample). The USFS' request does not specify which approach should be used for each sample, and this uncertainty casts substantial doubt on the USFS cost estimate. More specifically, if the Licensees were to collect the 72 requested samples, and adopt the general sequencing approach, processing alone could cost $1.1 to $1.4 million dollars and would not yield better data. In comparison, the eDNA portion of the Licensees' proposed *Pyramid Reach Fish Populations Study* would cost approximately $42,000 for fieldwork and analysis (Criterion 7).

Request Element #8 – QA/QC data	**ADOPTED.** The Licensees' proposed *Pyramid Reach Fish Populations Study* includes QA/QC of all data.
Request Element #9 – Prepare study report	**ADOPTED WITH MODIFICATION.** A separate study report is not required by FERC's ILP regulations. Available information will be provided to interested parties in the ISR, USR, DLA, and FLA. See Section 4.0 for additional information on reporting of study results.

3.2.9 Water Quality Study Request *(USFS and CDFW)*

The USFS and CDFW also requested respective water quality studies in their PAD comments. USFS has resubmitted the study request unchanged in its PSP comments (USFS, pp. 111 through 126). CDFW did not resubmit their *Water Quality Study Request.* However, the CDFW stated in its PSP comments that "those [study requests] that are not resubmitted are still considered to be CDFW requests for needed study plans" (CDFW pp. 17). The goal of both the USFS' *Water Quality* Study and CDFW's *Water Quality Study* is to "characterize existing conditions in project reservoirs and project affected stream reaches, and to determine needs for additional focused water quality studies or long term monitoring" (USFS, p. 113). The methods include sampling parameters, locations and timing. USFS and CDFW state that an additional goal of their requested studies is to "determine the source of mercury exceedance in Pyramid Lake and pH and chloride in Piru Creek" "to verify water quality in the project-affected river reaches and compliance with the United States Environmental Protection Agency (EPA) thresholds." (USFS, p. 118). The USFS and CDFW each estimate the cost of their respective study to be $413,000.

In its PSP comments, the NMFS did not request a water quality study, but stated it supported USFS' and SWRCB's requests.

As described below, the Licensees' proposed *Water Quality and Temperature Study* in Section 4.1.16 of this RSP adopts some, but not all, of the elements in the studies requested by USFS, and CDFW.

Request Elements	Licensees' Reply
Request Element #1 – Selection of water quality parameters	**ADOPTED WITH MODIFICATION.** The Licensees' proposed *Water Quality and Temperature Study* includes many of the parameters requested by USFS and CDFW. The Licensees did not adopt sampling for total coliform, fecal coliform, *Escherichia coli* and petroleum hydrocarbons. USFS and CDFW did not provide any evidence to suggest that any of these parameters are an issue within the proposed Project boundary, especially Quail Lake that supports non-contact recreation. The Licensees currently monitor for bacteria near the William E. Warner Powerhouse as part of an existing NPDES permit. Further, all recreation areas at Pyramid Lake have bathroom facilities; flush toilets at all drive up locations and vault toilets at boat-in only locations. There are no Project recreation facilities in Pyramid reach and waters released from the Project into Pyramid reach are not known to have issues with bacteria. (Criterion 5).

	USFS and CDFW did not address why the sampling is needed to achieve their shared study goal (i.e., determine the source of mercury exceedance in Pyramid Lake and pH and chloride in Piru Creek) or why existing information is not sufficient (Criterion 4). Project O&M and Project-related recreation do not introduce mercury or chloride into surface waters or would otherwise degrade pH.
Request Element #2 – Survey sites upstream of the Project	**ADOPTED.** The Licensees' proposed *Water Quality and Temperature Study* includes a single sampling location in Piru Creek immediately upstream of Pyramid Lake. While the Project has no effect on water quality upstream of Pyramid Lake, though no study request was made in their PSP comments, the Licensees acknowledge the SWRCB's need for an upstream sample in order to comply with its anti-degradation policy. This site will be sampled at the same time water quality samples are collected in the Pyramid reach.
Request Element #3 – Select sites with interested parties	**ADOPTED WITH MODIFICATION.** The Licensees' proposed *Water Quality and Temperature Study* includes proposed sampling sites.
Request Element #4 – Sample timing	**ADOPTED WITH MODIFICATION.** USFS and CDFW requests that reservoir and stream sampling occur during the spring runoff and summer low-flow conditions, as well as a third fall sample for reaches downstream of Project facilities. The Licensees' proposed *Water Quality and Temperature Study* includes sampling once in the fall. The Project operates year-round so potential affects to water quality should be similar throughout the year. Sampling in the fall, after the warm summer and prior to winter rains, captures data at a point after an entire season of summer low-flows.
Request Element #5 – Sample in second year based on review of first year study results	**NOT ADOPTED.** USFS and CDFW request a review of the data to determine if a second year of focused studies is required. The Licensees did not adopt this request because the ILP provides a process to modify a study if a second year of studies is needed, so there is no need to include such a provision in the study. Specifically, the ILP requires that an applicant produce an ISR that includes the results of the first year of studies, and that if stakeholders believe the first-year studies warrant additional study, the party may request that the study be modified to include an additional data collection.
Request Element #6 – Establish meteorological monitoring stations	**NOT ADOPTED**. USFS and CDFW request the Licensees establish and maintain as part of the study local meteorological stations. Neither agency describes why the stations are needed given that existing meteorological stations occur in the area. Meteorological station data have only been used in recent FERC relicensings in California if a water temperature model was being developed (which it is not in this relicensing), and then new stations were only required if it was clearly demonstrated that existing meteorological stations did not provide adequate data for the modeling.
Request Element #7 – Collect data in compliance with Licensees' Quality Assurance Program Plan (QAPP)	**ADOPTED.** As part of the Licensees' study, a QAPP will be developed in coordination with the laboratory conducting the analyses. The QAPP will also outline field procedures.

Request Element #8 – Consult with relicensing participants if the Licensees believe a study modification is needed	**ADOPTED WITH MODIFICATION.** USFS and CDFW request that the Licensees consult with relicensing stakeholders if the Licensees believe a study modification is needed. If the Licensees believe a significant study modification is required the Licensees will attempt to consult in advance with pertinent relicensing stakeholders as necessary and practical. The ILP also provides a process by which an applicant must disclose and explain each study plan variation in its ISR and USR.
Request Element #9 – Provide a study report	**ADOPTED WITH MODIFICATION.** A separate study report is not required by FERC's ILP regulations. Available information will be provided to interested parties in the ISR, USR, DLA, and FLA. See Section 4.0 for additional information on reporting of study results.

3.2.10 Channel Morphology Study Request *(USFS and CDFW)* and Channel Morphology Assessment Study Request *(SWRCB)*

USFS requested a study named *Channel Morphology* in its PAD comments and has resubmitted it unchanged in its PSP comments (USFS, pp. 127 through 140). In general, the goal of the requested study is to "characterize channel morphology, riparian and aquatic habitat conditions that may have been affected, or continue to be affected, by operation and maintenance of project facilities" (USFS, p. 128). The objective of the study is to inventory stream reaches to collect consistent region-wide existing stream condition data for stream monitoring. The study area would include Piru Creek upstream of Pyramid Lake and Pyramid reach. USFS estimated the cost to complete its requested study between $210,000 and $350,000.

CDFW did not resubmit their *Channel Morphology* study request. CDFW stated in its PSP comments that "those [study requests] that are not resubmitted are still considered to be CDFW requests for needed study plans" (CDFW p. 17). Information relevant to the *Channel Morphology* study request in the PSP comments identifies the need for predetermined triggers provided by CDFW and USFS for studying sediment transport, following the first year's study report. With the exception of resource management goals and the study area, CDFW's requested study named *Channel Morphology*, as provided in its PAD comments is essentially identical to USFS' requested study. CDFW's *Channel Morphology* objectives and goals from their PAD comments identify including Castaic Creek upstream and downstream of the Project and the Piru Creek Pyramid reach however the study area only identifies Piru Creek and alluvial reaches above and below Pyramid Lake.

In its PSP comments, NMFS did not request a channel morphology study, but stated it supported USFS' *Channel Morphology Study*.

As discussed below, the Licensees did not adopt the USFS', CDFW's, and SWRCB's study requests.

Request Elements	Licensees' Reply
Request Element #1 – Conduct channel morphology surveys in Piru Creek upstream of Pyramid Lake	**NOT ADOPTED.** The Licensees did not adopt the USFS' and CDFW's, requests for channel morphology surveys in Piru Creek upstream of Pyramid Lake for the reasons stated in Section 1.1.4 of this RSP. The Project has no effects on upstream channel morphology and, thus, there is no Project nexus for the study (Criterion 5). Given this explanation, the Licensees have not addressed in this reply the elements in the USFS' and CDFW's request regarding channel morphology surveys in Piru Creek upstream of Pyramid Lake.
Request Element #2 – Conduct channel morphology surveys in Castaic Creek upstream of Elderberry Forebay	**NOT ADOPTED.** The Licensees did not adopt CDFW's, and requests for channel morphology surveys in Castaic Creek upstream of check-basin dams for the reasons stated in Section 1.1.4 of this RSP. The Project has no effects on upstream channel morphology and thus there is no Project nexus for the study (Criterion 5). Further, CDFW did not describe why existing information is not adequate. As described in Section 3.2.2.2 of the PAD, the Project includes three check-dam basins on Castaic Creek, the sole purpose of which is to collect Castaic Creek sediment before it enters Elderberry Forebay. Further, Section 4.3.10.3 of the PAD describes the United States Army Corps of Engineers CWA Section 404 permit and CDFW Section 1600 agreement that LADWP holds for the operations of the check-dam basins, which include periodic removal of sediment and disposal of the sediment in compliance with the permits and FERC's approval. In addition, as was done in 2016, LADWP, after obtaining all necessary permits and approvals, periodically dredges Elderberry Forebay. Given this existing information and continuing permits, CDFW has not demonstrated how a channel morphology survey of Castaic Creek upstream of check-dam basins would inform license requirements. (Criterion 5) Given this explanation, the Licensees have not addressed in this reply the elements in the CDFW's request that are specifically related to channel morphology surveys in Castaic Creek upstream of check-dam basins.
Request Element #3 – Conduct channel morphology surveys in Castaic Creek downstream of the Project	**NOT ADOPTED.** CDFW's study request includes Castaic Creek upstream and downstream of the Project under "Criteria 1 – Goals and objectives of the study," but does not include Castaic Creek under "6.1. Study Area." The Licensees assume CDFW is requesting channel morphology surveys in Castaic Creek upstream and downstream of the Project. The Licensees address surveys upstream of the Project in the reply to Request Element #2 and downstream of the Project in this reply. The Licensees did not adopt CDFW's request for channel morphology surveys in Castaic Creek downstream of the Project (i.e., in Castaic Lake or farther downstream). CDFW did not describe the need for this information (Criterion 4), how the information would be used (Criterion 5), or what methods it proposed (Criterion 6). The portion of Castaic Creek below the Project is located downstream of Castaic Lake.

	Castaic Lake would have a much greater effect on Castaic Creek channel morphology than would Elderberry Forebay. Further, Castaic Lake is outside of the geographic scope of the relicensing as described in FERC's SD1. Given this explanation, the Licensees have not addressed in this reply the elements in CDFW's request that are specifically related to channel morphology surveys in Castaic Creek.
Request Element #4 – Conduct channel morphology surveys in Pyramid reach	**NOT ADOPTED.** The Licensees did not adopt USFS' and CDFW's request for channel morphology surveys in Pyramid reach for the following reasons: First, as described in Section 1.1.5 of this RSP, the study would not inform license requirements regarding flow in Pyramid reach (Criterion 5). The current flow regime in Pyramid reach mimics in both timing and volume the natural hydrology of the creek (Figure 1.1-1 in this RSP). Second, the Licensees have not adopted channel morphology surveys in Pyramid reach because the level of effort and cost is unwarranted given the type of channel and sediment availability that exists in the reach. Sandburg (2005)[44] states that tributaries continue to contribute sand and gravels, though the flow regime could affect substrate stratification. Outflow below Pyramid Dam is as close to inflow as possible so no additional change in management would be warranted (Criterion 5). Existing information (Sandburg 2005) suggests that sediment is not limiting in the reach, and USFS and CDFW have provided no information to suggest otherwise. The agencies have not shown that existing information is insufficient (Criterion 4), or that the information could inform license requirements (Criterion 5). In addition, the Licensees intend to conduct a bathymetric survey of Pyramid Lake in 2017 and will provide the information as available. This information can be used to assess the amount of sediment capture in Pyramid Lake. Given this explanation, the Licensees have not addressed in this reply the elements in the USFS' and CDFW's request that are specifically related to channel morphology surveys in Pyramid reach.

3.2.11 Hydrologic Alteration / Flow Regime Study Request *(USFS and CDFW)* and Indicators of Hydrologic Alteration Study Request *(SWRCB)*

The SWRCB's PSP comment states that "the Relicensing participants and the Licensees have come to consensus on the Quail Lake Fish Populations and the Indicators of Alterations study plans (SWRCB, Attachment A, p. 11), and the USFS'

[44] Sandburg, N.H. 2005. Middle Piru Creek Arroyo Toad (*Bufo californicus*) clutch surveys 2004. Prepared for United Water Conservation District. 59 pp. Cited in PAD as "Sandburg, Nancy H. 2005. Middle Piru Creek Arroyo Toad *(Bufo californicus)* Clutch Surveys 2005. DWR. February."

PSP comments within the study plan request state "Provided the study plan presented in the revised PSP document meets the needs of the SWRCB, the Forest Service believes the information collected will be sufficient for use in setting 4(e) conditions that protect reservation resources." (USFS, p. 141). In addition, in its PSP comments, NMFS did not submit a hydrologic alteration study request, but stated it supported the USFS' and SWRCB's study requests. The Licensees have included in this RSP the collaboratively-agreed to study plan, with minor clarifications to address FERC staffs' comments (see Section 2.0). Therefore, the Licensees believe the USFS, SWRCB and NMFS concur with the Licensees' *IHA Study* in this RSP.

CDFW did not resubmit a hydrologic alteration study request in its PSP comments or otherwise comment on the study, other than to say that "those [study requests] that are not resubmitted are still considered to be CDFW requests for needed study plans" (CDFW pp. 17). CDFW estimated the cost to complete its requested study between $100,000 and $120,000.

As described below, the Licensees' proposed *IHA Study* in Section 3.1.14 of this RSP adopts some, but not all, of the elements in CDFW's requested study. The study results will describe the relationship between Project inflow into Pyramid Lake and Project outflow into Pyramid reach.

Request Elements	Licensees' Reply
Request Element #1 – Perform IHA assessment in Piru Creek upstream of Pyramid Lake	**NOT ADOPTED.** The Licensees did not adopt CDFW's requests for an IHA assessment in Piru Creek upstream of Pyramid Lake for the reasons stated in Section 1.1.4 of this RSP. The Project has no effects on Piru Creek upstream of Pyramid Lake and thus there is no Project nexus for the study (Criterion 5). Given this explanation, the Licensees have not addressed in this reply the elements in the USFS', CDFW's, and SWRCB's request regarding an IHA assessment in Piru Creek upstream of Pyramid Lake.
Request Element #2 – Perform IHA assessment in Gorman Creek below Quail Lake	**NOT ADOPTED.** The Licensees did not adopt CDFW's request for an IHA assessment in Gorman Creek downstream of Quail Lake because CDFW did not describe the need for the information (Criterion 4), or how it would be used to inform license requirements (Criterion 5). As shown in Figure 1.1-1, almost 90 percent of the natural inflow into Pyramid Lake is gaged. If one wished to extrapolate the inflow for the remaining 10 percent, one would only need to add that to the gaged data. Given this explanation, the Licensees have not addressed in this reply the elements in the USFS', CDFW's, and SWRCB's request regarding an IHA assessment in Gorman Creek.
Request Element #3 – Using 15-minute flow data, for 10 discretionary up-ramp and down-ramp events calculate minimum, mean and maximum ramping rates inches per hour	**ADOPTED WITH MODIFICATION.** The Licensees' proposed *IHA Study* includes a comparison of 15-minute or hourly flow changes at gage 11109375 (Piru Creek upstream of Pyramid Lake), gage 11109395 (Canada de los Alamos), and gage 11109525 (Pyramid reach below Pyramid Dam) for up ten larger flow changes. The Licensees did not include stage changes in the proposed study

and feet per hour at existing gage locations in Pyramid reach	because CDFW did not describe the need for this additional information (Criterion 4) and flow rate is adequate for the comparison between the two locations (Criterion 5).
Request Element #4 – Calculate the magnitude, duration and volume of spill events below Pyramid Dam, and the theoretical starting storage necessary to avoid the spills	**NOT ADOPTED.** CDFW did not describe the need for this additional information (Criterion 4) or how the information would inform license requirements (Criterion 5). Licensees' spill events at Pyramid Lake are consistent with the requirements of Article 52 in the existing license, and the Licensees have stated their intention to maintain the existing flow regime to avoid unauthorized take of listed arroyo toads. See also Section 1.1.5 of this RSP.
Request Element #5 – Calculate indicators of hydrologic alteration using the IHA methods in Richter et al. (1996) in Pyramid reach	**ADOPTED WITH MODIFICATION.** The Licensees' proposed *IHA Study* includes calculating IHA statistics for flow into and out of Pyramid Lake from November 2007 through September 2015. The Licensees did not adopt the 30-year period of analysis requested by CDFW because: (1) daily average flow data to perform the analysis is only available from November 2007 through September 2015; (2) using synthesized flow data for a longer period of record would likely add confounding errors into the analysis; and (3) in 2005, Project releases were modified to represent the natural hydrology as prescribed in Article 52. Furthermore, the Licensees did not adopt CDFW's request that the IHA data be presented in five different water year types because CDFW did not describe what these water year types were, provide any rationale for the water year types (Criterion 4), or state how the data would be used to inform license requirements (Criterion 5). Article 52 does not include any water year types.
Request Element #6 – Using PeakFQ, perform a flood frequency analysis at existing gage locations Piru Creek upstream of Pyramid Dam, Pyramid reach, and Gorman Creek above and below Quail Lake. Calculate reoccurrence interval flows for 1.5, 2, 2.33, 5, 10, 25, 50, 100, 200 and 500 years	**NOT ADOPTED.** The Licensees did not adopt this request for three reasons. First, CDFW did not describe the need for this additional information (Criterion 4). Second, CDFW did not describe how the information would be used to inform license requirements (Criterion 5). Third, the information to perform the analysis is unavailable. PeakFQ uses instantaneous annual maximum peak flows. This information is not available at all the existing gages.
Request Element #7 – QA/QC data	**ADOPTED.** The Licensees' proposed *IHA Study* includes QA/QC of all data.
Request Element #8 – Prepare study report	**ADOPTED WITH MODIFICATION.** A separate study report is not required by FERC's ILP regulations. Available information will be provided to interested parties in the ISR, USR, DLA, and FLA. See Section 4.0 for additional information on reporting of study results.

3.2.12 Fish Passage Study Request *(USFS, CDFW and SWRCB)*

USFS requested a study named *Fish Passage* in its PAD comments and has resubmitted it unchanged in its PSP comments (USFS, pp. 149 through 154). In general, the primary goal of the requested study is "to determine the location, nature

and characteristics of barriers to fish passage and migration in project-affected reaches in Piru Creek, Castaic Creek, tributaries of these two streams and tributaries of project reservoirs" (USFS, p. 149). A secondary goal is "to identify Project facilities and operations (e.g., diversion structures, instream flow releases, and reservoir water surface elevations) that may affect fish passage" (USFS, p. 149). USFS states that the information gathered in achieving these goals may be used to inform the development of PM&E measures that may include: facility modifications, instream flow releases, seasonal reservoir elevation constraints, or removal of fish barriers within reservoirs. The study area would include all Project-affected stream reaches (Piru and Castaic Creeks), tributaries to these stream reaches, and tributaries to Project reservoirs and afterbays. USFS estimated the cost to complete its requested study between $100,000 and $150,000.

CDFW did not resubmit their *Fish Passage* study request. However, the CDFW stated in its PSP comments that "those [study requests] that are not resubmitted are still considered to be CDFW requests for needed study plans" (CDFW pp. 17). CDFW's requested study named *Fish Passage* as provided in its PAD comments is essentially identical to USFS' requested study.

NMFS did not request a specific study, but stated it supported USFS' study request.

As described below, the Licensees did not adopt USFS', CDFW's, or SWRCB's study requests. However, the Licenses included elements of the agencies' requests in Licensees' proposed Study 4.1.22, *Pyramid Lake Tributaries Fish Barriers Assessment Study*.

Request Elements	Licensees' Reply
Request Element #1 – Perform fish passage assessment in Piru Creek upstream of Pyramid Lake and Castaic Creek upstream of Elderberry Forebay, and their tributaries	**NOT ADOPTED.** The Licensees did not adopt USFS', CDFW's and SWRCB's requests for a fish passage assessment in Piru Creek upstream of Pyramid Lake and Castaic Creek upstream of check-dam basins, and in their tributaries, for the reasons stated in Section 1.1.4 of this RSP. The Project has no effect on movement of fish upstream of the Project facilities and thus there is no Project nexus for the study (Criterion 5). Given this explanation, the Licensees have not addressed in this reply the elements in the USFS', CDFW's and SWRCB's requests regarding a fish passage assessment in Piru Creek upstream of Pyramid Lake and Castaic Creek upstream of check-dam basins.
Element #2 – Conduct fish passage surveys in Pyramid reach, and tributaries to Pyramid reach	**NOT ADOPTED.** The Licensees did not adopt the USFS', CDFW's and SWRCB's request for a fish barriers assessment in Pyramid reach because currently the flows mimic in both timing and magnitude the natural hydrograph to protect an endangered species. In addition, the agencies have not established that there is an issue regarding fish barriers in Pyramid reach (i.e. rainbow trout are found throughout the reach). Nor have the agencies established a nexus between the Project and fish barriers if they were to occur in the reach (Criterion 5). In essence the agencies' request appears to be more of a research study.

	In addition, USFS and CDFW both identify an existing fish passage barrier in the Pyramid reach near Frenchman's Flat in Section 4.0 of their respective requested studies. The barrier was not constructed nor is it maintained by the Licensees. The Licensees acknowledge that this is a known barrier, and as such additional information is not needed regarding the barrier. Given this explanation, the Licensees have not addressed in this reply the elements in the USFS', CDFW's and SWRCB's request that are specifically related to fish passage surveys in Pyramid reach.
Request Element #3 – Identify and Qualitatively Assess Potential Upstream Fish Passage Barriers in Project Reservoirs	**ADOPTED WITH MODIFICATION.** The Licensees have developed the *Pyramid Lake Tributaries Fish Passage Barriers Study* to qualitatively assess potential barriers in each tributary to Pyramid Lake. The study will examine, within the Pyramid Lake NMWSE, fish passage barriers. The tributaries include Piru Creek, Gorman Creek, and Carlos Canyon. Pyramid Lake operation is currently restricted to protect fish, wildlife, and recreation. Section 3.2.3.2 of the PAD describes several major operational constraints. Per the 1970 Amendment No. 1 to the 1969 Memorandum of Understanding (MOU) between DWR and USFS, during normal operation conditions, water surface level variations do not exceed 14 feet during each 7-day period, and do not exceed 8 feet each day. In addition, the water surface of Pyramid Lake is not lowered below an elevation of 2,560 feet without taking additional safety precautions and making appropriate notifications. Article 58 of the existing license requires the Licensees to maintain Pyramid Lake surface elevations at the highest, most practicable levels commensurate with other Project purposes during the summer recreation season.

3.2.13 Wildlife Study Plan: Bats Study Request *(USFS),* and Wildlife (Bats) Study Request *(CDFW)*

USFS requested a study named *Wildlife Study Plan: Bats* (USFS, Chapter, pp. 141 through 154). There were several changes between the USFS study proposed initially the study proposed in their PSP comments, including a reduction in the proposed study area from a quarter mile around Project facilities to 500 feet and removal of cliff faces, mist net sampling has been removed, and there is no longer a specific number of sampling periods requested. In general, the goal of the requested study is "to document the presence, distribution and roosts of bat species within the study area and their use of project related facilities." (USFS, Chapter p. 141). The study area would include the FERC Project boundary (with an additional 500-foot buffer) for each Project and Project-affected stream reach in the vicinity of the Project dams, including all natural roost sites and Project facilities, developed recreation sites, and all bridges within the FERC Project boundary. USFS estimated the cost to complete its requested study between $120,000 and $145,000.

CDFW did not resubmit with its PSP comments the study named *Wildlife (Bats) Study* submitted with its PAD comments. However, the CDFW stated in its PSP comments

that "those [study requests] that are not resubmitted are still considered to be CDFW requests for needed study plans" (CDFW, p. 17) and reiterated their request for the evaluation of natural roost sites and Project-related structures and conducted focused surveys, acoustic sampling, mist net sampling and winter hibernacula evaluation (CDFW, p. 6). CDFW estimated the cost to complete its requested study as between $120,000 and $145,000.

In reference to Criterion 7, the Licensees believe that the USFS and CDFW significantly underestimated the cost to implement their requested new study. The Licensees estimate that implementation of the new study would cost between $250,000 and $350,000 for the following reasons: (1) all natural habitats where bats might roost would require survey, including all crevices, which would require first an investigation of the full (non-reservoir) Project area to find those locations (the Licensees note that the agencies did not define "crevice" is their study request, so the Licensees assumed crevices to include every small nook where a bat could tuck itself, even singularly in trees or rocks); and (2) multiple survey methods are required for all locations where bat activity is found, including short term acoustic sampling, winter hibernacula evaluation, and long term acoustic sampling (up to seven months).

As described below, the Licensees' proposed *Special-Status Terrestrial Wildlife Species –CWHR Study* in Section 4.1.7 of this RSP adopts some, but not all, of the elements in USFS' and CDFW's requested studies.

Request Elements	Licensees' Reply
Request Element #1 – Evaluate natural roost sites and Project-related structures within the study , as well as all bridges within the FERC Project Boundary	**ADOPTED WITH MODIFICATION.** The Licensees' proposed *Special-Status Terrestrial Wildlife Species – CWHR Study* will include an evaluation of potential affects to special-status bats, including roost sites. The Licensees' proposed study would provide adequate information at no additional cost compared to the study requested by USFS and CDFW. The agencies' requested study methods would include reconnaissance of all potential and known roost sites at Project facilities and known roost sites within the FERC Project boundary for bats, followed by mist-netting, acoustic sampling and long-term acoustic monitoring at all sites with signs of bat activity. The cost to complete the study is estimated to be between $120,000 and $145,000. The Licensees' proposed study, which would gather information on all special-status terrestrial wildlife species, would provide adequate information regarding bats at no additional cost. (Criteria 4 and 7)
Request Element #2 – Observed bat activity will be documented with photographs and global positioning system (GPS) coordinates	**ADOPTED.** The Licensees' proposed *Special-Status Terrestrial Wildlife Species – CWHR Study* specifies that all evidence of special-status terrestrial wildlife, including bats, will be documented by photographs and GPS coordinates will be taken where possible.
Request Element #3 – Conduct focused surveys , including acoustic sampling, mist net sampling, and winter hibernacula evaluation	**NOT ADOPTED.** The Licensees did not adopt this request element because the Licensees intend to propose in their DLA and FLA a measure to manage bats. Similar to other measures proposed on recent California relicensings, the measure would include the identification of bat activity at Project facilities after the new license is issued. The information from the sampling proposed by USFS would

	not inform the requirements of that measure (Criterion 5).
Request Element #4 – Perform QA/QC of data	**ADOPTED.** The Licensees' proposed *Special-Status Terrestrial Wildlife Species – CWHR Study* specifies that the Licensees will QA/QC all field data.
Request Element #5 – Prepare a study report	**ADOPTED WITH MODIFICATION.** A separate study report is not required by FERC's ILP regulations. Available information will be provided to interested parties in the ISR, USR, DLA, and FLA. See Section 4.0 for additional information on reporting of study results.

3.2.14 Wildlife Study Plan: Large Mammal Movement Study Requests *(USFS and CDFW)*

USFS requested a study named *Wildlife Study Plan: Large Mammal Movement* (USFS, pp. 169 through 181). The study proposed in PSP comments removes a sentence in the study area about including facilities within two miles of the Project, but since both studies also include a five mile buffer around facilities, this removal does not change the requirements of the study proposal. In general, the goal of the requested study is "to determine the location, type and number of barriers to wildlife movement due to project conduits or other facilities." (USFS, p. 169). The study area would include the FERC Project boundary for each Project-affected stream reach in the vicinity of the Project dams, including Project facilities and developed recreation sites. USFS estimated the cost to complete its requested study as between $50,000 and $75,000.

CDFW did not resubmit in its PSP comments the *Wildlife Study Plan – Large Mammal Movement Study* request that was in its PAD comments, but stated in its PSP comments that "those [study requests] that are not resubmitted are still considered to be CDFW requests for needed study plans" (CDFW pp. 15). However, CDFW reiterated their request to reevaluate additional features, such as roads and campgrounds, as barriers to movement (CDFW pp. 5). CDFW estimated the cost to complete its requested study as between $50,000 and $75,000.

In reference to Criterion 7, the Licensees believe that the USFS and CDFW significantly underestimated the cost to implement their requested new study. The Licensees estimate that implementation of the new study would cost between $200,000 and $300,000. The agency cost seems correct for only the evaluation of Project facilities. However, the requested study also includes the requirement to "inventory (and GPS) all known wildlife drinking/guzzler sites within 5 miles of the project area for repair/enhancement. Licensees will use game cameras for 1 week during each quarter of the year to record any use of existing structures for target species." This adds an extremely large area that would require survey, requiring multiple field crews over some considerable time. In addition, an unknown number of these sites would require a further four weeks of monitoring with a trail camera. The efforts involved in the work outside of the proposed Project boundary would elevate the cost to at least the cost estimated by the Licensees.

As described below, the Licensees' proposed *Special-Status Terrestrial Wildlife Species – CWHR Study* in Section 4.1.7 of this RSP adopts some, but not all, of the elements in USFS' and CDFW's requested studies.

Request Elements	Licensees' Reply
USFS and CDFW Request Element #1 – Identify potential Project barriers to wildlife movement	**ADOPTED WITH MODIFICATION.** As part of the Licensees' proposed *Special-Status Terrestrial Wildlife Species – CWHR Study,* the Licensees will evaluate two Project linear features for wildlife movement: (1) the 2-mile long Lower Quail Canal; (2) the six 2,400 foot long Castaic Powerplant penstocks; and (3) will map Project roads, fences, campgrounds, and drinking sites within the proposed Project boundary and evaluate how species movement may be impacted. The Licensees have not adopted CDFW's request to evaluate campgrounds, roads, and drinking sites outside the Project boundary (within 5 miles of the Project area) because these facilities do not impede movement of large mammals and additional information will not help inform license requirements (Criterion 5).
Request Element #2 – Conduct field assessment of segments	**ADOPTED WITH MODIFICATION.** As described in the Licensees' reply to Request Element #1, the Licensees will conduct field assessments of the Lower Quail Canal and Castaic Penstocks for barriers to large wildlife movement.
Request Element #3 – Prepare Geographic Information System (GIS) maps	**ADOPTED.** The Licensees' proposed *Special-Status Terrestrial Wildlife Species – CWHR Study* will include the preparation of GIS maps showing locations of Project facilities that could be wildlife barriers.
Request Element #4 – Analyze data	**ADOPTED.** The Licensees' proposed *Special-Status Terrestrial Wildlife Species – CWHR Study* will include an analysis of all field data recorded during the study.
Request Element #5 – Prepare a study report	**ADOPTED WITH MODIFICATION.** A separate study report is not required by FERC's ILP regulations. Available information will be provided to interested parties in the ISR, USR, DLA, and FLA. See Section 4.0 for additional information on reporting of study results.

3.2.15 Wildlife Study Plan: Raptor Species Study Request *(USFS)*

USFS requested in its PSP comments a study named *Wildlife Study Plan: Raptor Species* (USFS, pp. 169 through 180). In general, the goal of the requested study is "to document the presence, distribution of FSS [Forest Service Sensitive] and CDFW SSC/FP [fully protected] raptor listed [sic] species within the project area and the vicinity of the project area, which includes all suitable habitat within and adjacent to the project or that may be impacted by activities associated with the relicensing or recreational activities." (USFS, p. 171). In addition to the study request submitted by the USFS in its PAD comments, the USFS' request in its PSP comments includes a provision to "…[collect] egg shell fragments…[to be] submitted for analysis to identify the types and levels of chemicals present in the egg shell…" (USFS, p. 179). The study area would include the FERC Project boundary for each Project-affected stream reach in the vicinity (within 5 miles) of the Project dams, including Project facilities and developed recreation

sites. USFS estimated the cost to complete its requested study as between $150,000 and $175,000.

In reference to Criterion 7, the Licensees believe that the USFS has significantly underestimated the cost to implement its requested new study. Further, the USFS expanded the scope of the new study as compared to its study requested in the USFS' comments on the PAD, but did not modify the cost. The Licensees estimate that implementation of the new study would cost between $500,000 and $700,000 for the following reasons: (1) the study would require protocol surveys for seven species of raptors and some unspecified species with survey areas of up to 5 miles outside of the proposed Project boundary; (2) different species would require survey at differing times of day, with some nocturnal, and in different seasons; and (3) collection and analysis of egg shells from all fish-eating raptor nests. These pieces would be submitted for analysis, presumably to a qualified lab, to identify the types and levels of chemicals, unspecified, present in the egg shell. Costs for this study element alone would include obtaining permits for collection, successfully collecting egg shells from 'all' nests (current number unknown), proper handling and transport to qualified lab and chemical tests.

As described below, the Licensees' proposed *Special-status Raptors Study* and *Special-Status Terrestrial Wildlife Species – CWHR Study* in Sections 4.1.20 and 4.1.7 of this RSP adopts some, but not all, of the elements in USFS's requested studies.

Request Elements	Licensees' Reply
Request Element #1 – Perform the study within the FERC Project Boundary and Project-affected stream reaches in the vicinity of Project dams (e.g., within 5.0 miles or all suitable habitat contiguous in the immediate vicinity of the Project area)	**ADOPTED WITH MODIFICATION.** The Licensees propose to conduct the *Special-Status Terrestrial Wildlife Species – CWHR Study* within the proposed Project boundary and the *Special-Status Raptors Study* at Pyramid Lake and Quail Lake, including a 0.25 mile buffer around the reservoirs, Lower Quail Lake Canal and in the area of Castaic Powerplant. The Licensees do not propose to perform the study in stream reaches or within 5.0 miles of the Project area for three reasons. Regarding stream reaches, the only potentially affected stream reach is Pyramid reach. As described in Section 1.1.5, Project outflow into Pyramid reach mimics in both timing and magnitude the natural inflow into Pyramid Lake. In addition, the Licensees rarely perform Project O&M in Pyramid reach, nor are there any Project recreation facilities in Pyramid reach. Therefore the Project does not affect raptor use in this area. Information regarding raptors in the vicinity of Pyramid reach will not inform license requirements (Criterion 5). Second, Licensees perform no Project-related work that has impacts on special-status raptors up to 5.0 miles away. The protocol level surveys at specified sites and CWHR study with the proposed Project boundary will collect sufficient raptor information to determine where and what potential effects, if any, would occur information collected from areas outside of those proposed will not inform license requirements (Criterion 5).

Request Element #2 – Identify and map known occurrences of FSS/SSC raptor species and prepare field maps within and in the vicinity (within 5.0 miles) of the project	**ADOPTED WITH MODIFICATION.** The Licensees' proposed *Special-Status Terrestrial Wildlife Species – CWHR Study* and *Special-Status Raptors Study* includes this element for the study areas included in the studies, which do not include a 5.0 mile buffer of the proposed Project Boundary.
Request Element #3 – Identify study sites	**ADOPTED WITH MODIFICATION.** The Licensees will use the CWHR and raptors studies to identify areas/sites within the proposed Project boundary where Project facilities or activities could potentially affect raptors. The Licensees have not adopted USFS' request for a 1.5 mile buffer around these sites as described in the Licensees' reply to Element #2. For the CWHR study, sampling points will be randomly selected within vegetation types using GIS, and CWHR plot data, an established protocol, will be collected by qualified biologists, before running CDFW's CWHR program. This method will ensure all vegetation types in representative areas will be sampled to gather data sufficient to determine what kinds of habitat for all special-status raptors are available. The *Special-Status Raptors Study* focuses on the areas where nesting bald eagles, golden eagles and burrowing owls occur. For clarity, recreational off-highway vehicle use is not permitted within Project recreation facilities.
Request Element #4 – Conduct Field Surveys	**ADOPTED WITH MODIFICATION.** As part of the *Special-Status Raptors Study*, the Licensees will conduct protocol surveys for bald eagles, golden eagles and burrowing owls which have recent sightings or more than five records in the Project vicinity. Additionally, as part of the *Special-Status Terrestrial Wildlife Species – CWHR Study*, the Licensees propose to conduct field surveys to evaluate potential habitat and document incidental sightings of special-status wildlife including raptors.
Request Element #5 – Analyze Shell Fragments	**NOT ADOPTED.** The Licensees will not collect egg shell fragments and conduct chemical analyses for two main reasons. First, the information collected would not inform license requirements, making this requested element a research study, since the USFS has not described how this information is related to the Project or Project activities (Criterion 5). Second, this element was added on to the study without a change in the originally predicted level of effort or cost. The lack of change in the cost, despite the addition of a large chunk of proposed data collection (egg fragments from *all* nests would be analyzed), calls into question the methods for determining the level of effort of the study (Criterion 7).
Request Element #6 – Digital photographs, GPS documentation, distance to nearest facility and observed activities in the facility	**ADOPTED WITH MODIFICATION.** The Licensees will document all special-status terrestrial raptors sighted during both proposed studies with photography and GPS locations when possible. All observations of nearby activity and nearby facilities will be recorded and included in field notes. A GIS map of all located special-status raptor species will be produced.

Request Element #7 – Consult with Licensees' Project Operations Staff	**ADOPTED.** The Licensees' operations staff will be involved, to the extent necessary, in the *Special-Status Raptors Study* and *Special-Status Terrestrial Wildlife Species – CWHR Study.*
Request Element #8 – QA/QC Data	**ADOPTED.** The Licensees will subject all field data to QA/QC control procedures.
Request Element #9 – Prepare a study report	**ADOPTED WITH MODIFICATION.** A separate study report is not required by FERC's ILP regulations. Available information will be provided to interested parties in the ISR, USR, DLA, and FLA. See Section 4.0 for additional information on reporting of study results.

3.2.16 Wildlife Study Plan: ESA Terrestrial Species Study Request *(USFS)*, and Special-Status Species – Special Status Terrestrial Species Study Request (Avian, Mammal, Invertebrate) *(CDFW)*

USFS requested in its PSP comments a study named *Wildlife Study Plan: ESA Terrestrial Species* (USFS, pp. 195 through 205). The plan is the same as the plan that USFS submitted in its PAD comments, except for the inclusion of a list of study goals, and an introductory section that presents and explains the four Request Elements: 1) perform the study within the Pyramid reach; 2) perform the study in Castaic Creek upstream of the Project; 3) perform the study within the Project boundary, within Project-affected reaches, and within one mile of the Project, or all suitable contiguous habitat; and 4) conduct protocol level surveys, where one exists, for the listed terrestrial species. This requested study would focus on ESA-listed and California Endangered Species Act (CESA)-listed species, including California condor, least Bell's vireo, southwestern willow flycatcher, coastal California gnatcatcher, yellow-billed cuckoo western DPS, Mojave desert tortoise, vernal pool fairy shrimp, and Quino checkerspot butterfly. Monarch butterfly is also included, although this is not an ESA- or CESA-listed or ESA candidate species. In general, the goal of USFS' requested study is "to document the presence, distribution of ESA-listed [and CESA-listed] T&E species within the project area and the vicinity of the project area" (USFS, p. 196). CESA-listed raptors and owls addressed in a separate requested study (*Wildlife Study Plan: Raptor Species*). The study area is unclear, but would include the area within the Project boundary, unspecified Project-affected stream reaches including at least one mile of Pyramid reach and Castaic Creek upstream of the Project, or "all suitable habitat contiguous in the immediate vicinity of the Project area." Specific study sites would be selected based on a "reconnaissance survey," although USFS provides no details regarding this survey. Study sites explicitly include all developed recreation areas or any facilities, including roads, parking or staging areas, within a minimum of one-mile of suitable habitat. USFS estimated the cost to complete its requested study as between $150,000 and $175,000.

CDFW did not resubmit in its PSP comments its *Special Status Species – Special Status Terrestrial Species (Avian, Mammal, Invertebrate)* study request. CDFW stated in its PSP comments that "those [study requests] that are not resubmitted are still considered to be CDFW requests for needed study plans" (CDFW p. 17). CDFW's

requested study is in many respects the same as the USFS requested study, but most importantly is not limited to ESA- and CESA-listed species. The CDFW requested study includes an additional 25 species classified as California Fully Protected, SSC, and Watch List avian species. The study area is also similar to that for the USFS requested study, but is not evidently limited to a one mile distance for the Pyramid reach and Castaic Creek upstream of Elderberry Forebay. Comments by CDFW in its response to the PSP specific to this plan or generally applicable to wildlife studies are the geographic scope of the study, including upstream and downstream of the Project, within the Project boundary, and extending one mile from the Project, and the use of protocol surveys for all species, if survey protocols exist. Survey methods for species for which accepted protocols do not exist are not specified. CDFW estimated the cost to complete the requested study as between $150,000 and $175,000.

In reference to Criterion 7, the Licensees believe that the USFS and CDFW significantly underestimated the cost to implement their respective requested new studies. The Licensees estimate implementation would cost between $400,000 and $600,000 for the new study proposed by USFS and $500,000 and $700,000 for the new study proposed by CDFW for the following reasons: (1) the study areas for both studies encompass very large areas including any suitable habitat for any of the species within the proposed Project boundary and extending out one mile in all directions. The new study proposed by CDFW also includes the entirety of the Pyramid reach. The study areas may also include locations considered as Project facilities by the commenters, even if outside the proposed Project boundary. In addition, all developed recreation sites would have to be surveyed for any of the species if there is any suitable habitat within one mile, regardless of the suitability of the habitat at the recreation site; (2) all of the 12 ESA- and CESA-listed species and monarch butterfly, which is not listed and is not a candidate species for listing under ESA, would have to be surveyed by 'protocol' surveys (i.e., accepted presence/absence surveys) or an equivalent intensive effort for species with no accepted protocols. The new study proposed by CDFW is not limited to ESA and CESA, and therefore has a larger scope. Although established protocols do not exist for some of the species listed by USFS and most of the species addressed under the CDFW study, it is reasonable to assume that each species would require numerous surveys (e.g., at least three to five or more surveys) in order to conclude that the species was absent from the study area. Further, because the target species are diverse, multiple search methods, and separate surveys at different times of the year would be required; and (3) all suitable habitats in the study area would have to be surveyed. As indicated by earlier comments, surveys of representative sites would not be acceptable under USFS' and CDFW's requested new studies to meet study objectives of determining the distribution of each species.

As described below, the Licensees' proposed *Special-status Terrestrial Wildlife – CWHR Study, ESA-listed Riparian Bird Species – Southwestern Willow Flycatcher, Least Bell's Vireo, and Yellow-billed Cuckoo Riparian Habitat Evaluations Study (ESA-listed Riparian Bird Species Study)* and *ESA-listed Terrestrial Species – CWHR Study* in Sections 4.1.7, 4.1.10 and 4.1.18, respectively of this RSP adopts some, but not all, of USFS' and CDFW's requested elements.

Request Elements	Licensees' Reply
Request Element #1 – Perform the study in Pyramid reach	**NOT ADOPTED.** The Licensees do not propose to perform the indicated studies in the Pyramid reach. As described in Section 1.1.5, Project outflow into Pyramid reach mimics in both timing and magnitude natural inflow into Pyramid Lake. In addition, the Licensees do not perform Project O&M in the Pyramid reach beyond work on the access road nor are there any Project recreation facilities in Pyramid reach. Therefore, the Project will not affect terrestrial wildlife species use in this area. Information regarding terrestrial wildlife species in the vicinity of Pyramid reach will not inform license requirements (Criterion 5). The Licensees do not propose to modify flows in the Pyramid reach: outflow will equal inflow.
Request Element #2 – Perform the study in Castaic Creek upstream of Elderberry Forebay	**NOT ADOPTED.** The Licensees did not adopt CDFW's request that the study area include Castaic Creek upstream of check-dam basins for the reasons stated in Section 1.1.4 of this RSP. Project O&M has no impacts upstream of the check-dam basins.
Request Element #3 – Perform the study within the FERC Project Boundary and Project-affected stream reaches in the vicinity of Project dams, and within 1.0 mile of suitable habitat or all suitable habitat contiguous in the immediate vicinity of the Project area	**ADOPTED WITH MODIFICATION.** The Licensees propose to perform the studies within the proposed Project boundary. Inclusion of unspecified Project-affected reaches outside the proposed Project boundary and a one-mile distance from Project facilities or from suitable habitat were not adopted for the following reasons. First, neither the CDFW nor USFS defined what they mean by other 'project-affected reaches in the vicinity.' Having already indicated inclusion of the Pyramid reach and Castaic Creek upstream of the Project in Request Element #1 and 2, respectively, it is unclear what other dams or other stream reaches are addressed in Request Element #3. Without knowing which reaches are included, it is impossible to address this Request Element. Second, a one-mile radius around the Project is arbitrary, unrelated to potential for Project effects, and has not been explained or justified by CDFW or USFS. The explanation provided by USFS (p. 195), addresses only the Pyramid reach, which is already addressed in Request Element #2, and says nothing regarding the one-mile distance. It is true that some of the target species move long distances seasonally or can have large home ranges; however, this does not justify or explain the need for studies in areas where the Project has no effect. In addition, the CDFW study plan indicates that surveys should be performed at locations (e.g., Project facilities and developed recreation sites) based on distance from suitable habitat (i.e., within one-mile), rather than based on habitat suitability at these locations. This approach is not consistent with accepted scientific approaches or existing survey protocols (Criterion 6). CDFW also inexplicitly states (p. 216) that "specific sampling sites will likely shift between seasons to maximize the detecting bats." Given all of the considerations that would apply to surveys for so many target species, surveys extending one-mile from the Project could not realistically be achieved for the stated estimated costs provided by the agencies and would require a much larger cost, which has not been justified (Criterion 7). Performing the study 1.0 mile away from the Project is not necessary because the Licensees address Project facilities where the Project-related effects could potentially occur. The Licensees perform no

	Project O&M 1.0 miles away from the Project. Therefore, the information will not inform license requirements (Criterion 5).
Request Element #4 – Surveyors conduct protocol level surveys, where one exists, for all of the species	**ADOPTED WITH MODIFICATION.** CDFW and USFS did not request any specific protocols, instead stating that "established protocols will be used, where one exists." Inexplicably, given the scope of the requested study, CDFW states that "Licensees surveyors will conduct established protocol surveys, where one exists for the special status reptiles and amphibians." The Licensees will conduct USFWS protocol surveys for three species, southwestern willow flycatcher, least Bell's vireo, and yellow-billed cuckoo, which have a reasonable possibility of occurring in the Project area and being affected by Project-related activities and for which habitat assessments and surveys may provide information useful to the development of license conditions. Details of the surveys are included in the Licensees' proposed study, *ESA-Listed* Riparian *Bird Species Study*. The Licensees have not adopted this element for 10 other species included as target species by USFS (pp. 201-202) and the 35 other species included by CDFW (2016, pp. 113 through 116). Instead, the Licensees' proposed *ESA-listed Terrestrial Species - California Wildlife Habitat Relationship Study* and *Special-status Terrestrial Wildlife – CWHR* studies will assess habitat for ESA-listed, CESA-listed, and the other species included by CDFW unlikely to be affected by Project O&M or for which a habitat assessment is sufficient for compiling the Project-related information needed to develop license measures. This approach is consistent with recent relicensings in California, as described in Section 4.1.6. Although there are accepted protocols for presence/absence surveys for most of the ESA-listed species, similar accepted protocols do not exist for most of the other species.

3.2.17 Special Status Species – Reptile and Amphibian Study Request *(CDFW),* and Wildlife Study Plan: TES Reptiles and Amphibians Study Request *(USFS)*

CDFW did not resubmit in its PSP comments its *Special Status Species - Reptile and Amphibian* study request that was included in CDFW's PAD comments. CDFW stated in its PSP comments that "those [study requests] that are not resubmitted are still considered to be CDFW requests for needed study plans" (CDFW p. 17). In general, the stated goal is to "provide information…concerning amphibians and reptiles associated with project upland, reservoir and stream reaches affected by the project…" The study area would include all of the area within the FERC Project boundary, the Pyramid reach, and Castaic Creek upstream of Elderberry Forebay, and unspecified Project-affected stream reaches in the vicinity of the Project (within one mile) or all suitable contiguous habitat. Specific study sites would be selected based on a reconnaissance survey, although CDFW provides no details regarding this survey, and would change in some unspecified way based on season. Study sites also explicitly include all developed recreation areas or any facilities, including roads, parking or staging areas, within a

minimum of one-mile of suitable habitat. The study request does not include a list of target species, but is understood to include any potentially occurring amphibian or reptile species listed under the ESA, CESA, species classified as SSC by CDFW, or sensitive by USFS. The requested study included both detailed and undefined elements, and inconsistencies between the stated objectives and methods, as discussed below. Comments by CDFW in its response to the PSP specific to this plan or generally applicable to wildlife studies are the geographic scope of the study, including upstream and downstream of the Project, within the Project boundary, and extending one mile from the Project, and the use of protocol surveys. CDFW estimated the cost to complete the requested study as between $150,000 and $175,000.

USFS' requested new study named *TES Reptiles and Amphibians* (USFS, pp. 206 through 219) is essentially identical to CDFW's requested study, with the following few exceptions: stated resource management goals; inclusion of a list of special-status species, including three ESA-listed species - arroyo toad, California red-legged frog, and mountain yellow-legged frog - and 14 other special-status frogs, salamanders, snakes, and lizards; and expanding the study area to include all Project-affected reaches on or that may affect NFS lands. The plan is the same as the plan that USFS submitted in its PAD comments, except for an introductory section that presents and explains the three Request Elements: 1) perform the study within the Pyramid reach and Castaic Creek upstream of the Project; 2) perform the study within the Project boundary, within Project-affected reaches, and within one mile of the Project; and 3) conduct protocol surveys, where one exists, for reptiles and amphibians. USFS estimated the cost to complete the requested study as between $150,000 and $175,000.

In reference to Criterion 7, the Licensees believe that the USFS and CDFW significantly underestimated the cost to implement their requested new studies. The Licensees estimate that implementation of the new study would cost between $500,000 and $700,000 for the following reasons: (1) the study area encompasses a very large area including any suitable habitat for any of the species within the proposed Project boundary and extending out one mile in all directions, as well as the entirety of the Pyramid reach. The proposed study area possibly includes locations considered as Project facilities by the commenters, even if outside the proposed Project boundary. In addition, all developed recreation sites would have to be surveyed for any of the species if there was suitable habitat within a minimum of one mile, regardless of the suitability of habitat at the recreation site; (2) all of the 17 target species would have to be surveyed by 'protocol' surveys (i.e., accepted presence/absence surveys) or an equivalent intensive effort for species with no accepted protocols. Because protocols do not exist for most of the target species, the Licensees assumed a minimum of 3-5 surveys for these species. Protocol surveys for CRLF require up to 8 surveys of each location, including surveys at night. Further, because the target species are diverse (e.g., terrestrial salamanders, snakes, and lizards, as well as aquatic species), multiple search methods and separate surveys at different times of the year would be required; and (3) all suitable habitats in the study area would have to surveyed. As indicated by earlier USFS and CDFW comments, surveys of representative sites would not be acceptable under their requested new studies.

As described below, the Licensees' proposed *ESA-Listed Amphibians California Red-legged Frog, Special-Status Aquatic Amphibians and Semi-Aquatic Snakes, Special-Status Terrestrial Wildlife- California Wildlife Habitat Relationship and ESA-Listed Wildlife- California Wildlife Habitat Relationship studies* in Sections 4.1.9, 4.1.4, 4.1.7, and 4.1.18 of this RSP adopts some of CDFW's and USFS' requested elements.

Request Elements	Licensees' Reply
Request Element #1 – Perform the study within the Pyramid reach and Castaic Creek upstream of Elderberry Forebay	**ADOPTED WITH MODIFICATION**. The Pyramid reach was included in the PSP and is included in the RSP study area for the *Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study.* The request to include the Pyramid reach and Castaic Creek outside of the Project boundary was not adopted for the *ESA-Listed Amphibians California Red-legged Frog Study, the Terrestrial Wildlife-CWHR Study,* and *ESA-Listed Wildlife- CWHR Study* for reasons detailed in Sections 1.1.4 and 1.1.5. The proposed Project boundary does include a section of Castaic Creek above Elderberry Forebay that is within the proposed Project boundary; however, the request element would presumably require including a much longer reach of perhaps one mile. Information collected during the Licensees' annual surveys for arroyo toad and other sensitive species in a 4.5 miles section of the Pyramid reach will be included in the application.
Request Element #2 – Perform the study within the Project Boundary, in Project-affected reaches in the vicinity (up to one mile downstream of the dam), and within one mile of the Project area	**NOT ADOPTED**. Although each of the Licensees' studies would be performed within the proposed Project boundary, inclusion of unspecified Project-affected reaches outside the proposed Project boundary and a one-mile radius area around the Project were not adopted for the following reasons. First, neither the CDFW nor USFS defined what they mean by other 'project-affected reaches in the vicinity.' Having already indicated inclusion of the Pyramid reach in Request Element #2, it is unclear what other dams or other stream reaches are addressed in Request Element #2. Without knowing which reaches are included, it is impossible to address this Request Element. Second, a one-mile radius around the Project is arbitrary, unrelated to potential for Project effects, and has not been explained or justified by CDFW or USFS. USFS (p. 206) provides only general comments that "TES reptiles and amphibians...have both aquatic and terrestrial phases" and that therefore "suitable upland habitats contiguous with aquatic habitats are subject to use to [sic] TES reptiles and amphibians and need to be included in surveys." However, the seasonal use of certain habitats does not necessarily mean that survey methods are applicable to these habitats (e.g., presence/absence surveys for CRLF do not include surveys of uplands far from water). Furthermore, most of the target species are completely terrestrial, including two salamander species, the four lizards, and four of the five snakes, and some of these species are not known to move long distances. Neither CDFW nor USFS have indicated how these terrestrial species residing outside of the proposed Project boundary may be affected by normal Project O&M and how the necessary intensive surveys which would be required to document each of the target species is justified in the development of license conditions. In addition, the CDFW study plan indicates that surveys should be performed at locations (e.g., Project facilities and

	developed recreation sites) based on distance from suitable habitat (i.e., within one-mile), rather than based on habitat suitability at these locations. This approach is not consistent with accepted scientific approaches or existing survey protocols (Criterion 6). Given all of the considerations that would apply to surveys for so many target species, surveys extending one-mile from the Project could not realistically be achieved for the stated estimated costs provided by the agencies and would require a much larger cost, which has not been justified (Criterion 7).
Request Element #3 – Conduct established protocol surveys, where one exists, for reptiles and amphibians	**NOT ADOPTED/ADOPTED WITH MODIFICATION.** Neither CDFW nor USFS indicated which species would require protocol surveys, what protocols actually exist, or which should be used if multiple methods are available. The plans are confusing by omission of necessary details, including which species would require surveys of any kind. For example, the objectives listed in the USFS plan (p. 207) suggest that surveys only apply to three ESA-listed species: "If deemed warranted by USFWS at specific locations, perform Arroyo Toad, California Red-legged Frog and Mountain Yellow-legged Frog surveys to document whether they occur." No other surveys are described in the objectives. However, the USFS and CDFW plans both include multiple statements that indicate the studies require surveys for all of the "target species" (ESA-listed or not), if suitable habitat exists within the large study areas described in Elements #1 and 2. For example, Step 3 of the Methods of both plans states: "Licensees' surveyors will conduct established protocol surveys, where one exists, for the TES reptiles and amphibians....Surveys must be completed according to established protocols for target species." The USFS plan also includes a Table listing 17 "target species", 14 of which are not listed under the ESA. Notably, this table is incomplete, with no content for any of the species in the columns for "Habitat Requirements," "Critical Habitat in Vicinity," and "Occurrence in Project Vicinity." Determining the scope of the studies is further complicated because the terms "TES" and "ESA" are used more-or-less interchangeably in the study plans (see for example Methods, Step 1, which refers to "ESA-listed wildlife species" in the first sentence and "TES reptile and amphibian" in the second sentence, although presumably both sentences refer to all of the target species. Confusingly, USFS makes reference to (Mojave) desert tortoise in its justification for conducting protocol surveys (USFS, p 206), but does not include Mojave desert tortoise in the table of target species. The CDFW plan does not include a list of target species. As indicated in response to Request Element #2, most of the target species are completely terrestrial, and some of the species are fossorial or nocturnal in their habits, with no accepted "presence/absence survey" protocols. Therefore, survey results which could be interpreted as proof of absence would require intensive and specialized survey efforts. The study request includes no guidance regarding survey methods for these and other target species with no established protocols, such as search methods, the number of required surveys, or survey timing. As such, this element does not meet Criterion 6 in explaining how the study is consistent with generally accepted practices. This vagueness also makes it impossible to evaluate whether the cost estimate provided by the agencies for the study (i.e., $150,000-175,000) is realistic or whether

	the study can be justified by the actual cost compared to other sources of information or other approaches to obtaining needed information (Criterion 7). Finally, some of the species listed by USFS, including mountain yellow-legged frog and Coast range newt, are not known to occur in the Project vicinity. Licensee's proposed studies (*ESA-Listed Amphibians California Red-legged Frog, Special-Status Aquatic Amphibians and Semi-Aquatic Snakes, Special-Status Terrestrial Wildlife- California Wildlife Habitat Relationship and ESA-Listed Wildlife- California Wildlife Habitat Relationship*) include adequate information gathering to assess potential impacts to special-status and ESA-listed reptiles and amphibians and develop appropriate license measures. These studies are included in Sections 4.1.9, 4.1.4, 4.1.7, and 4.1.18 of the RSP.

3.2.18 Wildlife Study Plan: Migratory Bird Act Treaty Protected Bird Species, Forest Service Sensitive Species, CDFW Fully Protected and Species of Special Concern Study Requests *(USFS)*

USFS requested a study named *Wildlife Study Plan: Migratory Bird Act Treaty Protected Bird Species, Forest Service Sensitive Species, CDFW Fully Protected and Species of Special Concern* (USFS, pp. 215 through 223). The plan is the same as the plan that USFS submitted in its PAD comments, except for a list of objectives that were not included in the earlier plan, and an introductory section that presents and explains the two Request Elements: 1) Perform the study within the FERC Project boundary, in Project-affected reaches in the vicinity (up to one mile downstream of the dam), and within one mile of the Project area; and 3) conduct protocol surveys, where one exists. Comments by USFS in its response to the PSP generally applicable to wildlife studies are the same: the geographic scope of the study, including upstream and downstream of the Project, within the Project boundary, and extending one mile from the Project, and the use of protocol surveys. In general, the goal of the requested study is to "document the presence, distribution of FSS, CDFW SSC/FP listed species and migratory bird species within the project area and the vicinity of the project area…" (USFS, p. 221). The study scope would include 16 special-status birds, snakes, lizards, turtle, and mammals, as well as "migratory songbirds" as a group (no list provided). Seven of these species are also included as target species in another USFS study request (*TES Reptiles and Amphibians*). The study area is not clearly stated, but is described as the area within the Project boundary "in the vicinity of Project dams," but also described as "within one mile or all suitable habitat contiguous in the immediate vicinity of the Project area, including all Project facilities and developed recreation sites." In addition, the study includes all "Project-affected stream reaches affecting National Forest Service (NFS) lands," which are not specified (USFS, p. 228). USFS estimated the cost to complete its requested study as between $150,000 and $175,000.

In reference to Criterion 7, the Licensees believe that the USFS has significantly underestimated the cost to implement its requested new study. The Licensees estimate the requested new study would cost $1.5 million to $2.1 million. Reasons for this estimated cost include: (1) requirement to survey for approximately 40 diverse species,

necessitating separate trips and diverse expertise in many areas; (2) need to develop adequate survey methods for the majority of species, many of which have no accepted protocols; (3) large study areas (within a minimum of 1 mile or all suitable habitat contiguous in the immediate vicinity of the Project area); and (4) multiple years of survey would be required to conduct the surveys.

As described below, the Licensees' proposed *Special-Status Terrestrial Wildlife Species – CWHR Study* in Section 4.1.7 of this RSP adopts some of USFS' request elements.

Request Elements	Licensees' Reply
Request Element #1 – Perform the study within the FERC Project boundary, in Project-affected reaches in the vicinity (up to one mile downstream of the dam), and within one mile of the Project area	**ADOPTED WITH MODIFICATION.** The Licensees' adopted USFS' request to perform the study within the proposed Project boundary. Specifically, as part of the Licensees' proposed *Special-status Terrestrial Wildlife Species – CWHR Study*, the Licensees will conduct field surveys to evaluate potential habitat for Migratory Bird Treaty Act (MBTA) birds and all special-status wildlife within the boundary using CWHR methodology. The CWHR plots will be selected for all vegetation types with more plots in vegetation types that have more area in the boundary. The Licensees did not adopt USFS' requests that the study be performed in Project-affected reaches within one mile downstream of Project dams or within one mile of the Project area for the reasons stated in Section 1.1.4 and 1.1.5 of this RSP, and because USFS has not established the need for the information (Criterion 4), Project nexus to the resources in these areas, or how the information from the requested study in these areas would inform license requirements (Criterion 5). Furthermore, USFS has not justified the cost of this far-reaching Request Element. The Licensees never perform Project O&M activities upstream of the Project or one-mile outside of the proposed Project boundary, and perform no Project O&M activities downstream of Pyramid Dam beyond work on the access road. In addition, no Project-related recreation occurs in these areas. A one-mile radius around the Project is arbitrary, unrelated to potential for Project effects, and has not been explained or justified by CDFW or USFS. The explanation provided by USFS (p. 220), states that some of the target species "have wide ranging territories with use areas that vary depending upon the time of year" and that "upland habitats greater than one mile from the reservoir can be used for dispersal or foraging." It is true that some of the target species move long distances seasonally or can have large home ranges; however, this does not justify or explain the need for studies in areas where the Project has no effect. In addition, the USFS study plan indicates (p. 229) surveys should be performed at locations (e.g., Project facilities and developed recreation sites) based on distance from suitable habitat (i.e., within one-mile), rather than based on habitat suitability at these locations. This approach is not consistent with accepted scientific approaches or existing survey protocols (Criterion 6). The MBTA requires measures to avoid "taking" migratory birds, including eggs and nests, as could occur during required vegetation management along transmission lines, or if Project transmission lines were not in compliance with current guidelines to avoid bird collisions

	and electrocutions. Compiling information on migratory bird species composition and locations is not necessary for compliance with the MBTA. USFS provided no rationale for the need to perform a general bird survey, including the suggested use of mist netting to sample migratory birds, with no clear purpose in the development of license conditions.
Request Element #2 – Conduct established protocol surveys, where one exists	**NOT ADOPTED.** The Licensees did not adopt USFS' request that the Licensees conduct protocol surveys, where one exists, because USFS did not describe which protocol surveys they propose, so the Licensees cannot comment on whether they would be appropriate or needed (Criterion 4). Although USFS states (p. 221) that "these protocols are readily accessible from CDFW," contrary to this assertion, most of the listed target species do not have accepted species survey protocols and it is not the responsibility of the Licensees to identify methods that may be suitable for USFS's requested study. The USFS indicates use of mist netting and point count surveys for birds, but describes no methods for the butterflies, snakes, lizards, turtles, rodents, lagomorphs, and other mammals that are listed as target species. Mist netting is an intensive survey technique for which USFS has not provided justification. No methods are provided for any of the other species groups. The omission of these details, including specific search methods, the number of required surveys, or survey timing, makes it impossible to evaluate whether the study is consistent with generally accepted practices (Criterion 6). This vagueness also makes it impossible to evaluate whether the cost estimate provided by the agencies for the study (i.e., $150,000-175,000) is realistic or whether the study can be justified by the actual cost compared to other sources of information or other approaches to obtaining needed information (Criterion 7). Additionally, the Licensees' proposed *Special-status Terrestrial Wildlife – CWHR Study* includes adequate information gathering to assess potential impacts to MBTA birds and special-status wildlife species. The proposed study will evaluate habitat within the proposed Project boundary and Project activities occurring in areas in or near habitat or known MBTA birds and special-status wildlife species occurrences. This approach is consistent with recent relicensings in California, as described in Section 4.1.6.

3.2.19 Botanical Resources Study Request *(USFS and CDFW)*

USFS requested in its PAD comments a study named *Botanical Resources* and has resubmitted it unchanged in its PSP comments (USFS, Chapter2, pp. 232 through 241). The goal of the requested study is to "provide information to determine whether continued Project O&M or recreational use of Project facilities may have an adverse effect on vegetation and special-status plants." (USFS, p. 232). USFS estimated the cost to complete its requested study as between $180,000 and $200,000.

In its PAD comments, CDFW requested a study named *Botanical Resources*, which is similar to USFS' requested study. CDFW did not resubmit their *Botanical Resources* study request. However, the CDFW stated in its PSP comments that "those

[study requests] that are not resubmitted are still considered to be CDFW requests for needed study plans" (CDFW pp. 15). CDFW estimated costs to complete its requested study as between $80,000 and $100,000.

In reference to Criterion 7, the Licensees believe that the USFS and CDFW significantly underestimated the cost to implement their requested new study. Further, USFS and/or CDFW expanded the scope of their requested beyond the scope that was included in the study they requested in their comments on the PAD, but did not modify the cost. The Licensees estimate that implementation of the new study would cost between $880,000 and $1,170,000 for the following reasons: (1) a significant amount of time would be required to access and traverse all areas of the study to perform a floristic survey, including Piru Creek; (2) extensive data collection would be required to comply with CDFW's and USFS' special-status plant species protocols; (3) complete vegetation alliance mapping would be more intensive and time-consuming than Licensees' proposal to focus efforts on riparian and wetland vegetation; and (4) additional time would be required to identify and visit reference sites for special-status plants.

As described below, the Licensees' proposed *AIS Study* and *Botanical Resources Study* in Sections 4.1.1 and 4.1.5, respectively, of this RSP adopts some, but not all, of the elements in USFS' and CDFW's requested studies.

Request Elements	Licensees' Reply
Request Element #1 – Perform surveys in Pyramid reach	**NOT ADOPTED.** The Licensees do not propose to perform the study in Pyramid reach. As described in Section 1.1.5, Project outflow into Pyramid reach mimics in both timing and magnitude the natural inflow into Pyramid Lake. In addition, the Licensees rarely perform Project O&M in Pyramid reach nor are there any Project recreation facilities in Pyramid reach. Therefore the Project will not affect botanical resources in this area. Information regarding botanical resources in the vicinity of Pyramid reach will not inform license requirements (Criterion 5).
Request Element #2 – Perform surveys within FERC Project boundary and buffer areas	**ADOPTED WITH MODIFICATION.** The Licensees' proposed *Botanical Resources Study* specifies that the Licensees will conduct surveys within the proposed Project boundary. The Licensees did not adopt USFS' and CDFW's request for a buffer because the agencies provided no evidence to suggest there is a Project effect (nexus) within that area and therefore the information would not inform license requirements (Criterion 5). The Licensees perform no Project O&M outside the proposed Project boundary. Licensees will estimate the extent of a special-status plant species occurrence outside of the study area for those occurrences that are partially within and partially outside of the study area.
Request Element #3 – Conduct vegetation mapping for all vegetation types	**ADOPTED WITH MODIFICATION.** The Licensees' proposed *Botanical Resources Study* includes mapping wetland and riparian vegetation types, and conducting Proper Functioning Condition assessments of wetland and riparian areas. The Licensees did not adopt USFS' and CDFW's request for mapping other vegetation types in the *Botanical Resources Study*. The

	Licensees' *Botanical Resources Study* includes a comprehensive survey for special-status plants within the study area. The *Special-Status Terrestrial Species - CWHR Study* will ground-truth the existing CWHR map for the Project to correct and update the map. The CWHR vegetation map, combined with data from the *Botanical Resources Study*, will provide adequate information to develop license requirements (Criterion 5).
Request Element #4 – Data QA/QC	**ADOPTED.** The Licensees' proposed *Botanical Resources Study* includes QA/QC of all data.
Request Element #5 – Prepare study report	**ADOPTED WITH MODIFICATION.** A separate study report is not required by FERC's ILP regulations. Available information will be provided to interested parties in the ISR, USR, DLA, and FLA. See Section 4.0 for additional information on reporting of study results.

3.2.20 Invasive Noxious Weeds Study Request (*USFS*) and Comprehensive Non-Native Plant Survey (Aquatic and Terrestrial) Study Request *(CDFW)*

USFS requested a study in its PAD comments named *Invasive Noxious Weeds* and has resubmitted it unchanged in its PSP comments (USFS, pp. 242 through 254). The goal of the requested study is "to provide information to determine whether continued Project O&M or recreational use of Project facilities may have an adverse effect on special-status plants and vegetation by the presence and potential introduction of invasive noxious weeds." (USFS, p. 242). USFS estimated the cost to complete its requested study as between $160,000 and $180,000.

In its PAD comments, CDFW requested a study named *Comprehensive Non-native Plant Survey (Aquatic and Terrestrial) Study*, which is similar to USFS' requested study. CDFW did not resubmit their *Comprehensive Non-native Plant Survey (Aquatic and Terrestrial) Study* request. However, the CDFW stated in its PSP comments that "those [study requests] that are not resubmitted are still considered to be CDFW requests for needed study plans" (CDFW pp. 15). CDFW estimated costs to complete its requested study as between $30,000 and $40,000.

In reference to Criterion 7, the Licensees believe that the USFS and CDFW significantly underestimated the cost to implement their requested new studies. Further, USFS and/or CDFW expanded the scope of the new study as compared to the scope that was in the study they requested in their PAD comments, but did not modify the cost. The Licensees estimate that implementation of the new study would cost between $292,000 and $390,000 for the following reasons: (1) a significant amount of time would be required to access and traverse all areas of the study to perform a floristic survey, including Piru Creek; and (2) extensive data collection would be required to comply with CDFW's and USFS' non-native plant species protocols.

As described below, the Licensees' proposed *NNIP Study* in Section 3.1.6 of this RSP adopts some, but not all, of the elements in USFS' and CDFW's requested studies.

Request Elements	Licensees' Reply
Request Element #1 – Perform surveys in Pyramid reach	**NOT ADOPTED.** The Licensees do not propose to perform the study in Pyramid reach. As described in Section 1.1.5, Project outflow into Pyramid reach is generally equal to natural inflow into Pyramid Lake. In addition, the Licensees rarely perform Project O&M in Pyramid reach nor are there any Project recreation facilities in Pyramid reach. Therefore the Project will not affect NNIP in this area. Information regarding NNIP in the vicinity of Pyramid reach will not inform license requirements (Criterion 5).
Request Element #2 – Perform surveys within FERC Project boundary and buffer areas	**ADOPTED WITH MODIFICATION.** The Licensees' proposed *NNIP Study* specifies that the Licensees will conduct NNIP surveys within the proposed Project boundary. The Licensees did not adopt USFS' request for a buffer because the agencies provided no evidence to suggest there is a Project effect (nexus) within that area and therefore the information would not inform license requirements (Criterion 5). The Licensees perform no Project O&M outside the proposed Project boundary. Licensees will estimate the extent of a NNIP occurrence outside of the study area for those occurrences that are partially within and partially outside of the study area.
Request Element #3 – USFS and CDFW provided a list of additional NNIP species with potential to occur in the study area	**ADOPTED.** The Licensees' surveys will be floristic in nature; all species encountered will be reported, including all NNIP species listed in Tables 1 and 2 in CDFW's and USFS' proposed study plans. In addition, Licensees' will map occurrences of those additional NNIP species requested by USFS and CDFW that were not identified in the PAD. Data collection will be either quantitative or qualitative, depending on the type and distribution of weeds, as described in the proposed CDFW and USFS study plans.
Request Element #4 – Conduct Field Surveys	**ADOPTED WITH MODIFICATION.** The Licensees' proposed *NNIP Study* will include field surveys in conjunction with the *Botanical Resources Study*. When performing NNIP surveys on USFS lands, the Licensees will follow USFS protocols, excluding any treatment protocols.
Request Element #5 – Consult with the Licensees' Project Operations Staff	**ADOPTED WITH MODIFICATION.** The Licensees' operations staff will be involved, to the extent necessary, in the *NNIP Study*.
Request Element #6 – QA/QC data	**ADOPTED.** The Licensees' proposed *NNIP Study* includes QA/QC of all data.
Request Element #7 – Prepare study report	**ADOPTED WITH MODIFICATION.** A separate study report is not required by FERC's ILP regulations. Available information will be provided to interested parties in the ISR, USR, DLA, and FLA. See Section 4.0 for additional information on reporting of study results.

3.2.21 Engineering Study Request *(USFS)*

USFS requested a study named *Engineering and Project –Related Roads Maintenance and Use* in its PAD comments and resubmitted an updated *Engineering Study* in its PSP comments (USFS, pp. 255 through 262). In the new *Engineering* Study request the

USFS has incorporated its *Project-related Roads Maintenance and Use Study* into the updated *Engineering* study request. In general, the goal of the requested study is to assess the condition of buildings, roads, signs, paved surfaces, trails, and other structures in the Project area (including Los Alamos Campground), and on the road from Pyramid Lake to Los Alamos Campground. No methods are provided regarding the condition assessment for buildings, but some detail parameters regarding road condition inventory are provided. The study is intended to determine needed repairs, maintenance, improvements to associated assets, and prepare plans and specifications for the implementation of such repairs, maintenance, and improvements. USFS estimated the cost to complete its requested study to be approximately $100,000.

As described below, the Licensees' proposed *Recreation Facilities Demand Analysis and Condition Assessment Study (Recreation Study)* in Section 4.1.11 of this RSP adopts some, but not all, of the elements in USFS' requested studies.

Request Elements	Licensees' Reply
Request Element # 1 – Assess the condition of buildings and structures.	**ADOPTED WITH MODIFICATION.** In response to the USFS requested *Engineering Study*, the Licensees' proposed *Recreation Study* includes assessment of the conditions of buildings and structures associated with developed recreation sites within the proposed Project boundary. The purpose of the Study is not to prepare plans and specifications for the implementation of noted repair needs or outline potential changes in maintenance or other improvements, but rather to provide data on existing conditions to inform license requirements. Given this explanation, the Licensees have not addressed in this reply the elements in the USFS' *Engineering Study* request.
Request Element #2 – Perform a road condition inventory that will document road surface and condition, location and size of culverts, pull-outs, intersections, guard rails and other information about any obvious road condition or feature.	**ADOPTED WITH MODIFICATION.** In response to the USFS updated *Engineering Study* request, the Licensees' proposed *Recreation Study* includes an assessment of condition and dimensions of roads and parking areas at developed recreation facilities. The purpose of the study is not to prepare plans and specifications for the implementation of noted repairs or outline potential changes in maintenance or other improvements, rather to provide data on existing conditions to inform potential license requirements. Licensees' anticipate as part of the licensing a transportation management plan will be required and condition assessments for all Project roads would be more appropriate in the implementation of any such plan.

3.2.22 Large Woody Debris Study Request *(USFS and CDFW)*

USFS requested a study named *Large Woody Debris* in their PAD comments. The study request was submitted unchanged in their PSP comments (USFS, pp. 263 through 271). In general, the two goals of the requested study are to (1) assess the potential geomorphic effect of reducing large woody debris (LWD) supply to, and altering its transport capacity within, Pyramid reach; and (2) provide information required to assess potential effects on habitat for anadromous and land-locked

salmonid fish caused by any changes to geomorphic/LWD processes in Pyramid reach resulting from Project facilities or operations. (USFS, p. 263). The objectives are to quantify LWD trapped on an annual basis by Pyramid Dam, quantify LWD stored within the bankfull channel of Piru Creek upstream and downstream of Pyramid Dam, complete a LWD budget, and synthesize results with other studies to evaluate geomorphic and ecological effects of trapping LWD. The study area would include Piru Creek upstream and downstream of Pyramid Lake. USFS estimated the cost to complete its requested study between $150,000 and $200,000.

CDFW did not resubmit in its PSP comments its *Large Woody Debris* study request that was included in CDFW's PAD comments, but stated that "those [study requests] that are not resubmitted are still considered to be CDFW requests for needed study plans" (CDFW p. 17). With the exception of resource management goals the study named *Large Woody Debris* CDFW requested in their PAD comments is essentially identical to USFS' requested study. CDFW estimated the cost to complete its requested study between $150,000 and $200,000.

NMFS did not provide a specific LWD study request, but said it supported USFS' study request (NMFS, p. 9).

The Licensees did not adopt USFS' and CDFW's requested study for the reasons described below.

Request Elements	Licensees' Reply
Request Element #1 – Conduct LWD assessment in Piru Creek upstream of Pyramid Lake	**NOT ADOPTED.** The Licensees did not adopt the USFS' and CDFW's requests for a LWD assessment in Piru Creek upstream of Pyramid Lake for the reasons stated in Section 1.1.4 of this RSP. The Project has no effects on upstream LWD and thus there is no Project nexus for the study. Given this explanation, the Licensees have not addressed in this reply the elements in the USFS' and CDFW's request regarding a LWD assessment in Piru Creek upstream of Pyramid Lake.
Request Element #2 – Assess potential geomorphic effect of reducing LWD supply to, and altering its transport capacity within Pyramid reach	**NOT ADOPTED.** The Licensees did not adopt USFWS' and CDFW's request for two reasons. First, neither USFS nor CDFW provided any evidence to suggest that LWD is lacking in Pyramid reach due to the Project. The majority of the Project area is composed of mixed chaparral and coastal scrub. Montane hardwood, which includes pines, cedar, and fir species, only occurs in a few patches upstream of Pyramid Lake along Piru Creek and near Pyramid Dam (PAD, p. 4-134). Coniferous species that would provide LWD are not present in sufficient quantity to expect a change in channel morphology due to their presence or loss. Second, as reported in the Licensees' PAD, the Licensees rarely collect any LWD at Pyramid Lake, which supports the conclusion that the production of LWD upstream of Pyramid Lake is low and has little influence on geomorphic processes in Pyramid reach. The Licensees' proposed *Pyramid Reach Fish Populations Study* will collect additional information regarding fish habitat and LWD in the reach.

	The Licensees did not adopt the USFS' and CDFW's requests for information related to salmonids in Piru Creek downstream of Pyramid Lake for the reasons stated in Section 1.1.5 of this RSP.
Request Element #3 – Provide information required to assess potential anadromous and land-locked salmonid fish habitat impacts of any changes to geomorphic/LWD processes in the Middle Piru Creek resulting from Project facilities or operations	**NOT ADOPTED.** The Licensees did not adopt USFWS' and CDFW's request for two reasons. The Licensees are unaware of any anadromous fishes in Pyramid reach, and Chinook salmon Essential Fish Habitat does not include the reach. Refer to Section 1.1.5 of this RSP.

3.2.23 Groundwater Study Request *(CDFW)*

CDFW did not resubmit in its PSP comments the *Groundwater* study request it included in its PAD comments. However, CDFW stated in its PSP comments that "those [study requests] that are not resubmitted are still considered to be CDFW requests for needed study plans" (CDFW pp. 17). In general, the goal of the CDFW requested study is "to characterize and understand effects of the Project or by operation and maintenance of project facilities on surface water-ground water interactions as they relate to habitat for aquatic species (e.g., fish, riparian vegetation, groundwater dependent ecosystems) and water quality, and water quantity in the Piru Creek and Castaic Creek watersheds". The study area would include the watersheds and groundwater basins associated with Piru Creek and Castaic Creek. CDFW estimated the cost to complete its requested study between $350,000 and $700,000.

In reference to Criterion 7, the Licensees believe that CDFW significantly underestimated the cost to implement its requested new study. The Licensees estimate that implementation of the new study would cost between $1,000,000 and $2,000,000 because characterizing geohydrologic processes and aquifer extent within the highly complex geologic setting of the Project is a broad-reaching research study, that includes but is not limited to study elements such as: (1) development of physical modeling studies of selected study reaches representative of Project vicinity riverine processes; (2) measurement of soil moisture content and soil temperature profile to characterize groundwater infiltration and the dynamics of underlying water table aquifers as it relates to surface water-groundwater interactions and riparian root zones and to quantify and model the relationship between floodplain and shallow surficial aquifers and floodplain plant community types; (3) where appropriate, development of MODFLOW surface water-groundwater interaction models, including calibrating and validating the model to empirical monitoring data collected at study reach surface water-groundwater monitoring stations; (4) running predictive model scenarios of groundwater response to dam and other elements flow regimes; (5) development of integrated physical process and plant succession models in coordination with the flow alteration, geomorphology and botanical riparian conditions; (6) delineation of aquifer depth and extent via use of ground penetrating radar, geologic borings, wells or installation of piezometers; and (7) evaluation of engineering geology information from the Project area. In addition, this

research study would include describing pre-Project surface water-groundwater conditions in Piru and Castaic Creek basins; developing conceptual surface water-groundwater models of pre-Project and Project conditions, including identification of potential pathways for groundwater flow within the Project area and how the presence and operations of the Project affects groundwater flow; and using USFS' GDE Level II Inventory Field Guide to document occurrence of GDEs, evaluate pre-Project and Project occurrence of GDE in the vicinity of the Project, and assess how Project operations affect GDEs. This is only a rough estimation by the Licensees of study items that could affect study costs. Many elements of CDFW's study request included no details.

As described below, the Licensees did not adopt CDFW's requested Groundwater study.

Request Elements	Licensees' Reply
Overall	**NOT ADOPTED**. In general, the Licensees did not adopt CDFW's study requests because, as stated by FERC in its Scoping Document 2, the Project facilities "are products of the water supply function of the SWP and the potential issues raised would remain in the absence of hydroelectric generation." To Licensees' knowledge, FERC has not required such a study for any other California project that proposes no new construction, dewatering or groundwater extraction (Criterion 6).
Request Element #1 – Existing data synthesis	**NOT ADOPTED.** The Licensees did not adopt the CDFW's request for a *Groundwater Study* for the reasons stated in Section 1.1.4 of the RSP. In particular, as described in Section 1.1.4, an applicant does not have "a duty to determine if a problem exists." The Licensees did not adopt this element of the requested study because CDFW provided no evidence to support that the Project in any way adversely effects groundwater, nor do they adequately describe the Project nexus (Criterion 5) between Project operations and effects, and how the study results would inform the development of license requirements. Existing and proposed Project operations do not include groundwater extraction. The overall request is a research study, and essentially addresses the effects of Project construction, which is not within the scope of this relicensing.
Request Element #2 – Evaluate geohydrologic processes and aquifer extent	**NOT ADOPTED.** The Licensees did not adopt this element of the requested study because CDFW did not adequately describe the Project nexus to existing conditions (Criterion 5), but rather requested collection of information for comparison to natural flow processes (i.e., pre-Project). The CDFW have provided no evidence to support that the current Project in any way adversely affects groundwater resources. This study request would be an exhaustive research study regarding a resource that has not been identified as negatively impacted by the Project, and which essentially would assess Project effects of initial Project construction and operation.

Request Element #3 – Identify Project facilities and impoundments and groundwater flow alteration	**NOT ADOPTED.** CDFW did not describe the need for this additional information (Criterion 4) or how the information would inform license requirements (Criterion 5). As stated above, the CDFW request a very costly groundwater research study that would not inform license requirements, and is outside the purview of relicensing by attempting to assess pre-Project, not existing conditions. Related to this study element and as mentioned above, in Scoping Document 2 FERC addressed the USFS' comment "the Angeles Tunnel may have affected groundwater flow through the system" by stating "the physical features cited by the Forest Service are products of the water supply function of the SWP and the potential issues raised would remain in the absence of hydroelectric generation."
Request Element #4 – Assess groundwater dependent ecosystems	**NOT ADOPTED.** CDFW has provided no evidence to support that the Project in any way adversely affects groundwater resources or groundwater-dependent ecosystems (GDE). CDFW did not describe the need for this additional information (Criterion 4) or how the information would inform license requirements (Criterion 5), especially considering Project operations of continuous daily import of water via the SWP to an arid Project area. This request element would be most applicable to new construction and dewatering activities during construction; however, the Licensees are not proposing any new construction. The Licensees' proposed *Botanical Resources Study* includes a wetlands and riparian assessment.
Request Element #5 – Identify other shallow groundwater users	**NOT ADOPTED.** CDFW did not describe the need for this additional information (Criterion 4) or how the information would inform license requirements (Criterion 5). As mentioned previously in the reply, Project operations do not include groundwater extraction or any proposed construction that would cause dewatering effects; however, the Project's continuous daily import of water via the SWP provides a beneficial effect regarding groundwater, stream baseflow and water temperature. In addition, the CDFW's estimated range of $350,000 and $700,000 to complete this study is artificially low. Given the breadth and depth of this study request – including but not limited to basin-wide characterization of aquifers within the Piru Creek and Castaic Creek watersheds (including aquifer depth/extent studies such as ground-penetrating radar, borings, and installation of wells or piezometers), physical models, numerical models, piezometer installations, field studies and monitoring, consultation and reporting – the Licensees estimate the cost of this research study to be between $1,000,000 and $2,000,000. The cost could be even greater than the highest estimate due to the uncertainties associated with the requested study (Criterion 7.) To Licensees' knowledge, FERC has not required such a study for any other California project that proposes no new construction, dewatering or groundwater extraction (Criterion 6).

3.2.24 Groundwater and Groundwater Dependent Ecosystems Study Request *(USFS and CDFW)*

In its PSP comments, the USFS requested a study named *Groundwater and Groundwater Dependent Ecosystems* (USFS, pp. 272 through 284). In general, the goal of the USFS requested study is "to characterize and understand effects of the Project, or by operation and maintenance of project facilities, on surface water-ground water interactions as they relate to habitat for aquatic species (e.g., fish, riparian vegetation, groundwater dependent ecosystems) and water quality, and water quantity in the Piru Creek and Castaic Creek watersheds" (USFS, p. 273). The study area would include the watersheds and groundwater basins associated with Piru Creek and Castaic Creek. The USFS estimated the cost to complete its requested study between $200,000 and $500,000

In its PSP comments, CDFW did not resubmit its *Groundwater Dependent Ecosystems* study request made in its PAD comments, but stated that "those [study requests] that are not resubmitted are still considered to be CDFW requests for needed study plans" (CDFW pp. 15). The CDFW request has some but not all of the study elements of USFS's requested study. CDFW states that its overall goal of the requested study is "to inventory and determine effects to the groundwater-dependent ecosystems and adaptively manage these systems within the changing legal and policy framework" (CDFW, PAD Comments, Attachment 1, pp. 155-160). The study area would include GDE sites located within the FERC Project boundary, as well as the sources of GDE sites that may be located outside of the current FERC Project boundary. The CDFW estimated the cost to complete its requested study would be approximately $300,000.

In reference to Criterion 7, the Licensees believe that USFS and CDFW significantly underestimated the cost to implement their requested new study. The Licensees estimate that implementation of the new study would cost between $600,000 and $1,000,000 because characterizing geohydrologic processes and surface water-groundwater interactions within the highly complex geologic setting of the Project is a broad-reaching research study that would include, but not be limited to study elements such as: (1) delineation of aquifer depth and extent via use of ground penetrating radar, geologic borings, wells or installation of piezometers; (2) evaluation of engineering geology information from the Project area; (3) determination to a very fine degree of water balance between inflow and outflow of the Angeles Tunnel to determine whether there is a gain or loss of water through the systems; (4) identification of key potential pathways for groundwater flow within the Project and non-Project elements, and how the presence of the elements and associated facilities affects groundwater flow; (5) evaluation of changes in the groundwater flow system with continued operation over broad hydrologic conditions; (6) if first year studies identify that Project or non-Project facilities are interacting with groundwater aquifers, development of appropriate MODFLOW surface water-groundwater interaction models, including calibration and verification to empirical monitoring data collected at study reach surface water-groundwater monitoring stations; (7) running predictive model runs of groundwater response to Project and non-Project flow regimes; and (8) use of USFS' GDE Level II Inventory Field Guide to document occurrence of GDEs and to evaluate pre-Project and

Project occurrence of GDE in the vicinity of the Project. This is only a rough estimation by the Licensees of study items that could affect study cost as many elements of USFS' and CDFW's study request included no detail on the number of the various types of study sites or number of numerical modeling runs to be evaluated. Also, MODFLOW modeling, if considered appropriate, would be a second year study element, and the modeling costs could easily exceed the upper end of Licensees' estimate of costs to perform this study.

As described below, the Licensees did not adopt USFS' requested *Groundwater and Groundwater Dependent Ecosystems Study* or CDFW's *Groundwater Dependent Ecosystems.*

Request Elements	Licensees' Reply
Overall	**NOT ADOPTED**. In general, the Licensees did not adopt USFS' and CDFW's study requests because, as stated by FERC in its Scoping Document 2, the Project facilities "are products of the water supply function of the SWP and the potential issues raised would remain in the absence of hydroelectric generation." To Licensees' knowledge, FERC has not required such a study for any other California project that proposes no new construction, dewatering or groundwater extraction (Criterion 6).
USFS' Request Element #1 – Existing data synthesis	**NOT ADOPTED.** The Licensees did not adopt the USFS' request for a *Groundwater and Groundwater Dependent Ecosystems Study* or CDFW's request for a *Groundwater Dependent Ecosystems Study* for the reasons stated in Section 1.1.4 of this RSP. In particular, as described in Section 1.1.4, an applicant does not have "a duty to determine if a problem exists." USFS provided no evidence to support that the Project in any way adversely affects groundwater, nor does USFS adequately describe the Project nexus (Criterion 5) between Project operations and effects, and how the study results would inform the development of license requirements. Existing and proposed Project operations do not include groundwater extraction. The overall request is a research study, and essentially addresses the effects of Project construction, which is not within the scope of this relicensing.
USFS' Request Element #2 – Identify Project facilities and impoundments and groundwater flow alteration	**NOT ADOPTED.** USFS did not describe the need for this additional information (Criterion 4). As stated above, USFS' requests a very costly groundwater research study that is outside the purview of relicensing. As mentioned above, in Scoping Document 2, FERC addressed the USFS' comment that "the Angeles Tunnel may have affected groundwater flow through the system." FERC responded "the physical features cited by the Forest Service are products of the water supply function of the SWP and the potential issues raised would remain in the absence of hydroelectric generation"

USFS' Request Element #3 and CDFW' Request Element #1 – Identify and characterize groundwater dependent ecosystems; and	**NOT ADOPTED.** The Licensees did not adopt this element of the requested study because USFS and CDFW provided no evidence of support that the Project in any way adversely affects GDEs. Existing and proposed Project operations do not include groundwater extraction for any purposes nor any new construction or dewatering activities. In addition, the USFS' estimated range of $200,000 and $500,000 to complete this study is artificially low. Given the breadth and depth of this study request – including but not limited to characterization of aquifers and surface water-groundwater interactions within the Piru Creek and Castaic Creek watersheds (including aquifer depth/extent studies such as ground-penetrating radar, borings, and installation of wells or piezometers), water balance gaging of the Angeles Tunnel, field studies and monitoring, consultation and reporting – the Licensees estimate the cost of this research study to be between $600,000 and $1,000,000. The cost could be even greater than the highest estimate if second year studies include MODFLOW numerical modeling of surface water-groundwater interactions.

3.2.25 Scenery Integrity Objective Study Request *(USFS)*

USFS requested a study named *Scenery Integrity Objective Study.* USFS filed two copies of this study plan: one on pages 285 through 290 of its letter and the second on pages 348 through 356 (numbered pages 4 and 12 by USFS) of its letter. The first study plan was identical to the plan USFS filed with its comments on the PAD, and the second study plan was labeled "discussion draft" in the top left-hand corner of the first page, and states at the top of the first page of the study: "The Forest Service believes if the Licensees incorporate the included comments in their entirety, then the Forest Service will be in agreement with them for this study." The Licenses have focused on the second study plan in this RSP.

In general, the purpose of USFS' requested study is to document how Project facilities and features on NFS lands do or do not comply with the Angeles National Forest's (ANF) scenery goals and objectives, and with a 1969 MOU among DWR, ANF and LPNF to the extent scenic quality is addressed in the MOU. The study area would include "all Project facilities and features on and approaching public land administered by the Forest Service, and their associated viewsheds, within a 4 mile radius" (USFS, p. 289). USFS estimated the cost to complete its requested study would be between $25,000 and $35,000.

As described below, the Licensees' have substantially adopted USFS' requested *Scenery Integrity Objective Study,* replacing the Licensees' *Visual Quality Study* (called *Scenic Integrity Study* in this RSP) proposed in its PAD with the USFS' study (See Section 4.1.15 for Licensees' proposed study). Provided below are the Licensees' replies to the USFS' comments on the study. In addition, the Licensees have modified this study plan to address FERC staff's comments on this study, which primarily pertained to expanding the study to include Project facilities and features on non-NFS

lands (refer to Section 2.0 for the Licensees' replies to FERC staff's comments on this study).

Request Elements	Licensees' Reply
Request Element #1 – Update the Visual Management System terms in the study plan to Scenery Management System.	**ADOPTED.** When discussing Project facilities and features on NFS lands, the Licensees' replaced the Visual Management System terms in the study plan to similar Scenery Management System terms.
Request Element #2 – Clarify Project facilities and features to include a list or table.	**ADOPTED WITH MODIFICATION.** Since Section 3 in the PAD describes all Project facilities and features and includes useful maps and photographs, the Licensees referenced this section of the PAD in the study plan rather than developing a separate list of Project facilities and features.
Request Element #3 – Include all Project facilities and features in the proposed Project boundary. The Project boundary around Pyramid Lake should be consistent with the Project area defined in Exhibit R-4-b of the June 25,1991, Exhibit R.	**ADOPTED WITH MODIFICATION.** The Licensees' proposed Project boundary includes all existing facilities and features that are within the existing FERC license. It is inappropriate and unnecessary to make the proposed Project boundary consistent with Exhibit R-4-b because that exhibit map includes areas that do not include Project facilities and features.
Request Element #4 – Include certain references in the study plan.	**ADOPTED.** The Licensees included the references requested by the USFS in the References section of the study plan.
Request Element #5 – Include Foreground, Middleground and Background in the study plan.	**ADOPTED.** The Licensees included Foreground, Middleground and Background in the study plan.

3.2.26 Assess Projected Recreation Use and Demand in the Project Area Study Request *(USFS)*

USFS requested a study named *Assess Projected Recreation Use and Demand in the Project Area* in its PAD comments and has resubmitted it unchanged in its PSP comments (USFS, pp. 291 through 298). The USFS also provided additional clarifying comments related to its original study request. In general, the goal of the requested study is to "project recreation use and demand within the Project area through the term of the new Project license" (USFS, p. 279). The requested study is addressed in the *Recreation Study* and below. USFS estimated the cost to complete its requested study between $120,000 and $140,000.

As described below, the Licensees' proposed *Recreation Study* in Section 4.1.11 of this RSP adopts some, but not all, of the USFS' requested study.

Request Elements	Licensees' Reply
Request Element #1 – Assess projected recreation use and demand in the Project area: Limited information regarding recreation visitor characteristics, attitudes, and preference information of Project area recreation visitors is available	**ADOPTED WITH MODIFICATION.** The USFS noted in their RSP comments with the resubmitted study request that while they did not prescribe any study methods in the original study request, it did note in comments on the PAD that they recommend studies regarding recreation use and demand make use of and try and emulate the National Visitor Use Monitoring (NVUM) program with regard to new visitor use studies. The Licensees concurred with this general approach and have updated the study plan to help clarify the approach making use of NVUM. The proposed *Recreation Study* includes updates study methods consisting of six elements: (1) observational survey; (2) visitor use questionnaire; (3) research publications and existing information; (4) assess regional uniqueness and significance of the Project area's primary recreation opportunities; (5) interview user groups and recreation providers; and (6) regional demand assessment.

3.2.27 Assess Recreation Carrying Capacity of the Project Area Study Request *(USFS)*

USFS requested a study named *Assess Recreation Carrying Capacity of the Project Area* in its PAD comments and has resubmitted it unchanged in its PSP comments (USFS, pp.299 through 306). The USFS also provided new comments regarding the study. In general, the goal of the requested study is to "identify the maximum level of recreational facility development and use that the Project area lands and waters can accommodate without significantly affecting sensitive resources or creating undesirable crowded conditions" (USFS, p. 285). USFS estimated the cost to complete its requested study between $45,000 and $60,000.

As described below, the Licensees' proposed *Recreation Study* described in Section 3.1.11 of this RSP adopts some, but not all, of the USFS' requested study.

Request Elements	Licensees' Reply
Request Element #1 – Assess the recreation carrying capacity of the Project area	**ADOPTED WITH MODIFICATION.** The USFS noted in its PSP comments that while they requested the study methods be developed at a later date they did note along with the resubmitted study request that comments make note of some methodology including a recommendation to use the Interagency Visitor Use Management Council recommendations of implementing capacity studies and had other recommendations related to developing carrying capacity goals. The Licensees' proposed *Recreation Study* proposes study methods and has been updated to address the Visitor Use Management Council's recommended processes; however no specific methods have been developed by the Council at this time. The proposed *Recreation Study* includes methods to address three types of capacity considerations that are proposed and will be evaluated for each existing recreation facility (as identified in the existing Project recreation plan) in the carrying capacity component of study: (1) ecological/biophysical aspects; (2) management or facility aspects; and (3) social aspects. Qualitative assessments will guide this section of the Demand Analysis except where user and inventory data provide for a more quantitative analysis. The study does not address

	future goals regarding carrying capacity rather the study will provide the information needed to develop future recreation management proposals and plans in the Draft License Application.

3.2.28 Assess Regional Uniqueness and Significance of the Project Area's Primary Recreation Opportunities Study Request *(USFS)*

USFS requested a study named *Assess Regional Uniqueness and Significance of the Project Area's Primary Recreation Opportunities* in its PAD comments and has resubmitted it unchanged in its PSP comments (USFS, pp. 307 through 314). USFS also submitted additional clarifying comments with its resubmitted study request. In general, the goal of the requested study is to "identify the uniqueness and relative significance of the Project Area's primary recreational opportunities under existing and future proposed modified Project operations" (USFS, p. 307). USFS estimated the cost to complete its requested study between $40,000 and $60,000.

As described below, the Licensees' proposed *Recreation Study* in Section 4.1.11 of this RSP adopts some, but not all, of the USFS' requested study.

Request Elements	Licensees' Reply
Request Element #1 – Assess regional uniqueness and significance of the Project Area's primary recreation opportunities: limited information regarding regional uniqueness and significance of the Project Area's primary recreation opportunities is available	**ADOPTED WITH MODIFICATION.** The USFS clarified that while it requested the study methods be developed at a later date it was indicated that the Statewide Comprehensive Outdoor Recreation Plan findings do not address Forest land management plan strategies, goals, and objectives and recommend using the USFS National Visitor Use Monitoring (NVUM) survey results as they are more relevant to the National Forest lands. The Licensees have updated the proposed *Recreation Study* to include results of NVUM in its study. The proposed *Recreation Study* methods will determine the regional importance and uniqueness of the Project area's primary recreation opportunities by identifying a range of southern California parks and recreation areas in the greater Los Angeles area, and tabulating what is known about annual visitation, general recreation opportunities and visitor origins. That information can be compared and contrasted in a qualitative and, where possible, quantitative narrative to help understand the uniqueness of Project-based recreation opportunities and facilities. Site-specific factors that contribute to the uniqueness of the Project area that may increase user demand over the term of the new license can help inform the construct of questions and possible activities to be more thoroughly evaluated in the Demand Analysis portion of the *Recreation Study*. The USFS requested GIS data collection and maps to gauge the significance of the regional opportunity for each activity. Existing GIS data will be used for analysis.

3.2.29 Assess Fire Hazards from Project-Induced Recreation Study Request *(USFS)*

USFS requested a study named *Assess Fire Hazards from Project-Induced Recreation* in its PAD comments and has resubmitted it unchanged in its PSP comments (USFS,

pp 315 through 321). The USFS also provided additional comments regarding the need for the study. The goal of the requested study is to determine potential fire hazards from recreational use within the study area. The USFS proposes that the study be developed using the recreation use impact inventory and assessment in conjunction with fire history data, fire suppression resource response times and capabilities, and an assessment of existing fuel loading and vegetation profiles within the affected Project area. The requested study corresponds with the objectives identified in USFS' requested *Assess Existing Recreation Use and Demand in the Project Area Study*. USFS estimated the cost to complete its requested study between $30,000 and $40,000.

As described below, the Licensees did not adopt the USFS' study request.

Request Elements	Licensees' Reply
Request Element #1 – Perform fire risk assessment study	**NOT ADOPTED.** The Licensees have adequate existing information for inclusion in the DLA and no additional study is required (Criterion 4). Information is widely available regarding wildfire risks and hazards. Existing literature and data regarding wildfire risks can be obtained without a study. While this information was not presented in the PAD, it is widely available and can be used to develop measures to reduce fire risk when developing future recreation plans for the Project. The requested study would not inform license requirements (Criterion 5). Additionally, USFS notes that most fires are human caused and Licensee's agree, however a new study at the Project is not needed as the risks are not unique to Project recreation uses and can be addressed by applying widely used and standard management techniques for helping reduce risks associated with recreation use.

3.2.30 Whitewater Boating Study Request *(USFS and NPS)* and Whitewater Recreation Study Request *(AW)*

USFS requested a study named *Whitewater Boating* in its PAD comments and has provided further comments and updated the study goals and objectives of its original study request in its PSP comments (USFS, pp. 322 through 329). In general, the goal of the requested study is "to evaluate the impacts of the hydropower project on existing and potential recreational whitewater boating use in the major stream within the Project, Piru Creek" (USFS, p. 324). USFS' study area would include NFS lands within the Piru Creek corridor from Frenchman's Flat Campground to UWCD's Lake Piru boating takeout. The requested study would include a Level 1 assessment with three request elements and, if needed based on results of a Level 1 assessment, could include a Level 2 assessment with two request elements, as well as a Level 3 assessment with two request elements. USFS estimated the cost to complete its requested study as between $50,000 and $60,000.

The United States Department of the Interior, National Park Service (NPS) requested in its PAD comments a study named *Whitewater Boating* that is essentially identical to USFS' requested study. NPS estimated the cost to complete its requested study as

between $50,000 and $60,000. NPS did not resubmit its study request but provided further rationale for the study request in its PSP comments (NPS, pp. 2 through 4).

American Whitewater (AW) requested a study named Whitewater Recreation in its PAD Comments and has resubmitted it unchanged in its PSP comments (AW, pp.4 through 7). With the exception of resource management goals and study area, AW's requested study is essentially identical to USFS' requested study. AW's study area would include Piru Creek above and below Pyramid Lake. AW estimated the cost to complete its requested study to be $50,000.

In reference to Criterion 7, the Licensees believe the USFS, NPS and AW underestimated the cost to implement their requested new studies. The Licensee's estimate that implementation of the study as proposed by AW and USFS would cost between $150,000 and $250,000 for the following reasons: (1) the Level 1 assessment work involving a hydrology component, interviews with focus groups and a standalone report would require extensive efforts by several different specialists, including a comprehensive report production effort; (2) the Level 2 assessment would involve a site visit and additional standalone report with analysis of flow ranges, and recommendations that would require extensive planning and logistical arrangements, along with post-field trip processing of results and subsequent desktop publishing and editing of an additional report; and (3) a Level 3 assessment would require a controlled flow study and separate report. The controlled flow study would require significant planning and logistical arrangements and coordination involving plant operations staff, water schedulers, and recreation and other study specialists. In addition, there would be considerable time involved in coordinating and arranging for the many participants that would involve a comprehensive event planning program including the development of measures for safety, parking access, sanitation, evaluation protocols and other factors.

As described below, the Licensees adopted elements of USFS', NPS' and AW's study requests in Licensees Study 4.1.19, *Whitewater Boating Study*.

Request Elements	Licensees' Reply
Request Element #1 – Conduct a whitewater boating flow assessment in Piru Creek upstream of Pyramid Lake	**NOT ADOPTED.** The Licensees did not adopt AW's request for a whitewater boating study in Piru Creek upstream of Pyramid Lake for the reasons stated in Section 1.1.4 of this RSP. The Project has no effects upstream of Pyramid Lake and thus there is no Project nexus for the study. (Criterion 5) Given this explanation, the Licensees have not addressed in this reply elements regarding a whitewater boating assessment in Piru Creek upstream of Pyramid Lake.
Request Element #2 – Conduct a whitewater boating flow assessment in Pyramid reach	**ADOPTED WITH MODIFICATION.** The Licensees adopted in their *Whitewater Boating Study* the USFS', NPS's, and AW's requests for a whitewater boating flow assessment in Pyramid reach with some variations in procedures, such as proposing to do both Level 1 and Level 2 assessments.

3.2.31 Water Temperature Monitoring and Development of Water Temperature Model Study Request *(USFS)*

USFS requested in its PAD comments a study named *Water Temperature Monitoring and Development of Water Temperature Model*, and resubmitted it in its PSP comments mostly unchanged (USFS, pp. 330 through 344).The USFS' study area extends to Pyramid reach from Pyramid Dam to Blue Point Campground, as well as collecting for modeling purposes water temperature data in both Quail and Pyramid lakes. In addition, USFS requests consultation between the Licensees and relicensing stakeholders at various points during study development and implementation, including delaying model selection criteria definition to a later point in the study so it would be unknown in the study planning and evaluation phase. The USFS estimated the cost to complete the requested study would be $120,000 to $140,000.

In its PSP comments, NMFS did not request a water temperature monitoring and model study, but stated it supported USFS' request.

In reference to Criterion 7, the Licensees believe that the USFS significantly underestimated the cost to implement its requested new study. The Licensees estimate that implementation of the study would cost between $200,000 and $225,000 because to complete the study plan as described by the commenters would require additional field data collection including meteorological stations, and additional water temperature monitoring in reservoirs and stream reaches that the Licensees do not believe was factored into the cost.

As described below, the Licensees' proposed *Water Quality and Temperature Study* adopts some, but not all, of the elements in the study requested by USFS in its PSP comments.

Request Elements	Licensees' Reply
Request Element #1 – Develop a water temperature model that can be used to inform license requirements	**NOT ADOPTED.** The Licensees have not adopted the SWRCB's and USFS' request for a water temperature model study. Because the current flow regime is required by the ESA to prevent unauthorized take of arroyo toads, a study of impacts of alternative flow regimes on water temperature is not likely to inform development of new license conditions. Further, temperature was considered in determining the appropriate flow regime for Piru Creek in the 2009 FERC Order and ESA evaluations and the Licensees are not aware of any changes that would warrant reexamining this issue. The only surface waters into which the Project discharges are Castaic Lake and Pyramid reach. The relative volume of water released through Angeles Tunnel and the resulting temperature effects of the Project's discharges into Castaic Lake, which are made for water supply, are *de minimis* when compared to the large volume of the lake. Therefore, a water temperature model is not needed because it would not be useful to inform license requirements regarding water temperature effects on Castaic Lake and related requirements in the new license (Criterion 4 and Criterion 5). In addition, neither the USFS nor SWRCB provided any evidence to

	suggest that water temperatures in Pyramid reach, for which information exists, affects any resource. Note that the Licensees' proposed *Water Quality and Temperature Study* would gather continuous water temperature at four locations in Pyramid reach for a year and collect quarterly reservoir profiles in Quail and Pyramid lakes. If an interested party believes those data indicate a potential issue, the party could request FERC to direct the Licensees to collect additional information, including developing a water temperature model, at that time. However, the large cost to develop a model (the Licensees anticipate the SWRCB's and USFS' expected cost of between $100,000 and $150,000 is extremely low), given that it is unlikely to be needed, is not warranted at this time (Criterion 7). Given this explanation, the Licensees have not addressed in this reply elements in the USFS' and SWRCB's request that are specifically related to the development of a water temperature model (e.g., install and maintain meteorological monitoring stations, develop a water temperature model platform in consultation with relicensing stakeholders, calibrate and validate a water temperature model, synthesize water temperatures, develop a base case, and produce model reports).
Request Element #2 – Collect additional water temperature data and consult on sampling locations	**ADOPTED WITH MODIFICATION.** The Licensees' *Water Quality and Temperature Study* includes the collection of additional empirical water temperature data at select locations in Quail and Pyramid lakes and at four locations in Pyramid reach. The Licensees' proposed data will be collected for one year.
Request Element #3 – Prepare Study Report	**NOT ADOPTED.** A separate study report is not required by FERC's ILP regulations. Available information will be provided to interested parties in the ISR, USR, DLA, and FLA. See Section 4.0 for additional information on reporting of study results.

3.2.32 Water Balance / Operations Model Study Request *(SWRCB)*

The SWRCB PSP comments reiterated the SWRCB's request for a study named *Water Balance / Operations Model* (SWRCB, Attachment A, page 4). The objectives of the study are to inform decisions made for Project operations; (2) accurately reproduce observed reservoir levels, reservoir releases, and project ramping rates, and hydropower generation, within acceptable calibration standards over a range of hydrologic conditions; (3) provide output to inform other studies, analyses, and models; and (4) model changes in Project operations to determine effects on reservoir levels, reservoir releases and hydropower generation. (SWRCB, Attachment A, page 4). SWRCB estimated the cost to complete its requested study as between $100,000 and $150,000.

NMFS's PSP comments expressed support for the SWRCB study plan request for a Water Balance/Operations Model. NMFS's comments indicated the Project's operations and current flow regime may be affecting aquatic habitats and it is not possible to quantify impacts without new information or study. Water quality, temperature, and flow can change as it is discharged from a dam and travels downstream. Most of the water

that is conveyed by the Project comes from many miles away, from a variety of different watersheds, and this inflow may radically change local water quality as it mixes and then is released downstream. Thus, the timing and nature of Project-affected water and its effects on habitats should be adequately assessed.

In reference to Criterion 7, the Licensees believe that the SWRCB significantly underestimated the cost to implement its requested new study. The Licensees estimate that implementation of the new study would cost between $300,000 and $350,000 because a new model would need to developed to represent the effects of changes in Project operations on hydropower generation. To reasonably represent the Licensees' hydropower operations, an operations model would need to represent operations on an hourly, if not 15-minute, time step. A model capable of representing hourly operations for the facilities would require use of a relatively sophisticated optimization engine and an interface allowing for the user to define constraints and objective functions. The model would also require collection and analysis of historical operations and energy pricing data for use in development and calibration.

As explained below, the Licensees did not adopt SWRCB's requested study.

Request Elements	Licensees' Reply
SWRCB Request Element #1 – Develop a water balance and operations model that can be used to simulate current and potential future Project operations over a range of hydrologic conditions (e.g. range of water years types)	**NOT ADOPTED.** The SWRCB has not indicated what specific license conditions the output from the *Water Balance/Operations Model study* would inform. Existing license conditions already require DWR to release measured inflow to Pyramid Lake. Furthermore, since the volume of SWP water moving through Pyramid Lake under normal operations typically dominates the water balance of Pyramid Lake, but those operations are not restricted by FERC. Accordingly, a water balance model would not provide any meaningful information about reservoir levels, releases, ramping rates, or hydropower generation.
NMFS Request Element #1 – Develop a water balance/operations model to identify how the timing and nature of Project-affected water and its effects on habitats should be adequately assessed.	**NOT ADOPTED.** NMFS has not indicated what specific license conditions the output from the *Water Balance/ Operations Model Study* would inform. The effect of the Project on the timing and nature of flows will be assessed under the *IHA Study*.

3.2.33 Fish Entrainment Risk Assessment Study Request *(CDFW)*

CDFW did not submit in its PSP comments the *Fish Entrainment Risk Assessment* study request that it submitted in its PAD comments. However, CDFW stated in its PSP comments that "those [study requests] that are not resubmitted are still considered to be CDFW requests for needed study plans" (CDFW pp. 15). In general, the goal of the requested study is "to assess the potential effects of entrainment at these facilities [Pyramid Dam outlet pipe intake and radial gates and Angeles Tunnel intake] on fish." The study area would include Pyramid Lake. CDFW estimated the cost to complete its requested study in the $50,000 range.

In its PSP comments, NMFS did not request a fish entrainment study, but stated it supported CDFW's request.

In reference to Criterion 7, the Licensees believe that the CDFW significantly underestimated the cost to implement its requested new study. The Licensees estimate that implementation of the new study would cost between $125,000 and $150,000 for the following reasons: (1) the initial desktop risk assessment is estimated to cost between $30,000 and $50,000; (2) the engineering, construction, and implementation of a net large enough to handle the Castaic Powerplant tailrace flows of up to approximately 20,000 cfs would be very high. Preliminary estimates suggest that the cost would be in the $75,000 to $125,000 range; and (3) the duration of tailrace sampling was not specified by CDFW, which introduces additional unknown labor costs.

As described below, the Licensees' proposed *Fish Entrainment Risk Assessment Study* in Section 4.1.17 of this RSP adopts some, but not all, of the elements in CDFW's requested study.

Request Elements	Licensees' Reply
Request Element #1 – Assess entrainment at the Pyramid Dam radial gates and low level outlet, and at the Angeles Tunnel Intake	**ADOPTED WITH MODIFICATION.** The Licensees' proposed *Fish Entrainment Risk Assessment Study* would evaluate the potential for entrainment into the Pyramid Dam low level outlet and the Angeles Tunnel Intake, as requested by CDFW. The Licensees did not adopt CDFW's request to assess fish passage through the Pyramid Dam radial gates. CDFW's study request provides no basis for why this information is needed (Criterion 4) or would be useful to inform license requirements (Criterion 5). The assessment of risk of fish passing through a dam's radial gates is not consistent with studies performed in other relicensings, including those cited by CDFW.
Request Element #2 – The potential for entrainment at these intakes will be analyzed using existing fishery data from the "Fish Populations in Pyramid Lake Study"	**NOT ADOPTED.** The Licensees did not adopt CDFW's request that this study focus on fishes found near the low level outlet and Angeles Tunnel intake using gill netting data from the "*Fish Populations in Pyramid Lake Study*" for two reasons. First, it is unclear what "*Fish Populations in Pyramid Lake Study*" CDFW refers to. As stated in the PAD (section 4.5.4.4 Pyramid Lake, p.4-116), the most recent general fish surveys in Pyramid Lake were conducted by CDFW in May and October of 2013, but did not include gill netting. Nor did CDFW include in its PAD comments a request that the Licensees perform a "*Fish Populations in Pyramid Lake Study*" or any gill netting, and the Licensees did not propose such a study. Second, existing information adequately describes the fish species composition in Pyramid Lake, and existing literature on the life history of these fishes can be used to determine the likelihood by lifestage of these fishes occurring in the deep part of Pyramid Lake near the low level intake and Angeles Tunnel intake (Criterion 4). This is the approach in the Licensees' proposed *Fish Entrainment Risk Assessment Study.*

Request Element #3 – Use existing information to characterize the location and operation of the Pyramid Dam low outlet intake and the Angeles Tunnel intake, the approach velocities to the intakes, and to estimate the swim speed of fishes that may be near the intakes	**ADOPTED.** The Licensees' proposed *Fish Entrainment Risk Assessment Study* states the Licensees will use existing information to characterize the location and operation of the intakes, calculate approach velocities to the intakes, and estimate the swim speed of fishes that may be near the intakes.
Request Element #4 – Compare fish swim speeds with the approach velocities to the intakes	**ADOPTED.** The Licensees' proposed *Fish Entrainment Risk Assessment Study* provides that the Licensees will compare the swim speeds of the lifestages of fishes that are likely to be near the intakes with the approach velocities to the intakes.
Request Element #5 – QA/QC data	**ADOPTED.** The Licensees' proposed *Fish Entrainment Risk Assessment Study* includes QA/QC of all data.
Request Element #6 – Prepare study report and provide the information to interested parties as soon as possible	**ADOPTED WITH MODIFICATION.** A separate study report is not required by FERC's ILP regulations. Available information will be provided to interested parties in the ISR, USR, DLA, and FLA. See Section 4.0 for additional information on reporting of study results.

3.2.34 Comprehensive Argentine Ant Survey Study Request *(CDFW)*

CDFW did not resubmit in its PSP comments an Argentine ant study, but stated that "those [study requests] that are not resubmitted are still considered to be CDFW requests for needed study plans" (CDFW p. 17), which included a *Comprehensive Argentine Ant Survey*. In general, the goals of the requested study are "to document the presence and distribution of Argentine ants, determine if the Project could introduce or spread Argentine ants, and reduce Argentine ant habitat." The study area would include all Project facilities, Pyramid reach of Piru Creek, Castaic Creek at Elderberry Forebay and developed recreation facilities. In its PSP comments, CDFW stated that the study is needed because the Project introduces habitat for the ants. CDFW estimated the cost to complete its requested study as between $35,000 and $65,000.

In reference to Criterion 7, the Licensees believe that CDFW significantly underestimated the cost to implement its requested new study. The Licensees estimate that implementation of the new study would cost between $250,000 and $500,000 for the following reasons: (1) all land would need to be surveyed for argentine ants, covering hundreds of acres; (2) the protocol is set-up such that a single acre would need to be surveyed each morning; (3) hundreds of days of set-up and monitoring would be required to perform the requested study; and (4) although a trivial cost at a single acre, over hundreds of acres, the cost of the survey 'tools' would be significant.

As described below, the Licensees did not adopt the CDFW study request for the reasons stated below.

Request Elements	Licensees' Reply
Request Element #1 – Gather information necessary to answer six questions on the presence and distribution of the Argentine ant	**NOT ADOPTED.** The Licensees did not adopt the CDFW's requests for a *Comprehensive Argentine Ant Study* for the reasons stated in Section 1.1.4 of this RSP. In particular, as described in Section 1.1.4, an applicant does not have "a duty to determine if a problem exists." As discussed below, CDFW has not provided any evidence to suggest the Project contributes to the spread of Argentine ants. CDFW's goal for the study is to address some specific questions regarding Argentine ant's trophic structure and biodiversity displacements, impacts on native ants and other insects, impacts to pollination, seed dispersal and fruit set, or factors that influence the size and distribution of Argentine ants. CDFW's recommended methods would not provide the information to answer these questions. In addition, based on CDFW's expressed study goal of answering these questions, it appears CDFW's requested study is more of a research study on Argentine ants than an informative study that could help inform license conditions (Criterion 5). In addition, CDFW has not shown a demonstrative Project nexus (Criterion 5). While the Argentine ant is widespread in California, CDFW has provided no evidence that it is a nuisance at the Project, compared to anywhere else where it occurs in California, or that the Project has caused Argentine ant to invade the area or spread into new areas.
Request Element #2 – Initial reconnaissance and study site selection to develop and implement a study to assess the level of invasion by Argentine ants…and where their impacts are greatest	**NOT ADOPTED.** The Licensees did not adopt this element as CDFW did not adequately address the Project nexus (Criterion 5) for the proposed study area upstream and downstream of the Project. Section 1.1.4 of this RSP details the reasons why these areas would not be adopted into any study plans. Also, the study does not meet Criterion 6, as it was not designed for such a large study area. Per the proposed protocol, a hectare is broken up into a grid and 32 index cards containing cookies or tuna oil are spread throughout the area. Surveyors leave the cards in place for an hour in the morning and then check each one. The protocol was originally implemented on a single hectare (USGS 2015). Per the protocol, a single hectare can be done in a day, since the protocols recommends the surveys be performed in the morning. The FERC Project boundary contains approximately 1,515 hectares and could not easily be pared down to meet a 'comprehensive survey' that covers the proposed study area. Again, this appears to suggest that CDFW's requested study is more of a research study than a relicensing study.
Request Element #3 – Develop and implement an Argentine ant rapid assessment	**NOT ADOPTED.** CDFW requests the Licensees use the USGS 2015 protocol, which is not consistent with generally acceptable protocols (Criterion 6). The protocol was originally part of a larger study of the ESA-listed Pacific pocket mice (*Perognathus longimembris pacificus*) at Camp Pendleton (USGS 2015) – it is not a protocol that was designed solely for an ant survey.

Request Element #4 – Prepare a report that includes development and implementation of control measures for Argentine ants	**NOT ADOPTED.** The Licensee did not adopt this measure because the CDFW did not adequately address how information from the study would be used to inform license conditions (Criterion 5). The study would not inform license requirements since, at this time, there is no effective strategy for managing Argentine ants over large areas, particularly those not specifically tied to buildings (University of California, Riverside 2015). Therefore, the study would not provide information that would inform a long-term management approach for Argentine ants, as suggested by CDFW.

3.2.35 Herbicide, Pesticide and Rodenticide Effects on Vegetation and Wildlife Study Request *(CDFW)*

CDFW did not resubmit in its PSP comments the *Herbicide, Pesticide and Rodenticide Effects on Vegetation and Wildlife*, that CDFW included in its PAD comments, but stated in its PSP comments that "those [study requests] that are not resubmitted are still considered to be CDFW requests for needed study plans" (CDFW, p. 17). However, some information on the requested CDFW study was provided in their PSP comments (CDFW, p. 12). In general, the original CDFW goal of the requested study was "to determine if Project-related uses of pesticides cause deleterious effects to vegetation and wildlife and determine known poisonings of wildlife from rodenticide..." However, the CDFW's PSP comments focused solely on aquatic herbicides (CDFW, p. 12). The original request did not describe any specific elements, but in its PSP comments, CDFW recommended conducting water quality sampling in Quail Lake, Pyramid Lake and Piru Creek downstream of the reservoir to determine "what areas are impacted by the presence of pesticides…" (CDFW, p. 12). CDFW originally estimated the cost to complete its requested study as between $20,000 and $40,000, without any study details, but did not provide any updated costs for the methodology presented in their PSP comments.

In reference to Criterion 7, the Licensees believe that CDFW significantly underestimated the cost to implement its requested new study. The Licensees estimate that implementation of the new study would cost between $100,000 and $200,000, assuming the following for all of the details not included in the requested study: (1) necessity to develop and implement a new protocol to determine if pesticide use by the Licensees causes harm, bioaccumulation, death or other undefined deleterious effects to vegetation and wildlife; and (2) requirement to test any wildlife mortality/poisoning for possible secondary rodenticide poisoning. The scope of CDFW's requested new study is undefined, but is assumed to include the entire proposed Project boundary wherever pesticides are used and to find, collect, and test wildlife that appeared to have died. The efforts involved in both collecting samples and having them tested is all factored into the Licensees' cost estimate to implement the study.

The Licensees did not adopt the CDFW's study request for the reasons stated below.

Request Elements	Licensees' Reply
Request Element #1 – Conduct study to determine potential harm to document secondary poisoning	**NOT ADOPTED.** The Licensees did not adopt this request element because CDFW did not adequately describe the proposed study to determine if it's consistent with accepted practice (Criterion 6). In addition, no specific protocols were described in the CDFW request, although CDFW noted it has done secondary rodenticide studies. However, any methods from such studies were not described, nor was information given to describe the benefit of such previous studies that could justify the need for this type of study for a hydropower relicensing project. There was no mention of studies to determine if pesticides are causing deleterious effects to wildlife and vegetation. Furthermore, the letter said "…CDFW could not find an example of previous FERC studies of this kind…" Additionally, the PAD described the uses of pesticides on the Project. Pesticide use at the Project by the Licensees is governed by well-known recommended application practices that are deemed to be best practices for protecting the environment. This existing data is sufficient for determining license conditions (Criterion 5). Finally, the CDFW did not adequately address Criterion 7, since there were no details of the study from which to make a determination of cost, leaving the assumed cost of $20,000 to $40,000 unsupported.
Request Element #2 – Conduct water sampling specific to the use of pesticides to treat algae and aquatic weeds, including in Quail Lake, Pyramid Lake and Piru Creek downstream of the reservoir to determine what areas are impacted by the presence of pesticides.	**NOT ADOPTED.** The Licensees did not adopt this request element because there was insufficient description to determine if it's consistent with accepted practice (Criterion 6). Data collection protocols, specific sampling sites, and timing were not detailed in the CDFW's PSP comments. Additionally, the PAD described the uses of pesticides, including aquatic herbicides, on the Project. Pesticide use at the Project by the Licensees is governed by well-known recommended application practices that are deemed to be best practices for protecting the environment. This existing data is sufficient for determining license conditions (Criterion 5). Finally, the CDFW did not adequately address Criterion 7, since the original study request offer no details from which to make a determination of cost, leaving the assumed cost of $20,000 to $40,000 unsupported. Meanwhile, the PSP comments contained a request to conduct water samples at multiple sites without providing any costs.

4.0 STUDY PLANS

4.1 LICENSEES' REVISED STUDY PLAN

In developing this RSP, the Licensees carefully reviewed the requests for additional studies, comments provided to FERC, and existing information presented in the PAD. Stakeholder recommendations and study requests received from governmental agencies and other stakeholders have been considered and, where appropriate, have been included in this RSP. Complete versions of the individual study plans are provided below.

The Licensees propose 22 studies. This includes one study (*Quail Lake Fisheries Study*) on which the Licensees believe they have reached agreement with stakeholders, 17 studies that were proposed by the Licensees in their PSP and have been modified based on comments from FERC and stakeholders, and four studies that were not proposed by the Licensees in their PSP and have been added based on comments from stakeholders.

4.1.1 Aquatic Invasive Species Study

4.1.1.1 Project Nexus

Continued Project O&M and Project-related recreation activities have potential to introduce and propagate AIS. For the purpose of this *AIS Study*, AIS is defined as aquatic, non-native nuisance organisms that invade ecosystems beyond the species' natural, historic range or are native but are considered "nuisance" species because they cause environmental, recreational, or economic harm (e.g. cyanobacteria).

4.1.1.2 Existing Information and Need for Additional Information

Existing, relevant, and reasonably available information regarding AIS within the proposed Project boundary is provided in Section 4.5.1.1 of the Licensees' PAD. As a summary, the Licensees found records of two AIS in the Project reservoir or impoundments, and concluded 15 AIS have potential to occur in the Project reservoir and impoundments. Cyanobacteria (algae) are known to occur in Pyramid Lake, and in December of 2016, after the filing of the Licensees' PAD, adult quagga mussels were located in the Angeles Tunnel between Pyramid Lake and Elderberry Forebay. These mussels were located during a tunnel inspection by the Licensees' staff and were removed at that time. CDFW was notified of the finding. Los Angeles County Department of Parks and Recreation in conjunction with DWR and CDFW instituted boating restrictions on Pyramid Lake. Notifications were also sent to the Metropolitan Water District of Southern California (MWD) and the USFS.

Currently, the Licensees conduct plankton-tow surveys once to twice monthly depending on the time of year, and visual surveys monthly for quagga and zebra mussels in Pyramid Lake. With the recent finding of quagga mussels in the Angeles Tunnel, the Licensees will be expanding their monitoring per established regulations for the management of quagga and zebra mussels, including implementing DWR's *Quagga*

and Zebra Mussel Rapid Response Plan for the SWP and developing a containment plan. DWR is currently coordinating with CDFW on the development of a Quagga Mussel Control Plan for Pyramid Lake, Angeles Tunnel and Castaic Lake. The program includes management of vectors, mussel population monitoring, and public education. While DWR is working with CDFW towards approval of a control plan, it is implementing several measures to prevent the spread of mussels. Los Angeles County Department of Parks and Recreation also conducts pre-entry boat inspections at Pyramid Lake for quagga and zebra mussels, as well as, exit inspections where inspectors ensure that live-wells and bilges of watercraft leaving Pyramid Lake are drained of water and verifying that drain plugs are dislodged. The Licensees also conduct monitoring and management on Pyramid Lake for cyanobacteria. No formal surveys for other AIS are conducted in Pyramid Lake, Quail Lake or Elderberry Forebay.

Additional information is needed to determine if AIS are present in the study area for the *AIS Study*. If found, their locations in relation to Project facilities, Project O&M, and Project-related recreation activities will be identified to determine if these locations might facilitate the propagation of AIS within Pyramid Lake, Quail Lake and Elderberry Forebay.

4.1.1.3 Study Goals and Objectives

The goal of this *AIS Study* is to determine if continued Project O&M and Project-related recreation activities could increase the abundance of AIS or spread them to new areas if they are present within the study area for the *AIS Study*. This may occur if:

- An AIS is located within the study area for the *AIS Study*; and
- A specific Project O&M or recreation activity has a reasonable possibility of spreading AIS.

The objective of this *AIS Study* is to gather sufficient data necessary to fill recognized information gaps about the presence and location of AIS within the proposed Project boundary.

4.1.1.4 Study Methods

Study Area

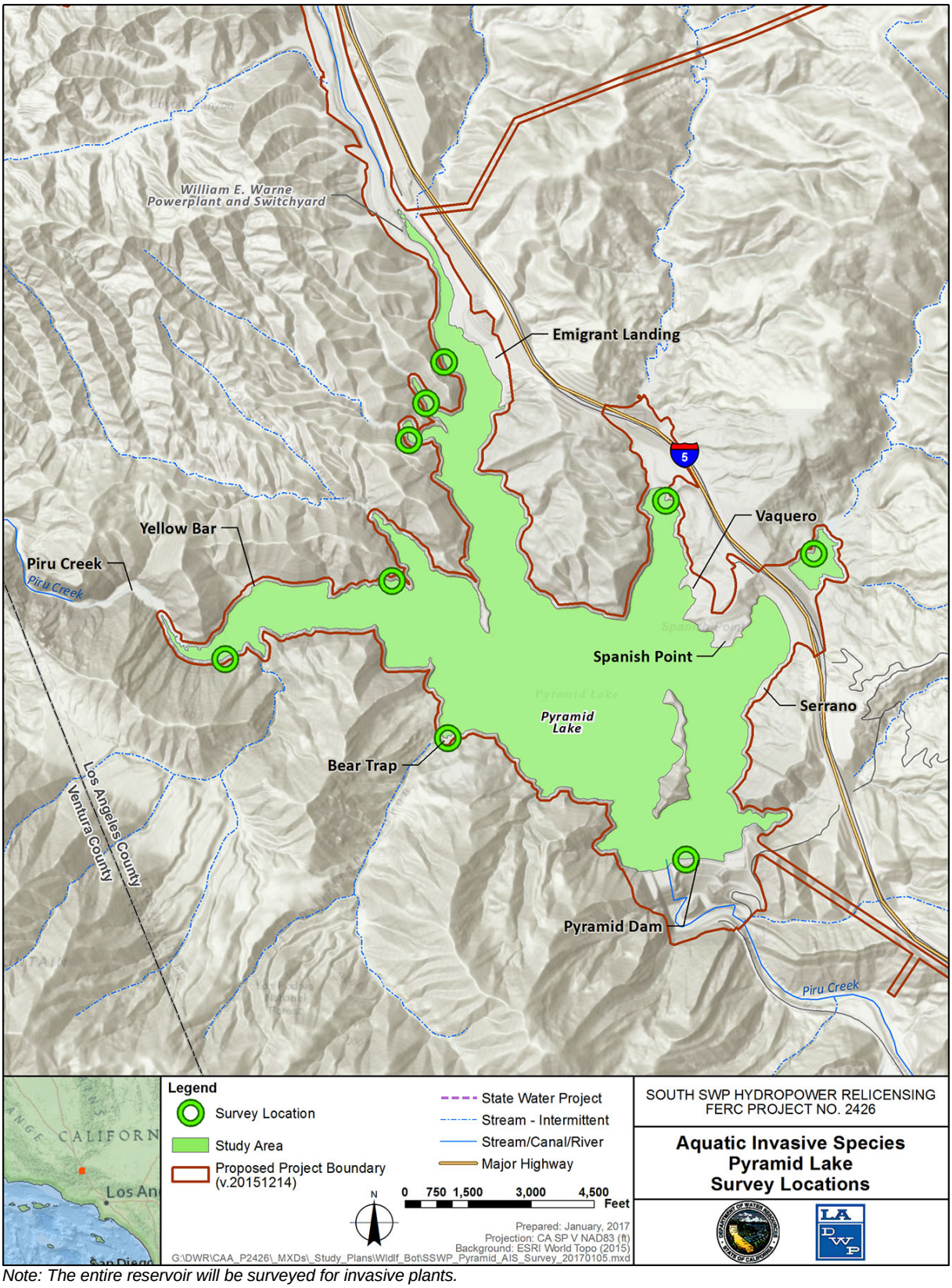
The study area for the *AIS Study* consists of Pyramid Lake, Quail Lake and Elderberry Forebay. Specific survey areas for each reservoir are shown on Figures 4.1-1 to 4.1-3.

General Concepts and Procedures

- Personal safety is the most important consideration of each fieldwork team. Fieldwork will only occur in safely accessible areas and under conditions deemed safe by the field crews. Locations within the study area that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed;

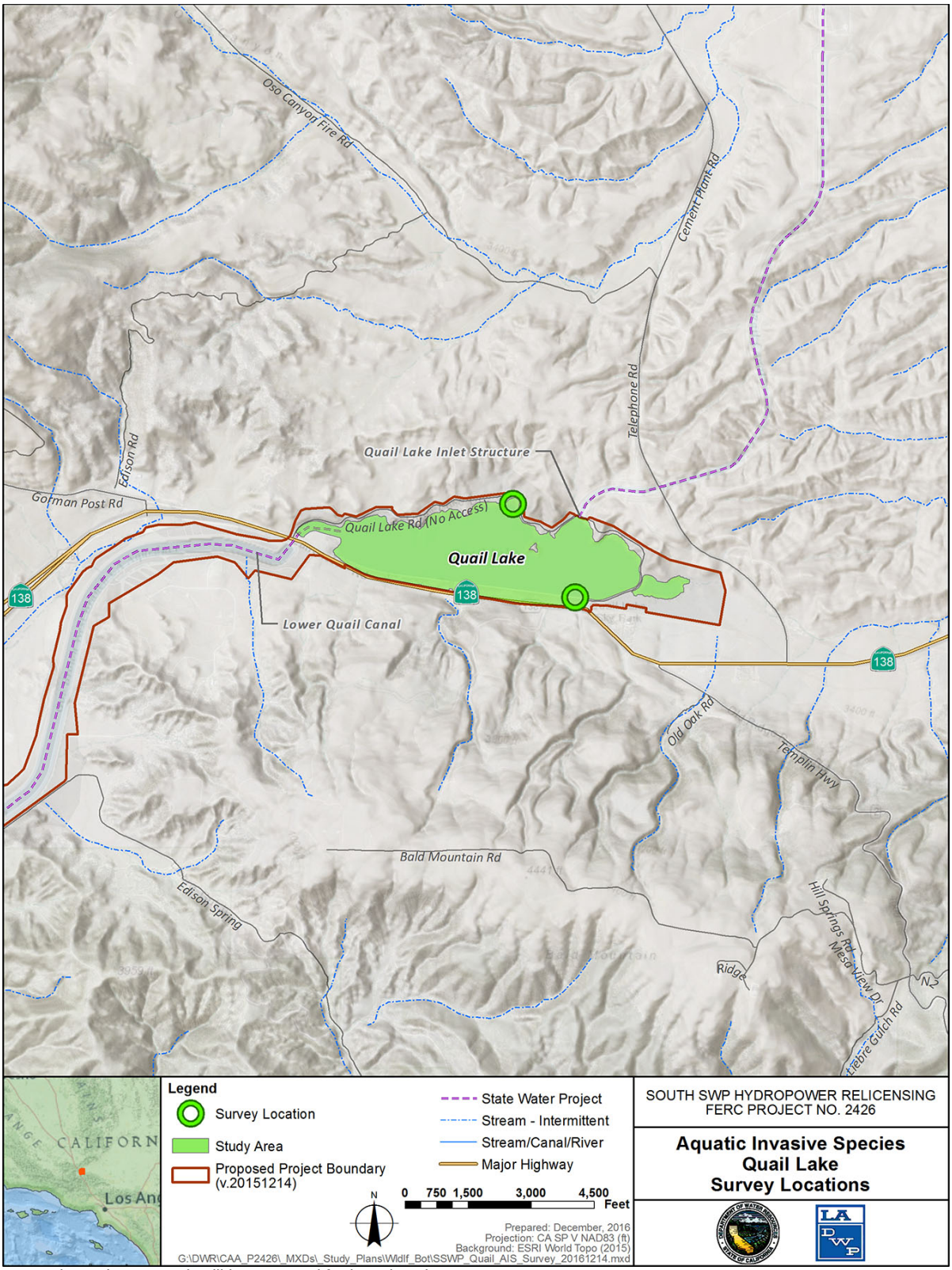
these areas will be identified in the data summary and an explanation for survey exclusion will be provided.

- The *AIS Study* will begin after FERC issues its Study Plan Determination.
- The *AIS Study* does not include the development of requirements for the new license, which will be addressed outside the *AIS Study*.
- The *AIS Study* focuses on AIS within the proposed Project boundary, but the study area for the *AIS Study* is specific to that resource.
- If required for the performance of the *AIS Study*, the Licensees will make a good faith effort to obtain permission to access private property well in advance of initiating the *AIS Study*. The Licensees will only enter private property if permission has been provided by the landowner.
- The Licensees will acquire all necessary agency permits and approvals prior to beginning fieldwork for the *AIS Study*.
- Field crews may make variances to the *AIS Study* in the field to accommodate actual field conditions and unforeseen problems. Any variances from the *AIS Study* will be noted in the data resulting from the *AIS Study*.
- To prevent the introduction and transmittal of amphibian chytrid fungus and invasive aquatic species (e.g., quagga mussels, zebra mussel, and Asian clams), field crews will be trained on, provided with, and use materials (e.g., Quat) for decontaminating their boots, waders, and other equipment when leaving or traveling between water-based study sites. Field crews will follow DWR's Quagga and Zebra Mussel Rapid Response Plan and CDFW's Aquatic Invasive Species Decontamination Protocol which can be found at the following link: (https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=43333). All boats used during the study will follow cleaning protocols, including inspections before and after use. All decontamination requirements in place at Project reservoirs including those of DWR's *Quagga and Zebra Mussel Rapid Response Plan* for the SWP will be strictly followed (DWR 2010).



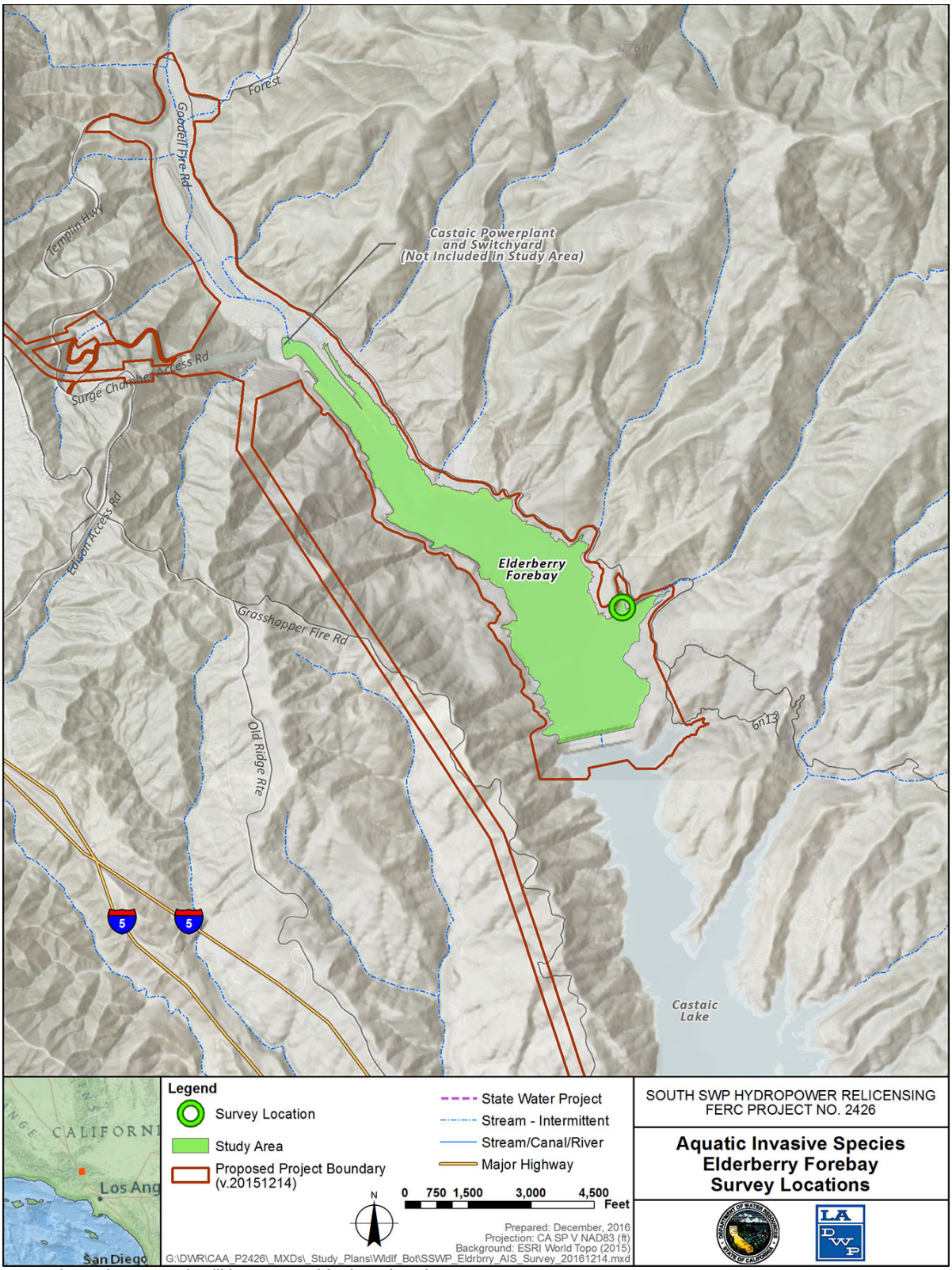
Note: The entire reservoir will be surveyed for invasive plants.

Figure 4.1-1. Map of Focused Survey Locations for Aquatic Invasive Species on Pyramid Lake



Note: The entire reservoir will be surveyed for invasive plants.

Figure 4.1-2. Map of Focused Survey Locations for Aquatic Invasive Species on Quail Lake



Note: The entire reservoir will be surveyed for invasive plants.

Figure 4.1-3. Map of Focused Survey Locations for Aquatic Invasive Species on Elderberry Forebay

Methods

The *AIS Study* will consist of three steps: (1) gather data and prepare for field effort; (2) conduct surveys; and (3) prepare final report. These steps are described below.

Step 1 – Gather Data and Prepare for Field Effort. The Licensees will prepare field maps for the *AIS Study*, depicting aerial imagery and Project features. Field preparation will include review of the *AIS Study Plan*, development of data sheets and determination of the survey period. This effort will include coordination with staff at Pyramid Lake, Quail Lake and Elderberry Forebay, including the Los Angeles County Department of Parks and Recreation, Los Angeles County Sheriff, and the Pyramid Lake concessionaire, Rocky Mountain Recreation Company.

Step 2 – Conduct Surveys. The Licensees will conduct specific surveys for aquatic invasive snails and clams (Asian clam, European ear snail, and New Zealand mudsnail), red-eared sliders, aquatic invasive plant species (sago pondweed, Eurasian watermilfoil, coontail, water primrose, water hyacinth, hydrilla, and parrot's feather milfoil) and by incidental siting, American bullfrog and red swamp crayfish. The Licensees currently conduct monitoring for zebra and quagga mussels at Pyramid Lake, so they are not proposed for inclusion in the field surveys. Staff from the Environmental Assessment Branch of DWR's Division of Operations and Maintenance monitor and sample for cyanobacteria, so cyanobacteria monitoring is not proposed for additional monitoring in this Study. However, if any AIS that are not specifically targeted during this *AIS Study* are observed, they will be recorded as incidental sightings.

Surveys for aquatic invasive snails and clams will be performed at nine locations on Pyramid Lake (see Figure 4.1-1). To the extent practical, survey sites will coincide with sites currently sampled for AIS by DWR. Two locations on Quail Lake will also be selected per Figure 4.1-2. Elderberry Forebay will also be surveyed for invasive snails and clams, with one transect selected along the shoreline (see Figure 4.1-3).

Specific survey sites will be located in areas where AIS are more likely to be introduced or in areas with potential habitat for AIS snails and/or clams. In general, areas with silt, sand, or gravel substrate and a relatively low gradient will be targeted for the focused survey, which will be conducted from a boat.

At each focused site, surveyors will establish a 320-foot transect along (parallel to) the shoreline, covering what is accessible from the boat (a total of approximately 3 feet, spread above and below the waterline). The Licensees will collect general site information, including the geographical extent of the site (using a map-grade GPS unit), the date and time of the survey, field crew member's present, and general characterization of the weather. Representative photographs of each site will be taken.

The Licensees will record the dominant and sub-dominant substrate, the average water depth, and the maximum water depth encountered during the survey. Basic water quality parameters will be collected including water temperature, dissolved oxygen (DO), pH, conductivity, and turbidity using a hand-held probe (e.g., HydroLab or YSI)

and measure water clarity using a Secchi disc. For purposes of characterizing the aquatic plant species composition along each transect, all aquatic vegetation will be identified to the species level within the littoral zone using a presence/absence protocol. The littoral zone is the near shore area where sunlight penetrates to the sediment and allows aquatic plants (macrophytes) to grow.

At each focused survey location, the presence or absence of Asian clams, European ear snail, New Zealand mudsnail, and channeled apple snail will be evaluated using two methods: visual surveys and a sediment sieve.

First, a visual inspection of the shoreline aquatic vegetation and immediate shallow water will occur at each survey site to determine the presence of snails, clams, or other mollusks. Depending on gradient, water level and clarity, staff will also visually inspect an area of the shoreline up to 33 feet from the wetted edge.

Additionally, up to 10 unique sediment samples will be collected and sieved within each focused site. Five samples will be collected along the shoreline (approximately 66 feet apart), and five more will be collected approximately 33 feet offshore, perpendicular from the corresponding onshore sample, which will be used as reference points for each offshore sample (Grohs and Klumb 2010). The samples collected along the shoreline, under the water, will involve shoveling substrate directly into a five-gallon bucket with a stainless steel wire cloth affixed to the bottom (Figure 4.1-4). Each sample will consist of enough sediment to fill the bucket to a predetermined volume (approximately two to three shovel loads). The substrate sample will be rinsed to remove the fine sediment, and staff will note the presence or absence of snails and clams of interest in each subsample. Other bivalves and mollusks will be identified to the extent possible.

Samples taken offshore will be collected using an Ekman dredge or similar device (Figure 4.1-5) and will follow the same process described above.

Figure 4.1-4. Example Sieve and Bucket System

Figure 4.1-5. Example Ekman Dredge

The Licensees will also conduct surveys for the red-eared slider. Basking and visual encounter surveys will be conducted in the nine focused locations in Pyramid Lake, the

two sites on Quail Lake and the one site on Elderberry Forebay identified for the aquatic invasive snail and clam surveys. The Licensees will survey suitable habitat within focused locations. Surveys will be performed with binoculars and a tripod-mounted spotting scope. Additionally, surveys will be conducted for a period of up to one hour per survey site and will occur at dawn. The following data will be recorded: date, time, observer, GPS location, weather description, presence or absence of slow-moving water, basking substrate type, percent submergent and emergent vegetation, estimated water depth, and description of nearby upland habitat. Additional reptile or amphibian species seen during these surveys will be recorded as incidental sightings.

To document the presence of aquatic invasive plants (including alligatorweed, water hyacinth, hydrilla, water primrose, parrotfeather, etc.) in the open water (as compared to the shoreline surveys described above), the Licensees will conduct one survey of the portions of Pyramid Lake open to motorized boats, following pre-established survey transects spaced approximately 96 feet apart. The water surface will be surveyed for aquatic plants. In addition to the boat operator, there will be two surveyors, one on either side of the boat, each scanning a 48-foot-wide area. A weed rake will be used along the transect and checked periodically to retrieve aquatic weeds that are not visible from the surface.

All aquatic plant species documented during the open water surveys will be identified to species level, if possible. If necessary for identification, plants will be collected and keyed using the Jepson Manual (Baldwin et. al. 2012).

If an AIS plant species is identified, the following information will be collected:

- Digital photos to document the occurrence
- GPS delineated point or polygon
- Estimated phenology and descriptions of reproductive state
- Potential Project-related activities in the vicinity of the specimen
- Estimated size of occurrence (i.e. number of individuals)

AIS plant surveys will be conducted in the late summer or early fall.

American bullfrog and red swamp crayfish will be noted if incidentally observed during the Study.

Quality Assurance and Quality Control

Field data will be collected in a manner that promotes high quality results, and will be subject to appropriate QA/QC procedures including rechecking field data sheets, spot-checking data, and reviewing electronic data, including GIS products, for completeness.

Analysis

Following the surveys, the Licensees will prepare GIS maps depicting AIS occurrences, Project facilities, Project-related recreation activities and other data collected during surveys. Water quality will be reviewed, where applicable and as relevant to the potential introduction or establishment of AIS in the study area for the *AIS Study*.

Reporting

The Licensees will compile *AIS Study* results for incorporation, to the extent they have been completed, into the ISR, USR, DLA, and FLA. A map showing the locations of AIS found in the reservoir will be included in the summary.

Specific AIS will be reported to relevant agencies within three days of being located as follows:

- CDFW, if quagga or zebra mussels, New Zealand mudsnail, or channel apple snail are located
- California State Parks, Division of Boating and Waterways, if water hyacinth is observed
- California Department of Food and Agriculture (CDFA), if hydrilla is observed

4.1.1.5 Consistency of Methodology with Generally Accepted Scientific Practices

The *AIS Study* methodology is consistent with recently performed surveys for AIS, including 2014 and 2016 surveys for Asian clams in New York and New Bullards Bar Reservoir in California respectively; 2010 surveys for New Zealand mudsnails in Washington; and 2012 surveys for aquatic invasive plants, snails and bivalves in the Umpqua National Forest in Oregon.

4.1.1.6 Schedule

The *AIS Study* will begin after FERC issues its Study Plan Determination. The Licensees anticipate the schedule below will be followed to complete the *AIS Study*.

Fieldwork Preparation	June 2018 – July 2018
Fieldwork	August 2018
Data QA/QC	October 2018
Data Analysis and Reporting	October 2018 – December 2018

4.1.1.7 Level of Effort and Cost

Based on the work effort described above, the Licensees estimate the current cost to complete this *AIS Study* will range between $140,000 and $181,000.

4.1.1.8 References

Baldwin, B. G., D. H. Goldman, D. J. Keil, R. Patterson, T. J. Rosatti, and D. H. Wilken, editors. 2012. The Jepson Manual: Vascular Plants of California, second edition. University of California Press, Berkeley.

Grohs, K. and R. Klumb. 2010. Asian clam sampling on five South Dakota Reservations. USFWS. Accessed October 17, 2016. Last updated October 7, 2010. Available online: <https://www.fws.gov/mountain-prairie/fisheries/gpFWCODocs/GrohsandKllumbSDReservationsAsianClamReport2010.pdf >. USFWS. Pierre, South Dakota.

DWR. 2010. The Quagga and Zebra Mussel Rapid Response Plan for the State Water Project. 93 pp. CONFIDENTIAL/PRIVILEGED – Not for Public Distribution.

4.1.2 Quail Lake Fisheries Assessment Study

4.1.2.1 Project Nexus

Continued Project O&M and Project-related recreation activities have the potential to affect fish populations in Quail Lake, which is used by the public for non-contact recreation, including fishing.

4.1.2.2 Existing Information and Need for Additional Information

Existing, relevant, and reasonably available information regarding fisheries in Quail Lake is provided in Section 4.5 of the Licensees' PAD. As a summary, the Licensees found mostly outdated, anecdotal information regarding fish populations or the fisheries in Quail Lake. A DWR brochure (DWR 1997) describes six species of fish that can be found there, including striped bass (*Morone saxatilis*), channel catfish *(Ictalurus punctatus*), Sacramento blackfish (*Orthodon microlepidotus*), tule perch (*Hysterocarpus traskii*), threadfin shad (*Dorosoma* sp.), and Sacramento hitch (*Lavinia exilicauda exilicauda*). Neither the Licensees nor CDFW stock fish in Quail Lake. This *Quail Lake Fisheries Assessment Study* will supplement existing information by providing current information regarding fish populations and the fisheries in Quail Lake.

4.1.2.3 Study Goals and Objectives

The goals of this *Quail Lake Fisheries Assessment Study* are to characterize: (1) fish species composition and relative abundance (i.e., not quantitative abundance estimates); (2) fish size and condition factor; and (3) the angling resources present at Quail Lake.

The objective of this *Quail Lake Fisheries Assessment Study* is to gather sufficient data necessary to fill recognized gaps in information concerning the distribution, occurrence, and condition of fish in Quail Lake, and the current status of the recreational fisheries in Quail Lake.

4.1.2.4 Study Methods

Study Area

The study area for the *Quail Lake Fisheries Assessment Study* will consist of the area within the proposed Project boundary surrounding Quail Lake. The study area for the *Quail Lake Fisheries Assessment Study* is shown below in Figure 4.1-6.

General Concepts and Procedures

- Personal safety is the most important consideration of each fieldwork team. Fieldwork will only occur in safely accessible areas and under conditions deemed safe by the field crews. Locations within the study area that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed; these areas will be identified in the data summary and an explanation for survey exclusion will be provided.

- The *Quail Lake Fisheries Assessment Study* will begin after FERC issues its Study Plan Determination.

- The *Quail Lake Fisheries Assessment Study* does not include the development of requirements for the new license, which will be addressed outside the Study.

- The *Quail Lake Fisheries Assessment Study* focuses specifically on fish populations within Quail Lake, but the study area for the *Quail Lake Fish Populations Study* is specific to that resource.

- If required for the performance of the *Quail Lake Fisheries Assessment Study*, the Licensees will make a good faith effort to obtain permission to access private property well in advance of initiating the Study. The Licensees will only enter private property if permission has been provided by the landowner.

- The Licensees will acquire all necessary agency permits and approvals prior to beginning fieldwork for the *Quail Lake Fisheries Assessment Study*.

- Field crews may make variances to the *Quail Lake Fish Populations Study* in the field to accommodate actual field conditions and unforeseen problems. Any variances in the *Quail Lake Fisheries Assessment Study* will be noted in the data resulting from the *Quail Lake Fisheries Assessment Study*.

- To prevent the introduction and transmittal of amphibian chytrid fungus and invasive invertebrates (e.g., quagga mussels, zebra mussel, and Asian clams), field crews will be trained on, provided with, and use materials (e.g., Quat) for decontaminating their boots, waders, and other equipment when leaving or traveling between water-based study sites. For guidance on correct procedures field crews will follow DWR's Quagga and Zebra Mussel Rapid Response Plan

and CDFW's Aquatic Invasive Species Decontamination Protocol found at https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=43333. All boats used during the study will follow cleaning protocols, including inspections before and after use. All decontamination requirements in place at Project reservoirs including those of DWR's *Quagga and Zebra Mussel Rapid Response Plan* for the SWP will be strictly followed (DWR 2010).

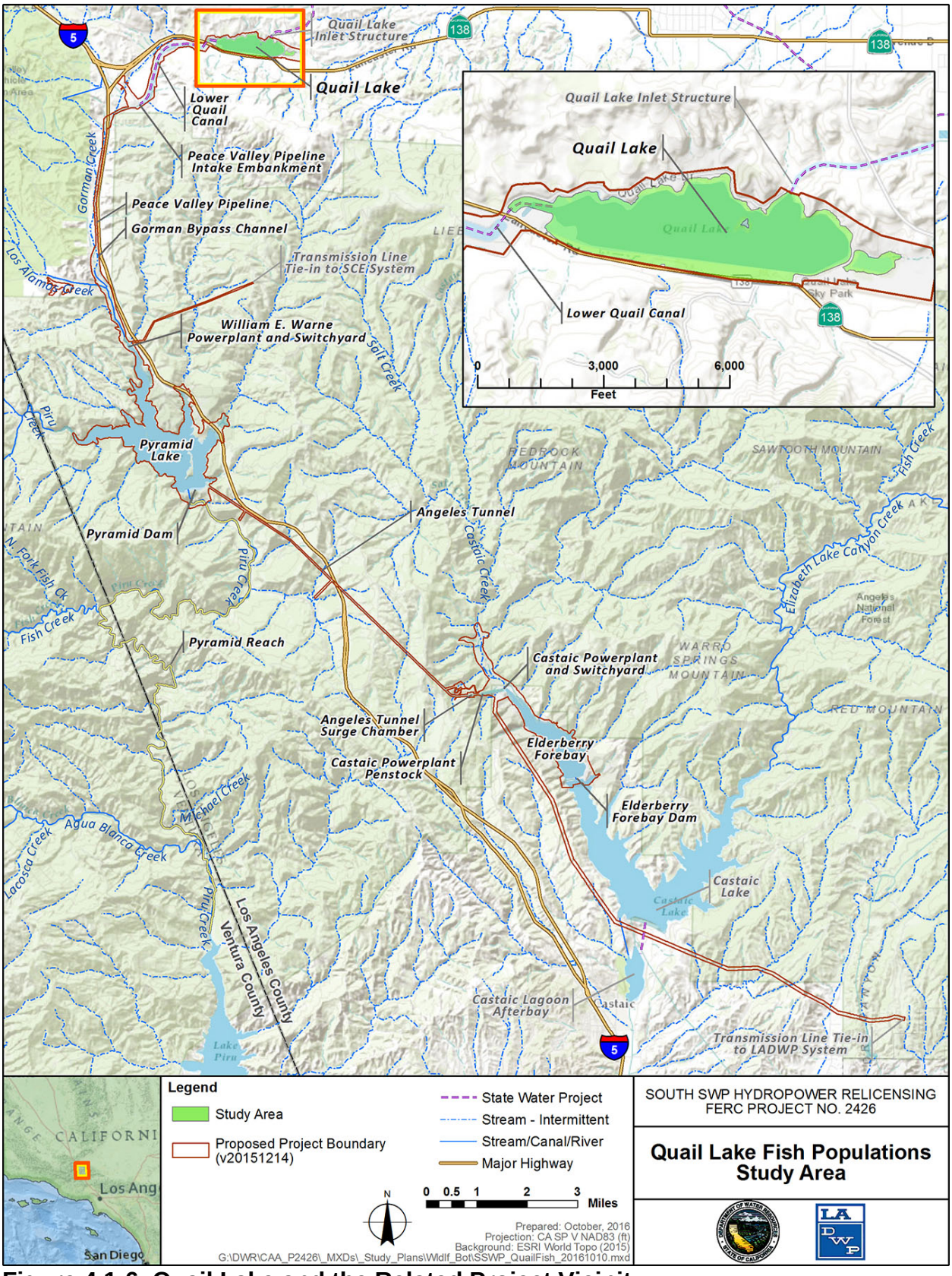


Figure 4.1-6. Quail Lake and the Related Project Vicinity

Methods

This *Quail Lake Fisheries Assessment Study* will consist of two core steps: (1) data gathering and planning; and (2) fieldwork, primarily electrofishing and creel surveys. These steps are described below.

Step 1 – Data Gathering and Planning. Prior to fieldwork being conducted, GIS data will be used to divide the Quail Lake shoreline into six segments of approximately 0.5 mile each, which will cover the entire shoreline of the reservoir. These segments will be treated as individual sites to divide the electrofishing into more manageable amounts and reduce the holding time for captured fish.

Planning for the creel surveys will include the selection of 50 days by stratified random sampling (16 high use days and 34 low use days) from October 1, 2017 through July 31, 2018, and will be limited to roughly 5 days per month (Pollock et al. 1994; Malvestuto 1996). Weekends and major holidays are considered high use days, and weekdays and the winter season are considered low use days.

Step 2 – Fieldwork. Fieldwork will consist of two elements: boat electrofishing and creel surveys, as described below.

Boat Electrofishing: Electrofish sampling will be conducted from the shoreline out to a depth that coincides with the radius of the electrofishing field. The radius of the electrofishing field will be estimated by measuring the maximum distance from the anode at which a voltage can be measured by a multimeter while the electrofishing unit is on. This will be measured prior to sampling activities each day and recorded. Water quality data for Quail Lake will be reviewed to ensure the electrofishing equipment is properly prepared and calibrated. Fish sampling will be conducted by boat electrofishing at night to provide data regarding species composition and relative abundance. This activity requires a CDFW-issued scientific collection permit, which will be applied for once the *Quail Lake Fisheries Assessment Study* is approved by FERC. Restrictions and limitations imposed by the scientific collecting permit may result in modifications to the methods used in this *Quail Lake Fisheries Assessment Study* in order to meet the permit requirements. Any variances from the study methods resulting from permit restrictions or limitations will be noted. The shoreline of Quail Lake will be sampled one night in October, using boat electrofishing beginning one hour after civil twilight. Boat electrofishing will take place using methods detailed by Reynolds (1996) and Bajer et al. (2012). Sampling will employ an approach similar to that used by CDFW in 2013 at Pyramid Lake. The six sites selected in Step 1 will be sampled for a minimum of 10 minutes (600 seconds) of pulsed direct current (or alternating current depending on the water quality) applied to the water, and this time will be recorded. A generator powered pulsator (Smith-Root 5.0 or similar) electrofishing unit will be used with one or two electrode booms to apply the appropriate current to the water. The sampling crew will include three team members: one boat operator, and two netters. Sampling will be conducted in a “leap frog” manner, in which a short portion of shoreline is fished followed by a “leap” of approximately 50 feet in order to limit herding or moving fish. Fish will be held in live wells with adequate aeration during sampling and processing.

Once the captured fish from each site are processed, they will be released near the end of the site where sampling began in order to temporarily segregate them from electrofishing sampling at the next site.

All collected fish will be identified to species and counted. General condition (e.g., muscle tone, vigor, color) will be noted and any external parasites will be documented and photographed. Up to 50 individuals of each species will be measured to the nearest millimeter (fork length or total length (TL) for centrachids) and weighed by digital scale to the nearest gram. Additional fish will be examined and counted.

General information recorded will include impoundment name, GPS sample site locations (beginning and end of each site), crew member names, weather conditions, air temperature, and water chemistry at approximate fish sampling location (i.e., water temperature, DO, and conductivity). Maximum depth (full extent of electrical field), average depth, primary substrate, secondary substrate, cover, adjacent shoreline characteristics, level of public use, and average bed slope will be recorded for each site. Representative photographs of each site will be included in the final report. Minimum, maximum, and mean water depths at the location will be recorded.

Creel Surveys: A stratified random sample of 16 high use days and 34 low use days will be selected for sampling between October 1, 2017 and July 31, 2018. High use days are weekends and major holidays and low use days are weekdays and the winter season. On average, 5 days per month will be sampled over the ten-month period. Additionally, a schedule of A.M. (7:00 – 10:00) or P.M. (3:00-6:00) surveys will be randomly selected for each survey day. This will provide for a total of 75 hours of potential survey time over the five months (3 hours per day for 25 days).

Creel surveys will be conducted at the parking area adjacent to Highway 138 (the parking area is the only access point to Quail Lake). The access and lack of boat launch will limit the area that anglers spread out around the reservoir and effectively funnel anglers to surveyors, which will aid in making sure all anglers are surveyed. Anglers will be interviewed as they return from their fishing trip.

Information to be collected in each interview will include the following:

- Start and end time of angling outing and the time of the interview
- Number of fish caught by species (including fish harvested and released)
- Targeted fish species
- Angler age by category (<16, 16–55, >55 years old)
- Angler gender (male, female)
- Angler distance traveled by category (<20 miles, 20–50 miles, >50 miles)

- Angler satisfaction ranking for number of fish caught, size of fish caught, and overall fishing experience (1=poor, 2=fair, 3=good, 4=excellent)
- Whether angling was the primary reason for their visit to Quail Lake
- Zip code of residences

Additional information that will be recorded each day will include:

- Date, day of the week
- Approximate air temperature
- General description of the weather
- A.M. or P.M. survey
- Harvested fish measured to the millimeter (fork or standard length depending on species); harvested fish will not be weighed

Similarly, CPUE will be calculated for game fish species for which creel data are collected. CPUE will be calculated by taking the total number of fish caught and dividing by the total number of angling hours (fish per hour of angling effort). Length information will be compared to the weight-length relationships developed from the electrofishing data to evaluate which stratum of the fish population are impacted by angling. The results of the qualitative angling interview questions will be summarized and presented with the electrofishing analysis.

Quality Assurance and Quality Control

Field data gathered during *Quail Lake Fisheries Assessment Study* will be collected in a manner that promotes high quality results, and will be subject to appropriate QA/QC for sample collection equipment, procedures, and cross-checking of data. As part of the QA/QC procedures, extreme care will be taken to ensure the data collected is accurate and maintained in a safe environment.

Electrofishing equipment will be calibrated prior to conducting sampling. A voltmeter will be used to measure voltage and amperage across 1-, 3-, 5-, and 10-foot intervals at 1, 3, 5, and 10 feet from the electrodes and the maximum range of the electrical field will be determined for a 1-foot span between electrodes. Measured values will be compared to the values given by the electrofishing equipment and recorded.

All data will be recorded on a prepared data sheet with fields for all required data. Field staff will fill in data during data collection and the field lead will review prior to leaving each site to verify all data has been recorded. The field lead will do a final review prior to the end of fieldwork each day. Data sheets will be scanned or photographed at the end of each day and copies will be uploaded to a server or emailed to the team to

create a digital back up. Similar procedures will be followed for all creel survey and electrofishing data.

Analysis

Boat electrofishing results will be documented both as total catch and in terms of CPUE. CPUE for fishes captured by boat electrofishing will be calculated by dividing the number of fish of each species captured by the length of time fished (e.g., fish per minute). CPUE will be summarized by species. Weight-length relationships, relative weight, proportional size distribution, and relative size distribution (Guy et al. 2007) will be calculated for special-status species, and any species captured that is recognized as game fish by CDFW.

Reporting

Quail Lake Fisheries Assessment Study methods and results will be prepared and included, to the extent completed and ready for inclusion, in the Licensees' ISR, USR, DLA, and FLA.

4.1.2.5 Consistency of Methodology with Generally Accepted Scientific Practices

The *Quail Lake Fisheries Assessment Study* methodology is generally consistent with recently performed electrofishing studies and creel surveys performed by CDFW and its contractors and the annual creel surveys being conducted by Environmental Science Associates, Inc. at Pyramid Lake. The level of effort (number of sampling days) is less than those being done at Pyramid Lake because Quail Lake is a much smaller and less trafficked reservoir.

4.1.2.6 Schedule

The *Quail Lake Fisheries Assessment Study* will begin after FERC issues its Study Plan Determination. The Licensees anticipate the schedule below will be followed to complete the *Quail Lake Fisheries Assessment Study*:

Fieldwork Preparation	June 2017 – October 2017
Fieldwork	October 2017 – July 2018
Data QA/QC	August 2018
Data Analysis and Reporting	August 2018

4.1.2.7 Level of Effort and Cost

Based on the work effort described above, the Licensees estimate the current cost to complete this *Quail Lake Fisheries Assessment Study* will range between $188,000 and $251,000.

4.1.2.8 References

Bajer, P. G., & Sorensen, P. W. (2012). Using boat electrofishing to estimate the abundance of invasive common carp in small Midwestern lakes. *North American Journal of Fisheries Management*, 32(5), 817-822.

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DWR. 1997. The State Water Project: Quail Lake (Brochure). Sacramento, CA.

Guy, C. S., Neumann, R. M., Willis, D. W., & Anderson, R. O. (2007). Proportional size distribution (PSD): a further refinement of population size structure index terminology. Fisheries, 32(7).

Malvestuto, S.P. 1996. "Sampling the Recreational Creel," pages 591–623 in *Fisheries Techniques*, Second Edition, B.R. Murphy and D.W. Willis, editors. American Fisheries Society, Bethesda, Maryland.

Pollock, K.H., C.M. Jones, and T.L. Brown. 1994. *Angler Survey Methods and Their Application in Fisheries Management.* American Fisheries Society Special Publication 25.

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.*

4.1.3 Pyramid Reach Fish Populations Study

4.1.3.1 Project Nexus

Continued Project O&M and Project-related recreation activities have the potential to affect fish populations in Pyramid reach (i.e., the 18.4-mile-long section of Piru Creek from Pyramid Dam to the NMWSE of Lake Piru).

4.1.3.2 Existing Information and Need for Additional Information

Existing, relevant, and reasonably available information regarding fish populations in Pyramid reach is provided in Section 4.5 of the Licensees' PAD. As a summary, surveys conducted by CDFW in Pyramid reach in 1987 detected two native species (rainbow trout and prickly sculpin) and five introduced fishes (bluegill, green sunfish, largemouth bass, catfish, and brown trout). CDFW stocked Pyramid reach with rainbow trout and largemouth bass in the 1930s, and with rainbow trout from the1940s to August 2008.

Additional information, which will be provided by this *Pyramid Reach Fish Populations Study*, is needed to determine the presence and locations of the fish community that occur in Pyramid reach that could be affected by the Project.

4.1.3.3 Study Goals and Objectives

The goals of this *Pyramid Reach Fish Populations Study* are to: (1) characterize fish species composition and relative spatial distribution; (2) estimate abundance (i.e., fish per mile in areas feasible for electrofishing) or relative abundance of fish by species; (3) analyze fish population size-structure and age-class structure; and (4) calculate the fish condition factor in Pyramid reach. The objective of this *Pyramid Reach Fish Populations Study* is to fill recognized gaps in existing information on the presence and extent of fishes in Pyramid reach.

4.1.3.4 Study Methods

Study Area

The study area for the *Pyramid Reach Fish Populations Study* includes Pyramid reach as shown in Figure 4.1-7 below.

General Concepts and Procedures

- Personal safety is the most important consideration of each fieldwork team. Fieldwork will only occur in safely accessible areas and under conditions deemed safe by the field crews. Locations within the study area that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed; these areas will be identified in the data summary and an explanation for survey exclusion will be provided.

- The *Pyramid Reach Fish Populations Study* will begin after FERC issues its Study Plan Determination.

- The *Pyramid Reach Fish Populations Study* does not include the development of requirements for the new license, which will be addressed outside the Study.

- The *Pyramid Reach Fish Populations Study* focuses specifically on fish populations within Pyramid reach, but the study area for the *Pyramid Reach Fish Populations Study* is specific to locations that can support that resource.

- If required for the performance of the *Pyramid Reach Fish Populations Study*, the Licensees will make a good faith effort to obtain permission to access private property well in advance of initiating the Study. The Licensees will only enter private property if permission has been provided by the landowner.

- The Licensees will acquire all necessary agency permits and approvals prior to beginning fieldwork for the *Pyramid Reach Fish Populations Study*.

- Field crews may make variances to the *Pyramid Reach Fish Populations Study* in the field to accommodate actual field conditions and unforeseen problems. Any

variances in the *Pyramid Reach Fish Populations Study* will be noted in the data resulting from the *Pyramid Reach Fish Populations Study*.

- To prevent the introduction and transmittal of amphibian chytrid fungus and invasive aquatic species (e.g., quagga mussels, zebra mussel, and Asian clams), field crews will be trained on, provided with, and use materials (e.g., Quat) for decontaminating their boots, waders, and other equipment when leaving or traveling between water-based study sites. Field crews will follow DWR's Quagga and Zebra Mussel Rapid Response Plan and CDFW's Aquatic Invasive Species Decontamination Protocol which can be found at the following link: (https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=43333). All boats used during the study will follow cleaning protocols, including inspections before and after use. All decontamination requirements in place at Project reservoirs including those of DWR's *Quagga and Zebra Mussel Rapid Response Plan* for the SWP will be strictly followed (DWR 2010).

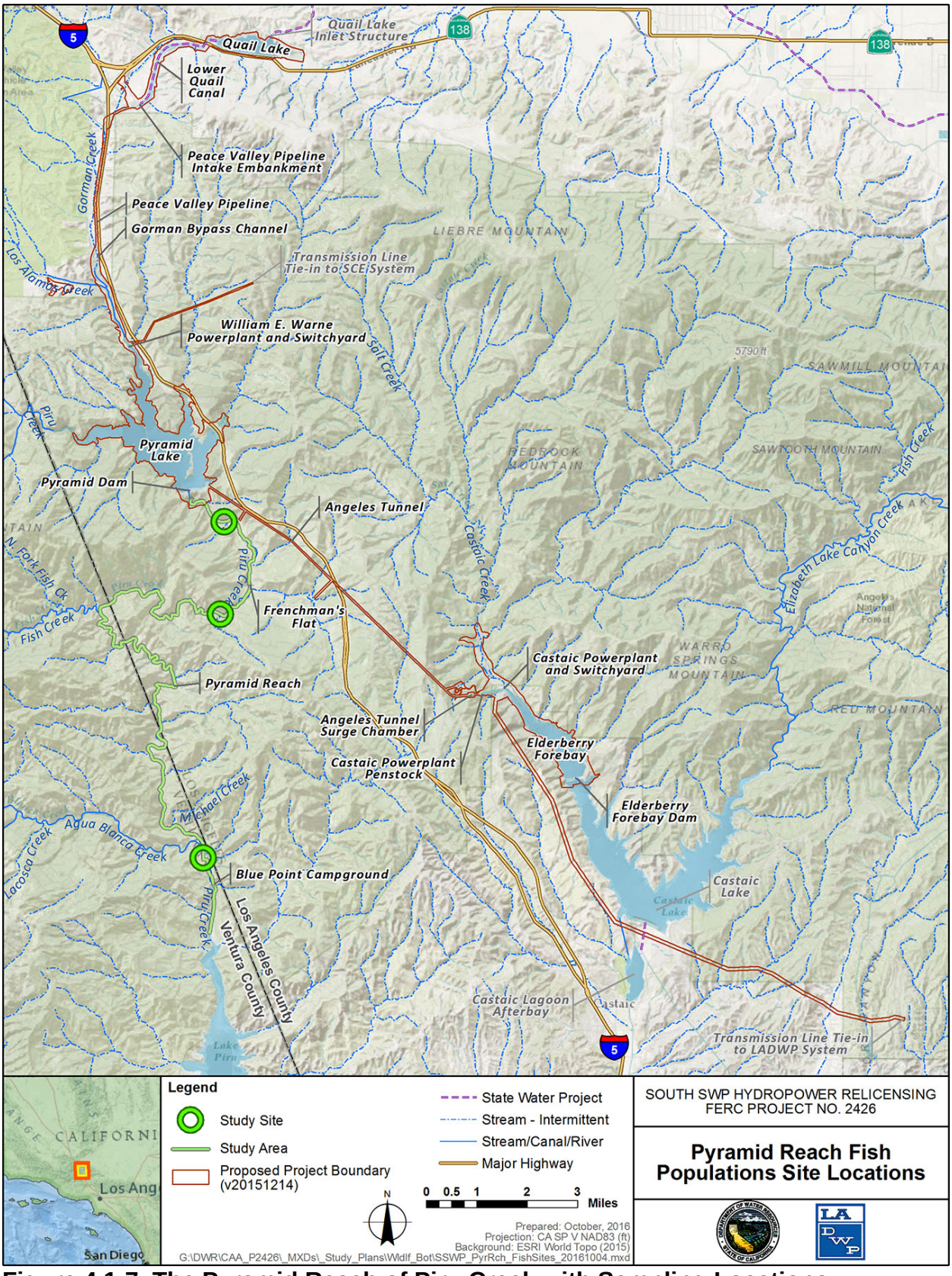

Figure 4.1-7. The Pyramid Reach of Piru Creek with Sampling Locations

Methods

Data collection for the *Pyramid Reach Fish Populations Study* will consist of four steps: (1) classify mesohabitat and channels; (2) conduct eDNA sampling; (3) select sampling sites for fish population sampling; and (4) sample fish population, as described below. Fish sampling will be predicated on the Licensees obtaining necessary federal and State of California permits for sampling. Required permits will include a CDFW scientific collecting permit for streams that do not contain federal ESA-listed species and an ESA section 10(a)(1)(A) authorization from the USFWS for arroyo toad.

Step 1 – Classify Mesohabitat and Channels. Mesohabitat will be classified from the NMWSE of Lake Piru upstream to Pyramid Dam. A three-tiered habitat mapping classification system developed by Hawkins et al. (1993) will be used to assist in the identification of individual habitat units in the field. Level III categories are generally modified/adopted from McCain et al. (1990) and Flosi and Reynolds (1994). Figure 4.1-8 shows the relationship among the three levels. At the broadest level, Level I categorizes habitats as “fast water” and “slow water.” In Level II, fast water and slow water are each subdivided into two categories: turbulent and non-turbulent, and scour pool and dammed pool, respectively. Level III includes the 18 distinct mesohabitat types that will be used to classify habitat for the study. These expand on the Level II classification by separating each habitat type by either gradient, physical structure, or geomorphic process.

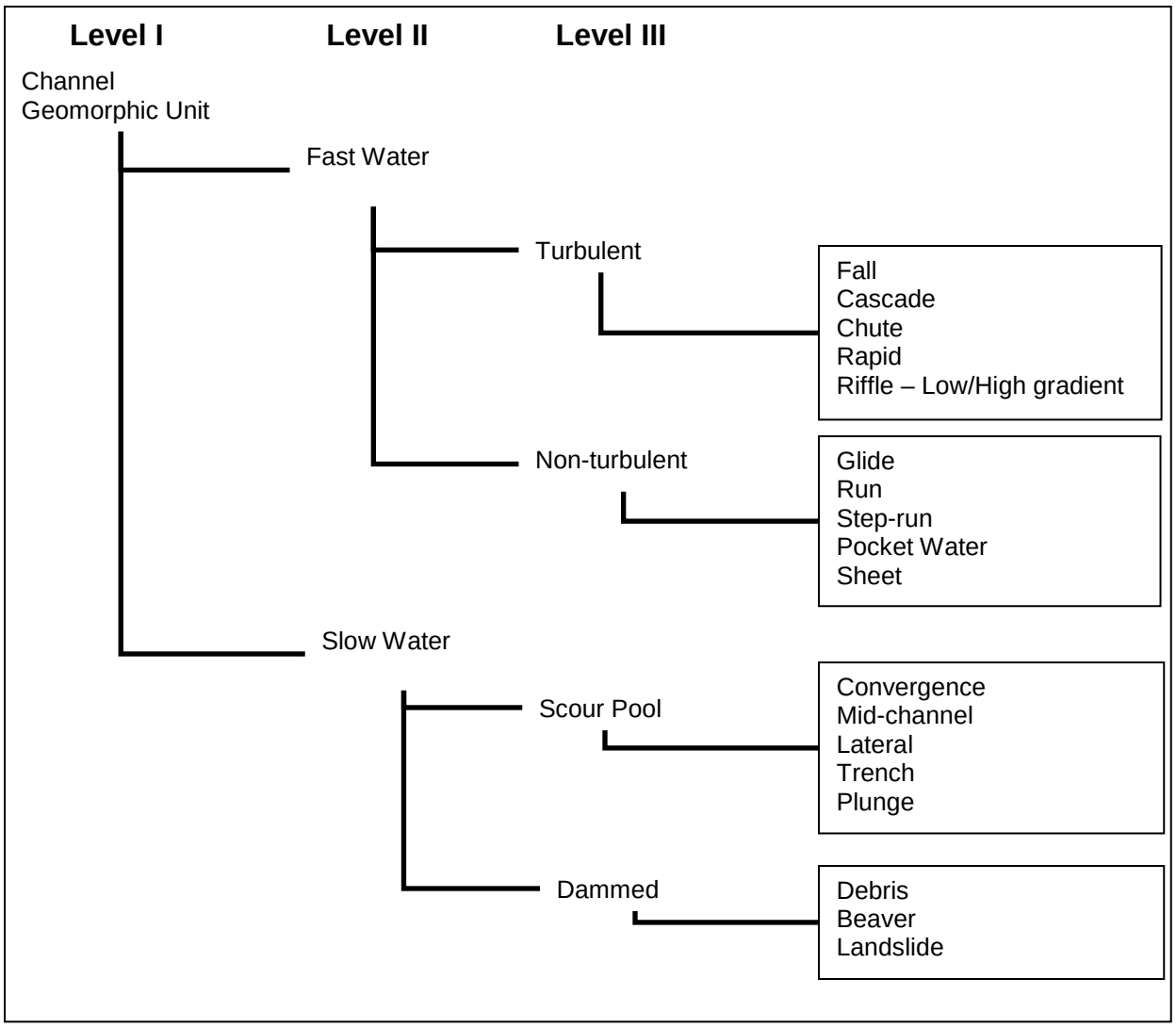

Figure 4.1-8. Key to Habitat Types

Each distinct habitat unit will be numbered consecutively in an upstream direction. Habitat type descriptions are listed in Table 4.1-1 below. Channel and habitat characteristics shown in Figure 4.1-8 and Table 4.1-1 will be assessed in all ground surveys, and the aerial imagery will be used to assess channel and habitat types when streams are clearly visible.

The extent of the ground-based habitat mapping surveys will be determined based on the visibility of the stream from aerial imagery, the length of the sub-reach to be surveyed, and whether the reach is accessible by field crews. Ground-based mapping will be conducted in those stream segments where habitat characteristics are not adequately discernible in the aerial imagery.

Limited ground-based mapping will also be conducted in stream segments that are conducive to mapping using aerial imagery to establish a baseline for mapping the remainder of the reach. Ground-based mapping in streams visible in the aerial imagery will be used to “calibrate the eye” by physically measuring and typing specific habitat units observed in the aerial imagery. Mesohabitat units assessed on the ground will then be “typed” in the remainder of the stream sub-reach using the aerial imagery.

The physical parameters (e.g., bankfull width, pool depth, substrate) measured for each mesohabitat unit during ground-based mapping are expected to be similar for those same mesohabitat units throughout the remainder of the sub-reach. Additional habitat information, such as counting LWD (any un-rooted wood with a minimum length of three feet and minimum diameter or four inches at the large end) in the channel, trout spawning gravel and spawning gravel patch size, and potential fish passage barriers, will be documented during ground based mapping at each fish sampling site.

Table 4.1-1. Habitat Types

I. Fast Water:			Riffles, rapid, shallow stream sections with steep water surface gradient.
	A. Turbulent:		Channel units having swift current, high channel roughness (large substrate), steep gradient, and non-laminar flow and characterized by surface turbulence.
		1.Fall:	Steep vertical drop in water surface elevation. Generally not modelable.
		2.Cascade:	Series of alternating small falls and shallow pools; substrate usually bedrock and boulders. Gradient high (more than 4 percent). Generally not modelable.
		3.Chute:	Narrow, confined channel with rapid, relatively unobstructed flow and bedrock substrate.
		4.Rapid:	Deeper stream section with considerable surface agitation and swift current; large boulder and standing waves often present. Generally not modelable.
		5.Riffles:	Shallow, lower-gradient channel units with moderate current velocity and some partially exposed substrate (usually cobble). • Low gradient – Shallow with swift flowing, turbulent water. Partially exposed substrate dominated by cobble. Gradient moderate (less than 4 percent). • High gradient – Moderately deep with swift flowing, turbulent water. Partially exposed substrate dominated by boulder. Gradient steep (greater than 4 percent). Generally not modelable.
	B. Non-turbulent:		Channel units having low channel roughness, moderate gradient, laminar flow, and lack of surface turbulence.
		1.Sheet:	Shallow water flowing over smooth bedrock.
		2.Run / Glide:	Shallow (glide) to deep (run) water flowing over a variety of different substrates.
		3.Step Run	A sequence of runs separated by short riffle steps. Substrates are usually cobble and boulder dominated.
		4.Pocket Water:	Swift flowing water with large boulder or bedrock obstructions creating eddies, small backwater, or scour holes. Gradient low to moderate.
II. Slow Water:			Pools; slow, deep stream sections with nearly flat water surface gradient.
	A. Scour Pool:		Formed by scouring action of current.
		1.Trench:	Formed by scouring of bedrock.
		2.Mid-channel:	Formed by channel constriction or downstream hydraulic control.
		3.Convergence	Formed where two stream channels meet.
		4.Lateral:	Formed where flow is deflected by a partial channel obstruction (stream bank, rootwad, log, or boulder).
		5.Plunge:	Formed by water dropping vertically over channel obstruction.
	B. Dammed Pool:		Water impounded by channel blockage.
		1.Debris:	Formed by rootwads and logs.
		2.Beaver:	Formed by beaver dam.
		3.Landslide:	Formed by large boulders.
		4.Backwater:	Formed by obstructions along banks (recorded as a comment or note to mapping).
		5.Abandoned Channel:	Formed along main channel, usually associated with gravel bars (not part of the main active channel; recorded as a comment or note to mapping).

Note: Adapted from McCain et al. 1990, and Hawkins et al. 1993.

Step 2 – Conduct eDNA Sampling. The eDNA sampling will be conducted at 1,640-foot intervals using a Garmin GPSMAP 60CSx (or similar) to determine sampling locations, from Pyramid Dam to the NMWSE of Lake Piru. Sampling will be conducted by biologists trained in eDNA collection. Sample collection will occur once during the spring run-off period, at the tail end of the descending limb of the hydrograph. This will limit the dilution effects of high flows and simultaneously maximize the potential for DNA transport in the water column. This is expected to follow a storm event in February or March when it is determined that field crews can safely access the sampling locations in the Pyramid reach. Sampling will be consistent with the protocol described in Bergman et al. (2016). For each sample, a maximum of 2 liters of water will be filtered using sterile tubing and a portable peristaltic pump. No water other than sample blank water will be transported or stored for sampling. Water samples will be filtered through a 0.45 micrometer sterile filter, and stored on ice for transport back to the lab. Samples will be labeled with sampling location, volume of water filtered, and any other information necessary for tracking and chain of custody purposes.

To prevent cross contamination of samples, new filters, tubing, and nitrile gloves will be used for each sample. In addition, after collection each sample filter will be returned to its original packaging and sealed in a secondary container prior to storage in a separate, dedicated transport container. All filters will be kept in the secondary storage container and placed in a -20 degrees Celsius (^{o}C) laboratory freezer until DNA extraction is performed. Any filters that are opened but not used will be considered contaminated and discarded. Field (negative) controls will be taken at the beginning and end of each field day.

eDNA samples will be tested for the presence of DNA from Santa Ana sucker (SSC), arroyo chub (SSC), (FE), and rainbow trout. These fish represent the primary game fish in the reach (i.e., rainbow trout) and the two listed native fishes, although the occurrence of the listed fish species in this reach have only been documented anecdotally. Any incidental sightings of the listed fish species will be noted.

In order to implement surveys that seek to use eDNA to detect species of interest, both a DNA barcode and means to assay for that DNA must exist. DNA barcoding is a technique for identifying species using a short DNA sequence from a standard position in the mitochondrial genome. DNA barcode sequences are very short relative to the entire genome and presently exist for many organisms or can be created reasonably quickly using routine laboratory practices. The Cytochrome B Oxidase subunit 1 mitochondrial region (COI) has emerged as a standard barcode region. Yet, the Cytochrome B (CytB) has proved equally adept at identifying higher animals. The current and most sensitive method to “assay” an eDNA sample for the presence of target DNA (DNA barcode) is quantitative PCR (qPCR). DNA barcodes for species of interest are used to create qPCR primer and probe sets, also referred to as assays.

The species of interest for this Project include: Santa Ana sucker, arroyo chub and rainbow trout. Currently from this list of species an assay exists only for rainbow trout. To detect the DNA from the other species of interest a DNA barcode must be established and qPCR assay must be developed.

Both DNA barcoding and qPCR assay development are standardized published procedures. The following describes the methods for the DNA barcoding and development of qPCR assays for each species of interest.

A minimum of 3 vouchered specimens should be used for DNA barcoding of the mitochondrial genes CytB and COI. In order to capture any genetic diversity of the CytB and COI genes within target species populations, the specimens should include individuals from across the known range.

DNA extractions for each specimen will be amplified by PCR using universal fish primers for CytB and COI. PCR amplification consists of a 15 µl total reaction volume. Each 15 µl reaction is composed of 7.5 µl Promega GoTaq® G2 Hot Start Colorless Master Mix (Promega Corporation), 1 µl 10 nM Forward primer, 10 nM Reverse primer, 3.5 µl ultra-pure nuclease free water, and 2 µl 100ng/ µl normalized DNA. Thermocycling is performed using the Promega Master Mix protocol with an optimized annealing temperature of 55° C and the complete cycle profile of 2 minutes. at 95° C initial denaturation, 40 cycles of 95° C for 30 seconds, 55° C for 30 seconds, 72° C for 1 minute, with a final extension at 72° C for 5 minute. PCR products are separated by electrophoresis in 1 percent agarose (w/v) gel at 90v for 20 minutes. Gels are visualized by BioRad mini trans illuminator (BioRad Laboratories, Inc.). Appropriate bands are excised from the gel using a brand new razor blade for each band and placed into individual sterile micro-centrifuge tubes. DNA is extracted from the agarose gel using QIAquick® Gel Extraction Kit following manufacturer's guidelines. Extracted DNA and primers are submitted to the University of California (UC) Davis DNA sequencing facility for DNA Sanger sequencing. DNA sequence data received from UC Davis DNA sequencing facility are aligned using Geneious alignment software (Geneious, Inc.) and analyzed for a lack of variability across the sequenced regions. Consensus fragments are used as the template for a nucleotide BLAST (Basic Local Alignment Search Tool). Results of the BLAST determine which portion of the CytB and/or COI regions are unique or conserved within species mitochondria yet retain intra species variation sufficient to use as a genetic barcode.

DNA barcode sequences for each species are used as template for qPCR assay design. Commercially available algorithms are used to analyze DNA barcode sequences and generate qPCR primer probe sets or assays. Primer probe sets generated by the algorithm are scored from highest to lowest. The highest scoring primer probe sets are queried for sequence similarity again using a BLAST of the National Center for Biotechnology Information (Nucleotide database as a means of determining in-silico species specificity. Primer and probe sets are then tested for in vitro specificity on the original vouchered specimen and for cross reactivity to any closely related and co-occurring species as well as the assay sensitivity. For all assay design and validation, we take into consideration and explicitly follow any applicable Minimum Information for Publication of Quantitative Real-Time PCR Experiments guidelines.

DNA from all samples and controls are extracted using PowerWater Sterivex™ DNA Isolation Kit (Mo Bio Laboratories, Inc.) following the manufacturer's recommended

guidelines. A DNA extraction negative control is processed in parallel to ensure sample integrity throughout extraction procedure. The DNA extraction control consists of Sterivex™ filtered the ultrapure water only. DNA extraction controls are processed using the same equipment utilized to extract DNA from all samples. Each sample and all controls are analyzed in triplicate for the presence of the GGS CytB mitochondrial gene using the qPCR primer and probe designed previously. DNA extract from each sample is analyzed in triplicate with each qPCR replicate consisting of a 10 µl reaction volume. Each 10 µl qPCR reaction is composed of 2x Applied Biosystems TaqMan Universal PCR Master Mix, No AmpErase UNG (Thermo Fisher ABI), 500-900 nM initial primer concentration, 2.5-10 uM initial probe concentration, and 4 µl DNA template. Thermocycling is performed using a Bio-Rad CFX 96 Real time System (Bio-ad Laboratories, Inc.) with the following profile: 10 min at 95° C, 40 cycles of 15 second denaturation at 95° C and 1 min extension at 60° C. Six template control (NTC) reactions are run on the plate with the control sample templates consisting of 4 µl of ultrapure water replacing DNA template within reaction volume. Three positive control reactions consisting of 20 ng/µl target species genomic DNA template are also tested in parallel to ensure consistent PCR performance. All PCR master mixes are made inside an ultraviolet (UV) PCR enclosed workstation. A DNA template is added to the master mix outside of the UV PCR workstation on a dedicated PCR set up workbench. All PCR reactions are conducted on instruments located outside of the main lab in a separate portion of the building. Results of the qPCR reactions are analyzed using BioRad CFX manager v3.1 (Bio-Rad Laboratories, Inc.). A sample is considered positive for the presence of target DNA if any one of the three replicates showed logarithmic amplification within 40 cycles.

Step 3 – Select Sampling Sites for Fish Population Sampling. Three representative sample sites will be selected: one in the 2-mile-long section of Pyramid reach between Pyramid Dam and the concrete structure upstream of Frenchman's Flat (stream segment 1); one within a mile downstream of Frenchman's Flat, within the stream segment from the concrete structure upstream of Frenchman's Flat to the confluence of Fish Creek (stream segment 2); and one just upstream of the confluence with Agua Blanca Creek within the stream segment from Fish Creek to the NMWSE of Lake Piru (stream segment 3). The sites will be selected at locations accessible to field crews and will represent the overall habitat ratios found in the reach using the mesohabitat mapping data created for the reach.

Prior to site selection in the field, preliminary sites will be selected using existing aerial imagery and habitat mapping data. Final sampling sites will be selected in consultation with USFS, USFWS, SWRCB, and CDFW. The Licensees will make a good faith effort to schedule the consultation on a day or days convenient to the Licensees and interested relicensing stakeholders, and will provide an email notice at least 30 days in advance of the meeting or site visit.

Sample sites are expected to vary in length, but typically range between 325 and 1,000 feet. Site length will be sufficient to include habitat that represents the ratio of riffle, run, and pool habitat present in the stream segment in which the site is located. Exact site length will be determined in the field by the Licensees.

Step 4 – Sample Fish Population. Multiple-pass depletion sampling (Reynolds 1996 and Temple et al. 2007) using backpack electrofishing equipment will be performed where permitted to capture fish and develop population estimates at the sampled sites for select species. This sampling is expected to occur in the fall (September or October). Upstream and downstream ends of each site will be blocked with fine mesh nets or a fish passage barrier. If required, the nets or passage barrier would span the full width and depth of the stream except where an upstream fish passage barrier obviates the need for head-end blocking or where edge or stream margin habitat is to be sampled. If necessary, salt blocks will be placed in the stream immediately above the electrofishing station to increase conductivity. Salt blocks will be used when fish are observed escaping the direct path of the electric field generated by the electrofishing unit at elevated settings.

Field crews will consist of at least two netters for each shocker. The Licensees will follow Temple, et al. (2007), who recommends one backpack electroshock crew for streams less than 24.6 feet wide and two backpack electrofish crews for streams 24.6 – 49.2 feet wide. In wadeable streams wider than 49.2 feet, the number of electroshocking crews will be expanded as necessary to assure effective and accurate sampling. Electrofishing will be conducted by a qualified professional biologist who is trained in electrofishing techniques, and will be implemented only where permitted by USFWS and CDFW.

Captured fish will be retained in aerated buckets and/or live cars until each pass is completed. Fish will be sedated as required in accordance with generally accepted scientific methodology and regulatory approvals. All fish will be identified to species and counted. Up to 50 individuals of each species will be measured to the nearest millimeter (fork length) and weighed by digital scale to the nearest gram. Effort will be made to measure representative fish species in all size classes, within the subsample of the measured species. The actual number of measured species will be determined through professional judgment based upon the size class homogeneity of the sample (i.e., number of size classes represented). If the Licensees are granted the appropriate scientific collecting permits to collect Santa Ana sucker and arroyo chub, and individuals are found during field sampling, tissue samples will be collected and turned over to CDFW and USFWS for analysis.

Scale samples will be collected on a subsample of larger, less abundant game fish for validating length-age indices. These species will include rainbow trout, brown trout, and largemouth bass if present during the surveys. Captured fish will be released downstream of the sampling area following completion of each electrofishing pass. Effort will be made to ensure sampling activities in the field will minimize potential injury or mortality to aquatic species. Mortalities and fish condition (spinal trauma, bruising) will be noted and recorded prior to release.

General information and habitat/channel metrics will be collected at each sample site. This information will include a distinct site identification marker, number of shockers, date and time, air and water temperature, conductivity, weather conditions, and GPS location of each end of the site. Metrics collected at each mesohabitat unit within the

sample site will include mesohabitat type, estimated average and maximum depth, estimated average wetted and bankfull width, dominant cover type, dominant and subdominant substrate, and sampling effort, in seconds. Habitat data collected will be consistent with that collected in Step 1.

Prior to electrofishing at a site and after installing both upstream and downstream block nets, the Licensees will walk the stream bank to directly look for the presence of known sensitive species, including WPT, arroyo toad, CRLF, or foothill yellow-legged frog (FYLF). If any sensitive species individuals are observed, the Licensees will note the observation and maintain a safe distance so as to not disturb the individual(s). The field lead will then relocate the site a safe distance upstream or downstream to a location that includes similar habitat types as the selected site, and repeat the procedure.

Precautions to guard against the incidental take of arroyo toad will be determined during the application for an ESA 10(a)(1)(A) permit from the USFWS. Restrictions and limitations imposed by this authorization may have a significant impact on the methods used for this *Pyramid Reach Fish Populations Study*. Any such changes will be noted in the final technical memorandum.

Quality Assurance and Quality Control

Field data gathered during this *Pyramid Reach Fish Populations Study* will be collected in a manner that promotes high quality results, and will be subject to appropriate QA/QC for sample collection equipment, procedures, and cross-checking of data. As part of the QA/QC procedures, extreme care will be taken to ensure the data collected is accurate and maintained in a safe environment.

Analysis

Individual Fish Condition Factor

Fish size and weight data will be summarized by species and sample site. Similarly, standard metrics including minimum, maximum, and mean fork length and weight will be reported. Length and weight data will be used to calculate a relative condition factor (Anderson and Gutreuter 1983) and to provide a general indication of the health of individuals, where factors greater than 1 indicate more healthy individuals. Relative condition factors for electrofishing sites will be calculated for length and weight data collected at all quantitative electrofishing sites.

Fish Species Populations and Biomass

Standing stock estimates in terms of fish population numbers and biomass will be calculated by species for each site and analyzed by age class. Electrofishing data will be analyzed using a scientific software package (e.g., Microfish or other similar program). Capture probabilities (the proportion of fish captured on a given electrofishing pass), size statistics, and biomass will be generated for each sample site using fish capture data. Biomass will be calculated based upon total weight measured for each species. Standing stock estimates will be reported as: (1) numbers and weight (grams)

of fish by species per 328 feet (100 meters) of stream; (2) numbers of fish by species per mile; (3) pounds of fish by species per acre of stream surface; and (4) kilograms of fish by species per hectare.

Game fish species population analysis will include size structure based on RSD. To provide an index of size structure for each site, traditional RSD of each species will be calculated. The RSD will be presented on a scale of 0 to 100 (Anderson and Neumann 1996). RSD will be calculated as the proportion of fish sampled greater than 6 inches, such that: RSD = (# of fish >6-inch in sample) / (# of fish in sample) x 100. The 6-inch length was chosen because it is often used as the smallest size where fish are desired by anglers. A high RSD indicates that a greater proportion of the population consists of fish in the size class desirable to anglers. Non-game fish species will be evaluated using length frequency distributions. No RSD calculations will be made on non-game fish species.

Selected fish species will also include an analysis by age class. Existing length-age indices will be used to determine the age class. Length-age indices are relatively accurate for smaller fish; however, confidence intervals reduce with larger fish. Scales collected, as described above, will be analyzed to assist in identifying age class breaks. Analysis of scales will follow methods described in Minard et al. (1997) and Schneider et al. (2000). Regression analysis will be used to analyze the data and, if necessary, adjust the indices.

Fish Community Analysis

The fish community analysis will also include species composition and relative abundance of the fish community (i.e., percent composition). In addition, the diversity of fish species will be assessed. Possible statistical analysis could ***include the Shannon Weaver Diversity Index, a means of characterizing species diversity. The condition of fish communities will also be evaluated at three levels of biological organization: individual level, populat***ion level, and community level. Evaluation of these three levels will be accomplished using electrofishing data, relative condition factors, and any in-field observations. Moyle et al. (1998) and Moyle and Marchetti (1998) provided the following descriptions of fish health at these levels:

Individual Level

Most fish in a healthy stream should: (1) have a robust body; (2) be free of disease, parasites, and lesions; (3) possess reasonable growth rates for the region; and (4) exhibit appropriate behavioral patterns.

Population Level

Fish populations in healthy stream environments: (1) exhibit multiple age classes indicating that reproduction is regularly occurring; (2) achieve a viable population size (i.e., occur in adequate numbers to maintain a self-sustaining population and the long-term persistence of the population); and (3) consist of mostly healthy individuals.

Community Level

Fish communities considered in good health in California: (1) are typically dominated by co-evolved species; (2) have a predictable structure as indicated by limited niche overlap among species and trophic levels; (3) are resilient in recovering from extreme events; (4) consist of a persistent species membership; and (5) are replicated geographically (i.e., can be found in similar habitats within the drainage or in other similar drainages).

Reporting

Pyramid Reach Fish Populations Study results will be included, to the extent completed and ready for inclusion in the Licensees' ISR, USR, DLA, and FLA.

4.1.3.5 Consistency of Methodology with Generally Accepted Scientific Practices

The methods are consistent with the methods used for recent FERC hydroelectric relicensing efforts in California, including the Drum-Spaulding Project (FERC Project No. 2310), the Yuba-Bear Hydroelectric Project (FERC Project No. 2266), and the Yuba River Development Project (FERC Project No. 2246), with the following exception: eDNA is a newly emerging monitoring tool that will augment the ability for surveys to detect rare, cryptic, and elusive species that are unlikely to be found using conventional methods.

4.1.3.6 Schedule

The *Pyramid Reach Fish Populations Study* will begin after FERC issues its Study Plan Determination. The Licensees anticipate the schedule below will be followed to complete the *Pyramid Reach Fish Populations Study*.

Fieldwork Preparation	July 2017 – July 2018
Habitat Mapping	July 2017 – September 2017
Site Selection	May 2018 – June 2018
Fieldwork (eDNA and sampling)	June 2018 – September 2018
Data QA/QC	August 2018 – November 2018
Data Analysis and Reporting	November 2017 – December 2018

4.1.3.7 Level of Effort and Cost

Based on the work effort described above, the Licensees estimate the current cost to complete this *Pyramid Reach Fish Populations Study* is between $136,000 and $181,000.

4.1.3.8 References

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4.1.4 Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study

4.1.4.1 Project Nexus

Continued Project O&M and Project-related recreation activities have potential to affect the following special-status aquatic amphibians and semi-aquatic snake species, each of which is classified as SSC by CDFW: western spadefoot (*Spea hammondii*), FYLF (*Rana boylii*), two-striped garter snake (*Thamnophis hammondii*), and South Coast garter snake (*Thamnophis sirtalis infernalis*).

4.1.4.2 Existing Information and Need for Additional Information

Existing, relevant, and reasonably available information regarding special-status aquatic amphibians and semi-aquatic snake species and their habitat within the proposed Project boundary is limited in extent and provided in Section 4.5 of the Licensees' PAD. As a summary, the Licensees determined that two aquatic-breeding special-status amphibians and two semi-aquatic snake species have the potential to occur within the proposed Project boundary. Three of these species have been documented in the vicinity of the Project by the California Natural Diversity Database (CNDDB) (CDFW 2015) or other sources (i.e., Project and adjacent areas covered by USGS 7.5-minute topographic quadrangle maps). However, only the two-striped garter snake has a high probability of occurring, with recent observations documented in areas adjacent to Piru and Castaic creeks, including observations each year during annual sensitive species surveys performed by the Licensees in the Pyramid reach (ESA 2010, 2011, 2012, 2013, 2014, 2015). South Coast garter snake is currently considered a geographic isolate (i.e., Ventura County to San Diego County) of the more widely distributed California red-sided garter snake (Humboldt County to San Diego County). Jennings and Hayes (1994) describe habitats of the South Coast garter snake as "marsh and upland habitats near permanent water that have good strips of riparian vegetation." Most records of South Coast garter snake are from the coastal plain; however, the range may extend an unknown distance into the adjacent foothills (Jennings and Hayes 1994). Table 4.1-2 below summarizes habitat requirements and known occurrences of the four species.

Table 4.1-2. Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Potentially Occurring in the Proposed Project Boundary

Species	Habitat Requirements	Known Occurrences in Project Vicinity (USGS Quadrangle Maps)
Western spadefoot	Breeds in vernal pools and other ponds that dry seasonally (rarely in permanent ponds), including stock ponds, storm-water detention basins, and pools on compacted soil, and occasionally in pools within intermittent streams. Non-breeding habitat is terrestrial in grasslands, oak woodlands, and occasionally chaparral.	Mint Canyon, Newhall, Val Verde, and Whitaker Peak. (No known occurrences within proposed Project boundary.)
Foothill yellow-legged frog	Aquatic in low to moderate-gradient, permanent streams and seasonal tributaries. Eggs are deposited in locations with low water velocity, including edgewater, pools, and pool tail-outs, and usually on cobble/boulder substrates and in shallow water. Generally not abundant in habitats where introduced fish and American bullfrog occur.	Cobblestone Mountain and Piru. (Documented in Piru Creek, but no recent records.)
Two-striped garter snake	Aquatic-feeding specialist closely associated with areas of permanent water, especially in and along rocky streams and ponds with riparian vegetation. Habitat suitability likely related to presence of aquatic vertebrate prey (i.e., amphibians and small fish).	Green Valley, Lebec, Piru, Mint Canyon, Val Verde, and Whitaker Peak. (Known along parts of Piru and Castaic creeks.)
South Coast garter snake	Shallow, permanent, low gradient water and associated dense, multi-storied vegetation. Closely associated with marshes and adjacent upland habitat. May be an aquatic-feeding specialist.	No records in CNDDB. Jennings and Hayes (1994) shows a record from Piru Creek south of Lake Piru (Piru quad).

Additional information, which will be provided by this *Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study*, is needed to determine presence or absence of these special-status species within the study area for the *Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study*.

4.1.4.3 Study Goals and Objectives

The goals of this *Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study* are to: (1) identify habitats suitable for special-status aquatic amphibians and semi-aquatic snake species; and (2) perform surveys to determine if these special-status species occur in the proposed Project boundary.

The objective of this *Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study* is to gather sufficient data necessary to fill gaps in existing information about the species' likely presence or absence.

4.1.4.4 Study Methods

Study Area

The study area for the *Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study* consists of the area within the proposed Project boundary, excluding lands overlying the Angeles Tunnel on which the Licensees do not perform any Project O&M activities. In addition, the study area for the *Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study* will include the Pyramid reach (Figure 4.1-9).

General Concepts and Procedures

- Personal safety is the most important consideration of each fieldwork team. Fieldwork will only occur in safely accessible areas and under conditions deemed safe by the field crews. Locations within the study area that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed; these areas will be identified in the data summary and an explanation for survey exclusion will be provided.

- The *Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study* will begin after FERC issues its Study Plan Determination.

- The *Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study* does not include the development of requirements for the new license, which will be addressed outside this Study.

- The *Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study* focuses specifically on special-status aquatic amphibians and semi-aquatic snakes within the proposed Project boundary, but the study area for the *Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study* is specific to locations that can support that resource.

- If required for the performance of the *Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study*, the Licensees will make a good faith effort to obtain permission to access private property well in advance of initiating the Study. The Licensees will only enter private property if permission has been provided by the landowner.

- The Licensees will acquire all necessary agency permits and approvals prior to beginning fieldwork for the *Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study*.

- Field crews may make variances to the *Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study* in the field to accommodate actual field conditions and unforeseen problems. Any variances from the *Special-Status Aquatic*

Amphibians and Semi-Aquatic Snakes Study will be noted in the data resulting from the *Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study*.

- To prevent the introduction and transmittal of amphibian chytrid fungus and invasive aquatic species (e.g., quagga mussels, zebra mussel, and Asian clams), field crews will be trained on, provided with, and use materials (e.g., Quat) for decontaminating their boots, waders, and other equipment when leaving or traveling between water-based study sites. Field crews will follow DWR's Quagga and Zebra Mussel Rapid Response Plan and CDFW's Aquatic Invasive Species Decontamination Protocol which can be found at the following link: (https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=43333). All boats used during the study will follow cleaning protocols, including inspections before and after use. All decontamination requirements in place at Project reservoirs including those of DWR's *Quagga and Zebra Mussel Rapid Response Plan* for the SWP will be strictly followed (DWR 2010).

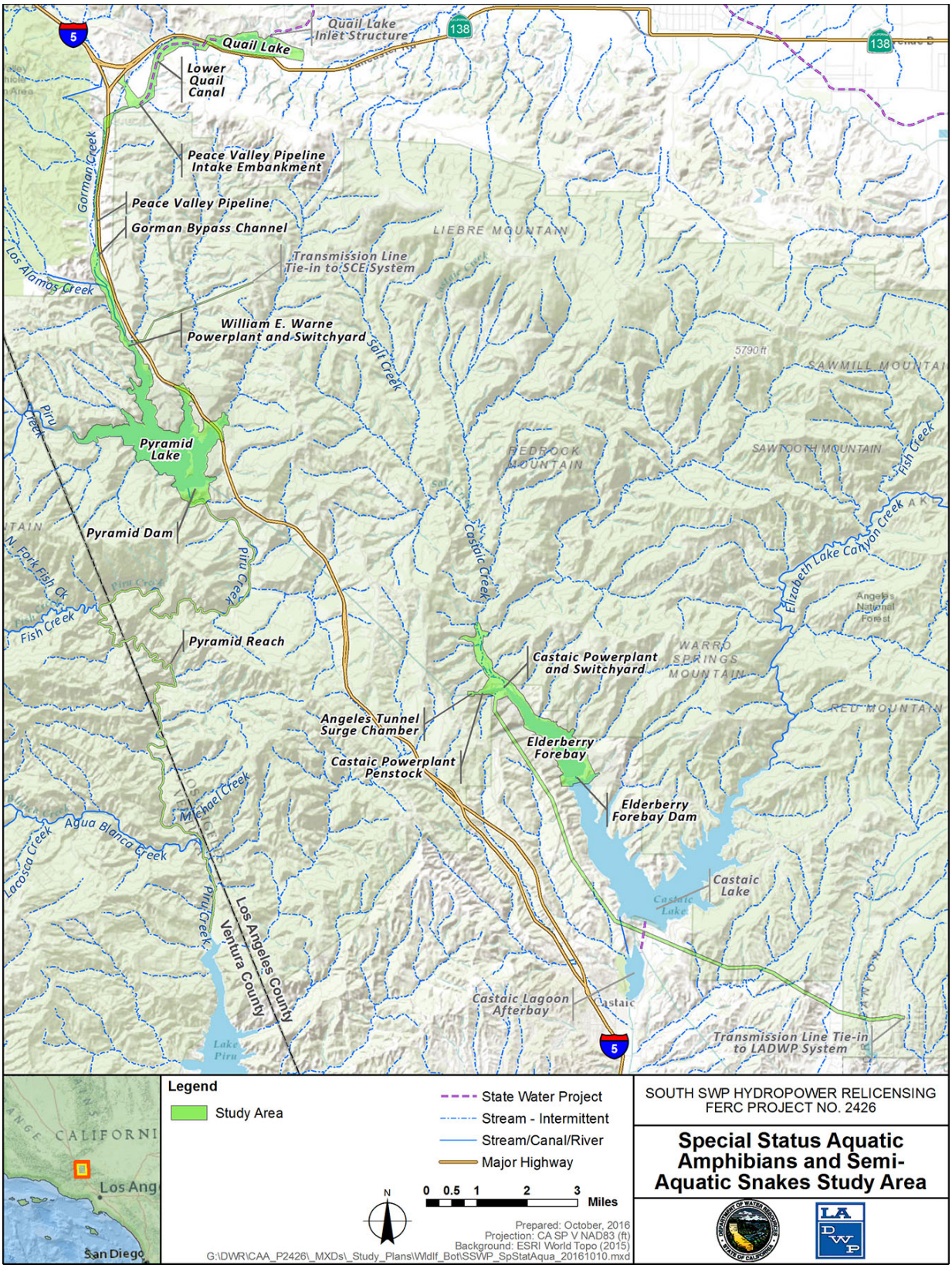

Figure 4.1-9. Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study Area

Methods

The *Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study* will consist of three steps: (1) identify potential habitat; (2) conduct field reconnaissance and surveys; and (3) prepare results. These steps are described below. Biologists performing the surveys will have the necessary permits, including a USFWS Section 10(a)(1)(A) species recovery permit for arroyo toad in order to perform special status-species surveys in areas where arroyo toad is likely to occur.

Step 1 – Identify Potential Habitat. The Licensees will use existing information, including known habitat requirements of the four target species, records of occurrence, aerial photographs, ground photographs, and field observations of habitat from the Licensees' other relicensing studies for preliminary identification of potential habitat that could support each of the species. Licensees will then prepare maps for Step 2, indicating these areas of potential habitat.

Step 2 – Conduct Field Reconnaissance and Surveys. Where additional information is needed to assess habitat suitability the Licensees will perform field reconnaissance of accessible potential habitat identified in Step 1 and to identify additional areas where potential habitat may occur. The information to be collected during field reconnaissance will include evidence that aquatic habitats are sufficient in duration to support the species, incidental observations of garter snake prey species (especially amphibians and small fish), presence of vernal pools or other flooded depressions too small to detect on aerial photographs, and potential egg deposition habitat for FYLF. Following review of this information, the Licensees will perform species surveys in areas determined to be potentially suitable habitat or at a representative set of sites if potentially suitable habitat for a species is determined to be abundant. A lower priority for survey sites may also apply to habitats within the 4.5-mile segment of the Pyramid reach between Ruby Canyon and the Blue Point Campground, which are surveyed annually for sensitive species, including two-striped garter snake, and thus survey data has already been collected from this segment.

The selection of survey sites will also take into account site-specific conditions, including safety, accessibility (i.e., road or trail access, topography), and permission from landowners to survey on private lands. Surveyors will include biologists or scientists that are qualified to identify each of the target species and their habitats, as well as other possibly occurring amphibians and snakes.

Survey methods will be appropriate to each species. FYLF is a diurnally active, stream species easily differentiated from other frog species and detectable by observation of one or more life stages (i.e., adults, juveniles, larvae, or egg masses) in suitable habitat. Visual encounter surveys for FYLF consisting of three survey periods will be performed in the upper portion of the Pyramid reach, if suitable habitat is documented. Two surveyors working in tandem will search along both banks of streams, 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. Surveyors will

exercise care to avoid disturbing egg masses and tadpoles of arroyo toad in areas where this species occurs. Each FYLF detection will be recorded by life stage along with water temperature, water depth, and substrate characteristics.

Western spadefoot is a fossorial species during terrestrial life stages and breeds somewhat unpredictably by season and location. Accordingly, surveys will focus on potential breeding habitats identified by the Licensees, which will be visually searched and dip-netted for larvae. Dip-netting will not occur in areas where arroyo toad individuals or arroyo toad egg masses are present. Two surveys per site will be performed, unless western spadefoot is detected on the first survey.

Both garter snake species are semi-aquatic, closely associated with streams and wetlands, particularly where amphibians and small fish occur, and are diurnally active. Therefore, although there are no established survey protocols, these species are likely to be detected, if present, by multiple visual inspections of potential habitat while walking and scanning suitable basking locations with binoculars. The Licensees will perform three visual surveys of potential habitat, covering representative habitat, or two surveys of entire habitat patches, if few suitable sites exist; however, the number of surveys per site may be reduced if target species are documented with fewer surveys.

Step 3 – Prepare Results. Following the surveys, the Licensees will develop summary text from field notes describing survey results and GIS maps depicting survey locations, special-status species occurrences, Project facilities, features, and specific Project O&M and Project-related recreation activities.

Quality Assurance and Quality Control

Field data will be collected in a manner that promotes high quality results, and will be subject to appropriate QA/QC procedures, including spot-checks of transcription and comparison of GIS maps with field notes to verify locations of sensitive habitats and species.

Analysis

Once the location of the special-status species in the study area for the *Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study* is determined, the Licensees will identify any Project O&M and Project-related recreation activities that occur in the vicinity where the species were documented.

Reporting

*Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Stud*y methods and results will be summarized and included, to the extent completed and ready for inclusion in the Licensees' ISR, USR, DLA, and FLA.

4.1.4.5 Consistency of Methodology with Generally Accepted Scientific Practices

This *Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study* is consistent with the goals, objectives, and methods outlined for special-status species on recent FERC hydroelectric relicensing efforts in California, including the Don Pedro Project (FERC Project No. 2299), the Yuba River Development Project (FERC Project No. 2246), and the Merced River Hydroelectric Project (FERC Project No. 2174). Survey methods for the two garter snake species, for which no standard survey protocols exist, follow general practices accepted by the scientific community.

4.1.4.6 Schedule

The *Special-Status Aquatic Amphibians and Semi-Aquatic Snakes Study* will begin after FERC issues its Study Plan Determination. The Licensees anticipate the schedule below will be followed to complete the Study.

Fieldwork Preparation	January 2018 – March 2018
Fieldwork	
Field Reconnaissance	July 2017
Surveys	March 2018 – September 2018
Data QA/QC	October 2018
Data Analysis and Reporting	October 2018 – June 2019

4.1.4.7 Level of Effort and Cost

Based on the work effort described above, the Licensees estimate the current cost to complete this Study is between $101,000 and $135,000.

4.1.4.8 References

CDFW. 2015. CNDDB. RareFind Version 5. Available online: nrmsecure.dfg.ca.gov/cnddb/view/query.aspx. Accessed July 31, 2015. Last updated July 7, 2015. California Department of Fish and Wildlife, Biogeographic Data Branch. Sacramento, CA.

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4.1.5 Botanical Resources Study

4.1.5.1 Project Nexus

Continued Project O&M and Project-related recreation activities have the potential to affect botanical resources, including special-status plant species. Continued Project O&M and Project-related recreation activities also have the potential to affect wetland and riparian habitats, which are considered special-status natural communities by the CDFW and provide habitat for numerous wildlife species, including ESA-listed birds. This *Botanical Resources Study* addresses these two resources (special-status plants, and wetland and riparian communities) in separate study components.

For the purpose of this *Botanical Resources Study*, a special-status plant species is a plant that meets one or more of the following criteria: (1) listed as a USFS Sensitive Species and occurs on NFS lands; (2) listed by the BLM as Sensitive and occurs on federal lands administered by BLM; (3) listed under the CESA as an endangered, threatened, or rare plant; (4) State-listed rare or a State candidate for listing species under the Native Plant Protection Act of 1977 (CDFW 2015a); or (5) listed by the California Native Plant Society (CNPS) on its Inventory of Rare and Endangered Plants, including species that are rated as CNPS 1A through 4B (CNPS 2015). Plants listed as federal threatened (FT) under the federal ESA, or as candidates or species proposed for listing under the ESA, will be addressed in the ESA-Listed Plants study, which is focused specifically on those resources.

This study also includes mapping and assessment of wetland and riparian habitats using the Bureau of Land Management's (BLM) PFC assessment (Prichard et al. 2003, Dickard et al. 2015). Federal policy defines wetlands as "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and which, under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." (Prichard et al. 1993) These can include marshes, shallow swamps, lakeshores, bogs, muskegs, wet meadows, estuaries, and riparian areas (Prichard et al. 1993). Riparian areas are defined as, "a form of wetland transition between permanently saturated wetlands and upland areas. These areas exhibit vegetation or physical characteristics reflective of permanent surface or subsurface water influence. Lands along, adjacent to, or contiguous with perennially and intermittently flowing rivers and streams, glacial potholes, and the shores of lakes and reservoirs with stable water levels are typical riparian areas. Excluded are such sites as ephemeral streams or washes that do not exhibit the presence of vegetation dependent upon free water in the soil." (Prichard et al. 1993).

4.1.5.2 Existing Information and Need for Additional Information

Existing, relevant, and reasonably available information regarding special-status plants known or with the potential to occur within the proposed Project boundary is provided in Section 4.6.3 of the Licensees' PAD. As a summary, the Licensees found that no comprehensive special-status plant surveys have been performed recently within the proposed Project boundary, but 44 special-status plant species have the potential to

occur (Table 4.1-3). Additional species may be added to this list based on field findings, or if recommended by resource agencies. The special-status plant survey component of this *Botanical Resources Study* will augment existing, relevant, and reasonably available information by mapping occurrences of special-status plants and compiling a floristic inventory of plant species in the proposed Project boundary.

Table 4.1-3. Special-Status Plants Known or with the Potential to Occur in the Project Study Area

Common Name/ Scientific Name	Status[1]	Flowering Period	Elevation Range (feet)	Habitats[2]	Potential for Occurrence in the Project Area
Mt. Pinos onion (*Allium howellii var. clokeyi*)	1B.3, LPNF	April - June	4265 - 6070	• Meadows and seeps (edges) • Pinyon and juniper woodland	Potential habitat exists.
California androsace (*Androsace elongata ssp. acuta*)	4.2	March - June	492 - 4282	• Chaparral • Cismontane woodland • Coastal scrub • Meadows and seeps • Pinyon and juniper woodland • Valley and foothill grassland	Potential to occur in upland areas surrounding Quail Lake and Pyramid Lake.
Horn's milkvetch (*Astragalus hornii var. hornii*)	1B.1	May - October	197 - 2789	• Lake margins with alkaline soils • Meadows and seeps • Playas	Potential habitat exists. Potential to occur in wetland areas surrounding Pyramid Lake.
Round-leaved filaree (*California macrophylla*)	1B.2, BLM	March - May	49 - 3937	• Cismontane woodland (clay soils) • Valley and foothill grassland (clay soils)	CNDDB occurrences in Lebec, La Liebre Ranch, Whitaker Peak, and Warm Springs Mountain quadrangles. Potential to occur in upland areas surrounding Quail Lake.
Catalina mariposa lily (*Calochortus catalinae*)	4.2	February - June	49 - 2297	• Chaparral • Cismontane woodland • Coastal scrub • Valley and foothill grassland	Potential habitat exists.
Club-haired mariposa lily (*Calochortus clavatus var. clavatus*)	4.3, ANF, LPNF	March - June	246 - 4265	Typically occurs on serpentinite, clay, rocky soils in: • Chaparral • Cismontane woodland • Coastal scrub • Valley and foothill grassland	Potential habitat exists. Potential to occur in upland areas surrounding Pyramid Lake.

Table 4.1-3. Special-Status Plants Known or with the Potential to Occur in the Project Study Area (continued)

Common Name/ Scientific Name	Status[1]	Flowering Period	Elevation Range (feet)	Habitats[2]	Potential for Occurrence in the Project Area
Slender mariposa lily (*Calochortus clavatus var. gracilis*)	1B.2, ANF, LPNF, BLM	March - November	1050 - 3281	• Chaparral • Coastal scrub • Valley and foothill grassland	CNDDB occurrences in Black Mountain, Liebre Mountain, Newhall, Whitaker Peak, and Warm Springs Mountain quadrangles. Specifically identified by CNDDB as occurring near the southwestern end of Elderberry Forebay. Potential to occur in upland areas surrounding Quail Lake and Pyramid Lake.
Late-flowered mariposa lily (*Calochortus fimbriatus*)	1B.3, ANF, LPNF	June - August	902 - 6250	Often occurs on serpentinite soils in: • Chaparral • Cismontane woodland • Riparian woodland	Potential habitat exists. Potential to occur in upland areas surrounding Quail Lake.
Palmer's mariposa lily (*Calochortus palmeri var. palmeri*)	1B.2, ANF, LPNF, SBNF	April - July	2329 - 7841	Mesic areas, including: • Chaparral • Lower montane coniferous forest • Meadows and seeps	CNDDB occurrences in Liebre Mountain, La Liebre Ranch, and Whitaker Peak quadrangles. Potential to occur in upland areas surrounding Quail Lake.
Plummer's mariposa lily (*Calochortus plummerae*)	4.2	May - July	328 - 5577	Granitic, rocky soils in: • Chaparral • Cismontane woodland • Coastal scrub • Lower montane coniferous forest • Valley and foothill grassland	Potential habitat exists. Potential to occur in upland areas surrounding Pyramid Lake.
Peirson's morning-glory (*Calystegia peirsonii*)	4.2	April - June	98 - 4921	• Chaparral • Cismontane woodland • Coastal scrub • Lower montane coniferous forest • Valley and foothill grassland	CNDDB occurrences in Whitaker Peak quadrangle. Specifically mapped by CNDDB in proposed Project boundary in Castaic Creek area upstream of Castaic Powerplant. Potential to occur in upland areas surrounding Quail Lake and Pyramid Lake.

Table 4.1-3. Special-Status Plants Known or with the Potential to Occur in the Project Study Area (continued)

Common Name/ Scientific Name	Status[1]	Flowering Period	Elevation Range (feet)	Habitats[2]	Potential for Occurrence in the Project Area
Mt. Gleason paintbrush (*Castilleja gleasoni*)	1B.2, CR, ANF, BLM	May - September	3806 - 7119	• Chaparral • Lower montane coniferous forest • Pinyon and juniper woodland	CNDDB occurrences Liebre Mountain quadrangle.
Island mountain-mahogany (*Cercocarpus betuloides var. blancheae*)	4.3	February - May	98 - 1969	• Closed-cone coniferous forest • Chaparral	Potential habitat exists.
Mojave spineflower (*Chorizanthe spinosa*)	4.2	March - July	20 - 4265	• Mojavean desert scrub • Playas	Potential habitat exists.
Monkey-flower savory (*Clinopodium mimuloides*)	4.2	June - October	1001 - 5906	• Streambanks, mesic areas • Chaparral	Potential habitat exists. Potential to occur in stream bank areas in the vicinity of Pyramid Lake (DWR 2014, Environmental Science Associates 2014a).
Paniculate tarplant (*Deinandra paniculata*)	4.2	March - November	82 - 3084	Usually vernally mesic areas, sometimes sandy soils in: • Coastal scrub • Valley and foothill grassland • Vernal pools	Potential habitat exists.
Mt. Pinos larkspur (*Delphinium parryi ssp. purpureum*)	4.3, LPNF	May - June	3281 - 8530	• Chaparral • Mojavean desert scrub • Pinyon and juniper woodland	Potential habitat exists.
Umbrella larkspur (*Delphinium umbraculorum*)	1B.3, LPNF	April - June	1312 - 5249	• Chaparral • Cismontane woodland	CNDDB occurrences Lebec quadrangle.
Tehachapi buckwheat (*Eriogonum callistum*)	1B.1	May - July	4593 - 5676	Openings, rocky soils, and limestone areas in chaparral	Potential habitat exists.

Table 4.1-3. Special-Status Plants Known or with the Potential to Occur in the Project Study Area (continued)

Common Name/ Scientific Name	Status[1]	Flowering Period	Elevation Range (feet)	Habitats[2]	Potential for Occurrence in the Project Area
Fort Tejon woolly sunflower (*Eriophyllum lanatum var. hallii*)	1B.1, LPNF	May - July	3494 - 4921	• Chaparral • Cismontane woodland	CNDDB occurrences Lebec quadrangle.
San Gabriel bedstraw (*Galium grande*)	1B.2, ANF, BLM	January - July	1394 - 4921	• Broadleaved upland forest • Chaparral • Cismontane woodland • Lower montane coniferous forest	Potential habitat exists.
Palmer's grappling hook *(Harpagonella palmeri*)	4.2	March - May	66 - 3133	On clay soils; open grassy areas within: • Chaparral • Coastal scrub • Valley and foothill grassland	Potential habitat exists.
Newhall sunflower (*Helianthus inexpectatus*)	1B.1	August - October	984 - 984	Freshwater, seeps in: • Marshes and swamps • Riparian woodland	Potential habitat exists.
Los Angeles sunflower (*Helianthus nuttallii ssp. parishii*)	1A	August - October	33 - 5495	Marshes and swamps (coastal salt and freshwater)	Presumed extirpated, not likely to occur.
Vernal barley (*Hordeum intercedens*)	3.2	March - June	16 - 3281	• Coastal dunes • Coastal scrub • Valley and foothill grassland (saline flats and depressions) • Vernal pools	Potential habitat exists.
Southern California black walnut (*Juglans californica*)	4.2	March - August	164 - 2953	Alluvial areas in: • Chaparral • Cismontane woodland • Coastal scrub • Riparian woodland	Potential habitat exists.

Table 4.1-3. Special-Status Plants Known or with the Potential to Occur in the Project Study Area (continued)

Common Name/ Scientific Name	Status[1]	Flowering Period	Elevation Range (feet)	Habitats[2]	Potential for Occurrence in the Project Area
Fragrant pitcher sage (*Lepechinia fragrans*)	4.2, ANF, SBNF	March - October	66 - 4298	• Chaparral	Potential habitat exists.
Ross' pitcher aage (*Lepechinia rossii*)	1B.2, ANF, LPNF	May - September	1001 - 2592	• Chaparral	CNDDB occurrences Whitaker Peak quadrangle.
Ocellated Humboldt lily (*Lilium humboldtii ssp. ocellatum*)	4.2	March - August	98 - 5906	Openings in: • Chaparral • Cismontane woodland • Coastal scrub • Lower montane coniferous forest • Riparian woodland	Potential habitat exists. Potential to occur in upland or riparian areas surrounding Pyramid Lake.
Sylvan microseris (*Microseris sylvatica*)	4.2	March - June	148 - 4921	• Chaparral • Cismontane woodland • Pinyon and juniper woodland • Valley and foothill grassland (serpentinite)	Potential habitat exists. Potential to occur in upland areas surrounding Quail Lake and Pyramid Lake.
Tehachapi monardella (*Monardella linoides ssp. oblonga*)	1B.3, LPNF	May - August	2953 - 8104	• Lower montane coniferous forest • Pinyon and juniper woodland • Upper montane coniferous forest	Potential habitat exists.
Baja navarretia (*Navarretia peninsularis)*	1B.2, ANF, LPNF, SBNF	May - August	4921 - 7546	Mesic areas, including: • Chaparral (openings) • Lower montane coniferous forest • Meadows and seeps • Pinyon and juniper woodland	CNDDB occurrences in Lebec quadrangle.
Piute mountains navarretia (*Navarretia setiloba*)	1B.1	April - July	935 - 6890	Clay or gravelly loam in: • Cismontane woodland • Pinyon and juniper woodland • Valley and foothill grassland	CNDDB occurrences in Lebec quadrangle. Potential to occur in upland areas surrounding Quail Lake.

Table 4.1-3. Special-Status Plants Known or with the Potential to Occur in the Project Study Area (continued)

Common Name/ Scientific Name	Status[1]	Flowering Period	Elevation Range (feet)	Habitats[2]	Potential for Occurrence in the Project Area
Robbins' nemacladus (*Nemacladus secundiflorus var. robbinsii*)	1B.2, ANF, LPNF	April - June	1148 - 5577	Occurs in openings in: • Chaparral • Valley and foothill grassland	Potential habitat exists. Potential to occur in upland areas surrounding Quail Lake and Pyramid Lake .
Short-jointed beavertail (*Opuntia basilaris var. brachyclada*)	1B.2, ANF, SBNF, BLM	April - August	1394 - 5906	• Chaparral • Mojavean desert scrub • Pinyon and juniper woodland	CNDDB occurrences in Newhall quadrangle.
Bakersfield cactus (*Opuntia basilaris var. treleasei*)	1B.1	April - May	394 - 4757	Sandy or gravelly areas in: • Cismontane woodland • Valley and foothill grassland	Potential habitat exists. Potential to occur in upland areas surrounding Quail Lake.
Adobe yampah (*Perideridia pringlei*)	4.3	April - July	984 - 5906	Serpentinite, often clay soils in: • Chaparral • Cismontane woodland • Coastal scrub • Pinyon and juniper woodland	Potential habitat exists. Potential to occur in upland areas surrounding Quail Lake and Pyramid Lake.
Hubby's phacelia (*Phacelia hubbyi*)	4.2	April - July	0 - 3281	Gravelly, rocky, and talus-slope areas in: • Chaparral • Coastal scrub • Valley and foothill grassland	Potential habitat exists.
Mojave phacelia (*Phacelia mohavensis*)	4.3	April - August	4593 - 8202	Sandy or gravelly soils in: • Cismontane woodland • Lower montane coniferous forest • Meadows and seeps • Pinyon and juniper woodland	Potential habitat exists.
Chaparral ragwort (*Senecio aphanactis*)	2B.2	January - April	49 - 2625	Sometimes on alkaline soils in: • Chaparral • Cismontane woodland • Coastal scrub	Potential habitat exists. Potential to occur in upland areas surrounding Pyramid Lake.

Table 4.1-3. Special-Status Plants Known or with the Potential to Occur in the Project Study Area (continued)

Common Name/ Scientific Name	Status[1]	Flowering Period	Elevation Range (feet)	Habitats[2]	Potential for Occurrence in the Project Area
San Bernardino aster (*Symphyotrichum defoliatum*)	1B.2, ANFSP, LPNFSP, SBNF, BLM	July - November	7 - 6693	Near ditches, streams, springs in: • Cismontane woodland • Coastal scrub • Lower montane coniferous forest • Meadows and seeps • Marshes and swamps • Valley and foothill grassland (vernally mesic)	CNDDB occurrences in Lebec quadrangle. Potential to occur in shoreline areas and adjacent wetlands of Quail Lake and Pyramid Lake.
Greata's aster (*Symphyotrichum greatae*)	1B.3, BLM	June - October	984 - 6594	Mesic areas, specifically: • Broadleafed upland forest • Chaparral • Cismontane woodland • Lower montane coniferous forest • Riparian woodland	CNDDB occurrences in Liebre Mountain and Whitaker Peak quadrangles. Potential to occur in upland areas surrounding Quail Lake and Pyramid Lake.
Lemmon's syntrichopappus (*Syntrichopappus lemmonii*)	4.3	April - June	1640 - 6004	Sandy or gravelly soils in • Chaparral • Pinyon and juniper woodland	Potential habitat exists. Potential to occur in upland areas surrounding Pyramid Lake.
Silvery false lupine (*Thermopsis californica var. argentata*)	4.3	April - October	2182 - 7661	• Cismontane woodland • Lower montane coniferous forest • Pinyon and juniper woodland	Potential habitat exists.

Sources: CDFW 2015b, CNPS 2015, BLM 2015, USFS 2013
Notes:
[1]CNPS Status:
1A = presumed extirpated in California and either rare or extinct elsewhere
1B = rare, threatened, or endangered in California and elsewhere
2A = presumed extirpated in California, but common elsewhere
2B = rare, threatened, or endangered in California, but more common elsewhere
3 = more information is needed
4 = plants of limited distribution
Threat Ranks (number following period):
1-Seriously threatened in California (over 80 percent of occurrences threatened / high degree and immediacy of threat)
2-Moderately threatened in California (20-80 percent occurrences threatened / moderate degree and immediacy of threat)
3-Not very threatened in California (less than 20 percent of occurrences threatened / low degree and immediacy of threat or no current threats known)
[2]Habitats" = habitats are limited the those types that occur within the Project vicinity

The following quadrangles were queried: Lebec, La Liebre Ranch, Black Mountain, Whitaker Peak, Warm Springs Mountain, Newhall, and Cobblestone Mountain
Key:
DWR = California Department of Water Resources
CR = California Rare
ANFSP = Angeles National Forest Sensitive Plant
LPNFSP = Los Padres National Forest Sensitive Plant
SBNF = San Bernardino National Forest
BLM = Bureau of Land Management
CNDDB = California Natural Diversity Database

Existing, relevant, and reasonably available information regarding wetland and riparian habitats within the proposed Project boundary is provided in PAD Sections 4.7.1 and 4.7.2. The Licensees also found that no recent comprehensive riparian or wetland habitat assessment has been performed within the proposed Project boundary. The wetland and riparian PFC assessment component of this *Botanical Resources Study* will augment existing, relevant, and reasonably available information by conducting wetland and riparian studies in the proposed Project boundary.

Additional information on botanical resources will be generated by the *Special-status Terrestrial Wildlife –CWHR Study*. As part of the study, the CWHR map generated for the Project PAD will be ground-truthed and an updated and corrected map developed. This will include the removal of any incorrect alliances, such as the Pinyon-Juniper (identified as being <1 percent of the Project acreage) and identification of any additional sensitive natural communities (per VegCAMP crosswalk)[45] beyond the wetland and riparian areas already included as part of the survey.

4.1.5.3 Study Goals and Objectives

The goals of this *Botanical Resources Study* are to: (1) perform surveys to identify occurrence locations of special-status plant species in the proposed Project boundary; (2) use PFC protocols to assess wetland and riparian areas in the proposed Project boundary; (3) identify potential wetland and riparian habitat locations for the Special-Status Terrestrial Wildlife Species, CWHR, and ESA-listed Riparian Bird species studies; and (4) collect ancillary data related to sensitive habitats and species, including geographic extent and indications of potential threats resulting from Project O&M and Project-related recreation activities.

The objective of this *Botanical Resources Study* is to gather sufficient data necessary to fill recognized gaps in existing information about the presence of special-status plants and wetland and riparian habitats in the *Botanical Resources Study* area.

4.1.5.4 Study Methods

Study Area

The study area for the *Botanical Resources Study* will consist of the land area within the proposed Project boundary, excluding lands overlying the Angeles Tunnel on which the Licensees do not perform any Project O&M. This includes staging areas; construction areas; upstream maintenance areas above reservoirs; fuel modification requirement areas; areas cleared for access to transmission line poles and access routes to these areas; Lower Quail Canal, Quail Lake, and associated maintenance roads/areas and recreational features; and Gorman Bypass Channel and associated maintenance roads/access. The study area for the *Botanical Resources Study* is shown in Figure 4.1-10.

[45] Per the crosswalk, only one non-wetland/riparian sensitive natural community was identified as potentially occurring in the study area.

General Concepts and Procedures

- Personal safety is the most important consideration of each fieldwork team. Fieldwork will only occur in safely accessible areas and under conditions deemed safe by the field crews. Locations within the study area that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed; these areas will be identified in the data summary and an explanation for survey exclusion will be provided.

- The *Botanical Resources Study* will begin after FERC issues its Study Plan Determination.

- The *Botanical Resources Study* does not include the development of requirements for the new license, which will be addressed outside the Study.

- The *Botanical Resources Study* focuses specifically on the resource within the proposed Project boundary, but the study area for the *Botanical Resources Study* is specific to the areas within the proposed Project boundary containing ecological conditions suitable for that resource.

- If required for the performance of the *Botanical Resources Study*, the Licensees will make a good faith effort to obtain permission to access private property well in advance of initiating the Study. The Licensees will only enter private property if permission has been provided by the landowner.

- The Licensees will acquire all necessary agency permits and approvals prior to beginning fieldwork for the *Botanical Resources Study*.

- Field crews may make variances to the *Botanical Resources Study* in the field to accommodate actual field conditions and unforeseen problems. Any variances to the *Botanical Resources Study* will be noted in the data resulting from the *Botanical Resources Study*.

- To prevent the introduction and transmittal of amphibian chytrid fungus and invasive aquatic species (e.g., quagga mussels, zebra mussel, and Asian clams), field crews will be trained on, provided with, and use materials (e.g., Quat) for decontaminating their boots, waders, and other equipment when leaving or traveling between water-based study sites. Field crews will follow DWR's Quagga and Zebra Mussel Rapid Response Plan for decontaminating their boots, waders, and other equipment between water-based study sites, and will follow CDFW's Aquatic Invasive Species Decontamination Protocol found at the following link: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=43333. All boats used during the study will follow clean protocols, including inspections before and after use. All decontamination requirements in place at Project reservoirs including those of DWR's *Quagga and Zebra Mussel Rapid Response Plan* for the SWP will be strictly followed (DWR 2010).

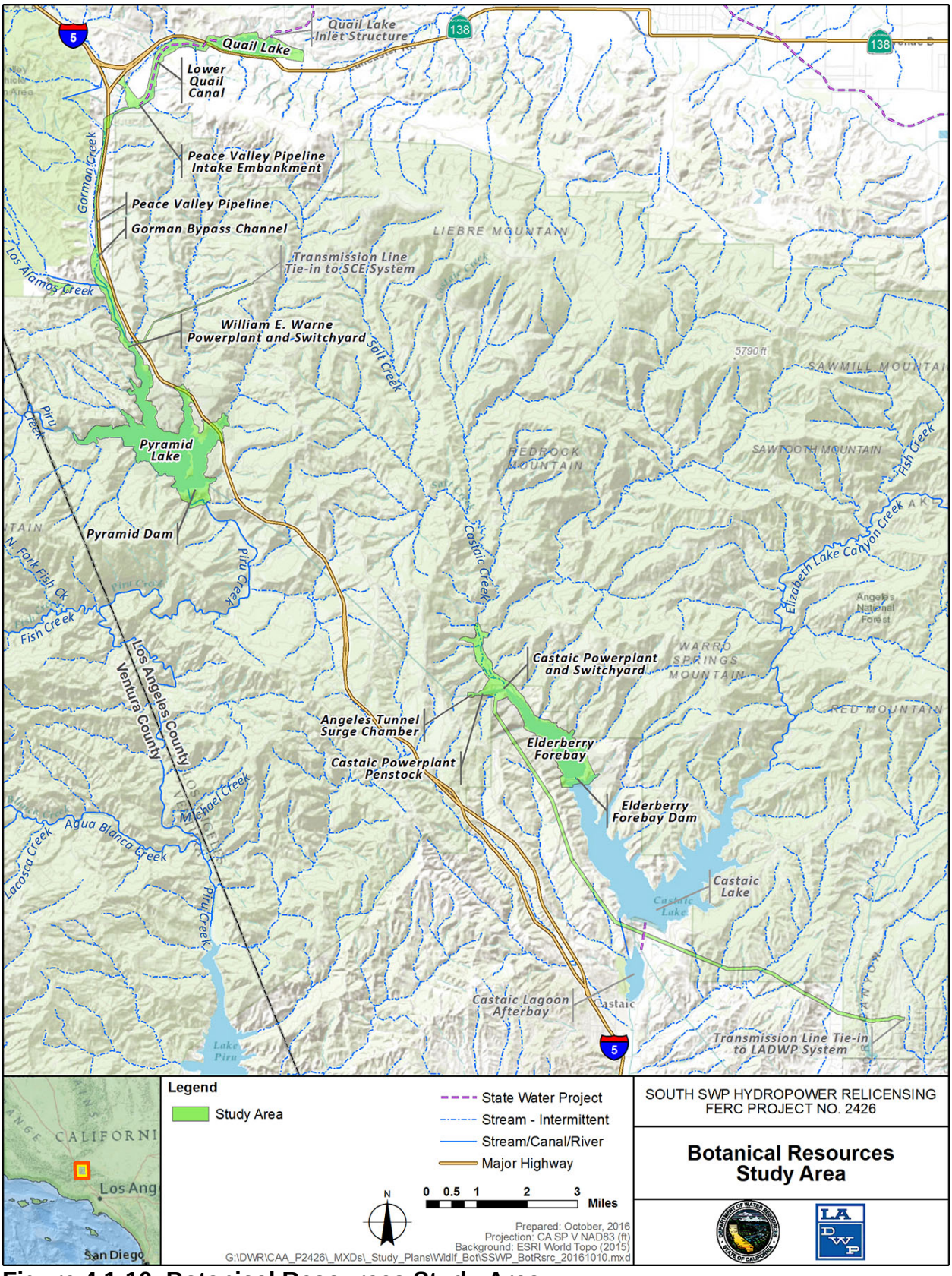

Figure 4.1-10. Botanical Resources Study Area

Methods

The *Botanical Resources Study* will consist of three separate steps: (1) existing data assembly; (2) special-status plant surveys; and (3) wetland and riparian assessment. These steps are described below.

Step 1 – Existing Data Assembly. Prior to implementing field studies, the Licensees will review existing data, including National Wetlands Inventory (NWI) data (USFWS 2016), aerial imagery, and other relevant data that may be identified during this *Botanical Resources Study*. Field maps will be prepared with suitable aerial imagery that displays the CWHR habitat and will use these maps for field navigation and data collection.

Step 2 –Special-Status Plant Surveys. Prior to implementing special-status plant surveys, field staff will review and print the list of special-status plants that are known or have potential to occur within the study area for the *Botanical Resources Study* (Table 4.1-7). Additionally, field staff will visit reference sites, if available, for special-status plants most likely to occur in the Project study area (those known from CNDDB reports in the Project or surrounding quadrangles or with other known occurrences nearby). This may include the following plants: Round-leaved filaree; Slender mariposa lily; Palmer's mariposa lily; Peirson's morning-glory; Umbrella larkspur; Fort Tejon woolly sunflower; Ross' pitcher sage; Baja navarretia; Piute Mountains navarretia; Short-jointed beavertail; San Bernardino aster; and Greata's aster.

The Licensees will conduct a botanical survey in the study area for the *Botanical Resources Study* to identify the locations of special-status plant species, if present. The Licensees will conduct special-status plant surveys that will follow applicable CDFW protocol methodology described in the botanical survey section of the CDFW *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (2009). This protocol uses systematic sampling techniques to ensure thorough coverage of plant communities that could support special-status plant species. The CDFW protocol states that “the level of effort required per given area and habitat is dependent upon the vegetation and its overall diversity and structural complexity, which determines the distance at which plants can be identified.” Staff will conduct surveys by walking all locations in the study area that can be safely accessed (as described in section *4.1.5.4 Study Methods*) to ensure thorough coverage, noting all plant taxa observed. Documentation of surveys on NFS lands will include completion of USFS’ data forms for any USFS sensitive plant species, as specified in the USFS Threatened, Endangered, and Sensitive Plants Element Occurrence Protocol and Field Guide (USFS 2014) and Threatened, Endangered and Sensitive Plants Element Occurrence Protocol and Field Guide (USFS 2015).

Field staff will perform surveys that provide coverage of known flowering periods between March and August, (encompassing the period within which the potentially occurring special-status species bloom), as well as survey outside those months, with at least two survey visits being performed in all suitable habitats to maximize the likelihood of detection of all plant species. Surveyors will be botanists or scientists that are qualified to identify plant species likely to occur in the study area for the *Botanical*

Resources Study. Taxonomy and nomenclature will be based on *The Jepson Manual* (Baldwin et al. 2012). If a special-status plant is identified, the survey team will prepare a California Native Species Field Survey Form so the occurrence can be added to the CNDDB. Surveyors will collect and record the following data associated with each occurrence (either to the edge of the occurrence, or to the edge of the study area for the *Botanical Resources Study*, whichever is less, though surveyors will estimate the size of the occurrence outside of the study boundary to the extent possible):

- Digital photographs to document the occurrence, phenology, reproductive state, associated habitat, and indications of potential threats
- Location and approximate extent of the special-status plant population delineated using a handheld GPS device and the estimated number of plants in the population
- Habitat description, including dominant and subdominant vegetation in the area
- Activities observed in the area that have a potential to adversely affect the population (e.g., recreational trails and uses)

The Licensees will review and verify field data and create a digital data layer depicting the locations of special-status plant species.

Step 3 –Wetland and Riparian Assessment. A qualified team of field staff will assess the condition of wetland and riparian habitat using the PFC qualitative methods for wetland (Prichard et al. 2003) and riparian areas adjacent to flowing water (Dickard et al. 2015). Surveyors will identify areas to be evaluated prior to field surveys during the review of existing information, as described in Step 1. Additional areas may be identified during reconnaissance of the Project's study area. Field staff will traverse, or survey by boat, the entire length of riparian vegetation for each area to be assessed and will collect data at representative areas. Surveyors will determine the locations where PFC data will be collected (sample points) while in the field based on site observations. Surveyors will collect data at a minimum of one sample location per each discrete wetland or riparian area. For wetland or riparian areas that span a sufficiently large area such that physical and biological features vary significantly (as determined in the field based on best professional judgment by the Licensees' field staff), up to three sample points will be evaluated. For lotic areas, field staff will complete the Reach Information Form (Lotic) and PFC Assessment Form (Lotic) (Dickard et al. 2015) and will record species observed. For lentic areas, field staff will complete the Lentic Standard Checklist (Prichard et al. 2003). The Reach Information Form records location and description of lotic reaches. The PFC Assessment Form (for lotic areas) and the Lentic Standard Checklist (for lentic areas) record information on attributes and processes that are used to determine functionality and that will be used for other studies dependent upon this data. Surveyors will also collect GPS points, take photographs at each sample point, and photograph features at other locations to document conditions within each wetland and riparian area. The Licensees will review and verify field data and create a wetland and riparian area digital data layer that captures relevant data.

Quality Assurance and Quality Control

Field data will be collected in a manner that promotes high quality results, and will be subject to appropriate QA/QC procedures, including spot-checks of transcription and comparison of GIS maps with field notes to verify locations of sensitive habitats and species.

Analysis

After completion of special-status plant species surveys and wetland and riparian habitat PFC assessment, the Licensees will evaluate data and identify sensitive and unique areas. Areas that are, or may be, susceptible to disturbance by Project O&M or Project-related recreation activities will be noted.

Reporting

Botanical Resources Study results will be incorporated into the Licensees' ISR, USR, DLA, and FLA to the extent they have been completed at the time they are needed for each of the aforementioned licensing milestones. If any special-status plants are found, a report will be developed and considered Privileged, and will be provided only to FERC, USFWS, and CDFW. If any of these occurrences are found on NFS lands, this Privileged report will also be provided to the USFS and reported using the USFS' *Threatened, Endangered and Sensitive Plants Element Occurrence Field Guide* (USFS 2008) protocol.

4.1.5.5 Consistency of Methodology with Generally Accepted Scientific Practices

Elements of this *Botanical Resources Study* are consistent with the goals, objectives, and methods outlined for most recent FERC hydroelectric relicensing efforts in California, including the Don Pedro Project (FERC No. 2299), the Yuba River Development Project (FERC No. 2246), and the Merced River Hydroelectric Project (FERC No. 2174), and will follow applicable standard botanical survey methods as defined by CDFW (2009) and USFS (2008).

4.1.5.6 Schedule

The *Botanical Resources Study* will begin after FERC issues its Study Plan Determination. The Licensees anticipate the schedule below will be followed to complete the *Botanical Resources Study*.

Fieldwork Preparation	April 2017 – February 2018
Fieldwork	May 2017 – April 2018
Data QA/QC	May 2017 – September 2018
Data Analysis and Reporting	October 2018 – December 2018

4.1.5.7 Level of Effort and Cost

Based on the work effort described above, the Licensees estimate the current cost to complete this *Botanical Resources Study* will range between $520,000 and $694,000.

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4.1.6 Non-Native Invasive Plants Study

4.1.6.1 Project Nexus

Continued Project O&M and Project-related recreation activities may facilitate the spread of NNIP. For the purpose of this *NNIP Study*, an NNIP is a plant species that is listed as “A”, “B”, or “C” by the CDFA (CDFA 2010). Other NNIP of interest include species of concern to ANF and LNPF that are not rated by the CDFA.

4.1.6.2 Existing Information and Need for Additional Information

Existing, relevant, and reasonably available information regarding NNIP known or with the potential to occur within the proposed Project boundary is provided in Section 4.6 and Section 4.7 of the Licensees' PAD. As a summary, the Licensees found that no comprehensive NNIP surveys have been performed recently in the proposed Project boundary. A list of NNIP species with potential to occur in the Study Area was identified in the Licensees' PAD. Based on input from USFS and CDFW, the Licensees identified a revised list of target NNIP to focus on during field surveys (Table 4.1-4). This *NNIP Study* will augment existing information by providing current information regarding NNIP within the proposed Project boundary.

Table 4.1-4. Target NNIP Species to Survey in the Study Area

Scientific Name	Common Name	CDFA
***Acacia* sp.**	Acacia	B
***Acroptilon repens**	Russian knapweed	B
**Ageratina adenophora*	Eupatory	
***Ailanthus altissima*	Tree of heaven	C
***Arundo donax*	Giant reed grass	B
***Asphodelus fistulosus*	Asphodel	B
**Atriplex semibaccata*	Saltbush	
**Brassica tournefortii*	African mustard	
***Cardaria draba/pubescens*	Hoary cress/Whitetop	B
***Carduus pycnocephalus*	Italian thistle	C
***Centaurea solstitialis*	Yellow star thistle	C
***Centaurea maculosa*	Spotted knapweed	A
***Centaurea melitensis*	Tocalote	C
***Cirsium arvense*	Canada thistle	B
***Cirsium vulgare*	Bull thistle	C
**Cistus creticus*	rockrose	
**Cnicus benedictus*	blessed thistle	
**Colutea arborescens*	Bladderpod senna	
**Conium maculatum*	Poison hemlock	
***Cortaderia jubata/selloana*	Pamapas grass	B
***Cynara cardunculus*	Artichoke thistle	B
**Cynosurus echinatus*	Hedgehog dogtailgrass	
***Cystisus scoparius*	Scotch thistle	C
***Delairea odorata*	German ivy	B
**Dipsacus sativus*	Teasel	
**Dimorphotheca sinuata*	African daisy	
**Eichornia crassipes*	Water hyacinth	
**Elaeagnus angustifolius*	Russian olive	

Table 4.1-4. Target NNIP Species to Survey in the Study Area (continued)

Scientific Name	Common Name	CDFA
**Erharta* sp.	Veldtgrass	
**Eucalyptus globulus*	Blue gum	
**Euphorbia dendroides*	Tree spurge	
***Euphorbia terracina*	Geralton carnation	B
**Ficus carica*	Fig	
**Foeniculum vulgare*	Fennel	
**Fumaria officinalis*	Fumitory	
***Genista monospessulana*	French broom	C
***Halogeton glomeratus*	Halogeton	A
**Hedera helix*	English ivy	
***Hydrilla verticillata*	Hydrilla	A
**Lathyrus latifolius*	Perennial sweetpea	
***Lepidium latifolium*	Perennial pepperweed	B
***Linaria genistifolia* ssp. *dalmatica*	Dalmatian toadflax	A
**Lobularia maritima*	sweet alyssum	
**Marrubium vulgare*	horehound	
**Nicotania glauca*	Tree tobacco	
**Olea europaea*	Olive	
***Pennisetum clandestinum*	Kikuyu grass	C
**Pennisetum setaceum*	Fountain grass	
**Picris echioides*	Bristly ox-tongue	
**Prunus cerasifera*	Cherry plum	
**Pyracantha* sp. *pyracantha*	Pyracantha	
**Raphanus sativus*	Wild radish	
***Retama monosperma*	Bridal broom	B
**Ricinus communis*	Castorbean	
**Robinia pseudoacacia*	Black locust	
**Rosemarinus officianalis*	Rosemary	
**Rubus discolor*	Himalayan blackberry	
***Salsola tragus*	Russian thistle	C
***Salsola paulsenii*	Barbwire Russian thistle	C
**Saponaria officinalis*	Bouncing bet	
**Schinus molle*	Peruvian pepper tree	
**Silybum marianum*	Milk thistle	
***Spartium junceum*	Spanish broom	C
**Stipa miliacea*	Smilo grass	
***Tamarix ramosissima*	Saltcedar	B
**Tradescantia fluminensis*	Small-leaved spiderwort	

Table 4.1-4. Target NNIP Species to Survey in the Study Area (continued)

Scientific Name	Common Name	CDFA
***Tribulus terrestris*	Puncture vine	C
**Ulnus parvifolia*	Chinese elm	
**Vinca major*	Periwinkle	
**Washingtonia robusta*	Mexican fan palm	

Key: CDFA = California Department of Food and Agriculture
CDFA Ratings:
A - An organism of known economic importance subject to state (or commissioner when acting as a state agent) enforced action involving: eradication, quarantine regulation, containment, rejection, or other holding action.
B - An organism of known economic importance subject to: eradication, containment, control or other holding action at the discretion of the individual county agricultural commissioner. OR An organism of known economic importance subject to state endorsed holding action and eradication only when found in a nursery.
C - An organism subject to no state enforced action outside of nurseries except to retard spread. At the discretion of the county agricultural commissioner. OR An organism subject to no state enforced action except to provide for pest cleanliness in nurseries.
**Full-datasets to be collected only on USFS land*
***Occurrence to be mapped wherever found*

4.1.6.3 Study Goals and Objectives

The goals of this *NNIP Study* are to: (1) identify and map the locations of NNIP in the study area for the *NNIP Study*; and (2) to collect ancillary data related to NNIP, including geographic extent of occurrences and/or number of individuals, and indications of the potential threats for NNIP to expand in the study area for the *NNIP Study*.

The objective of this *NNIP Study* is to gather sufficient data necessary to fill recognized gaps in existing information on the presence and extent of NNIP in the study area for the *NNIP Study*.

4.1.6.4 Study Methods

Study Area

The study area for the *NNIP Study* will consist of the area within the proposed Project boundary, excluding lands overlying the Angeles Tunnel on which the Licensees do not perform any Project O&M. This includes staging areas; construction areas; upstream maintenance areas above reservoirs; fuel modification requirement areas; areas cleared for access to transmission line poles and access routes to these areas; Lower Quail Canal, Quail Lake, and associated maintenance roads/areas and recreational features; and Gorman Bypass Channel and associated maintenance roads/areas. The study area for the *NNIP Study* is shown in Figure 4.1-11.

General Concepts and Procedures

- Personal safety is the most important consideration of each fieldwork team. Fieldwork will only occur in safely accessible areas and under conditions deemed safe by the field crews. Locations within the study area that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed;

these areas will be identified in the data summary and an explanation for survey exclusion will be provided.

- The *NNIP Study* will begin after FERC issues its Study Plan Determination.
- The *NNIP Study* does not include the development of requirements for the new license, which will be addressed outside the Study process.
- This *NNIP Study* focuses specifically on non-native invasive plants within the proposed Project boundary, but the study area for the *NNIP Study* is specific to the areas that can support that resource.
- If required for the performance of the *NNIP Study*, the Licensees will make a good faith effort to obtain permission to access private property well in advance of initiating the *NNIP Study*. The Licensees will only enter private property if permission has been provided by the landowner.
- The Licensees will acquire all necessary agency permits and approvals prior to beginning fieldwork for the *NNIP Study*.
- Field crews may make variances to the *NNIP Study* in the field to accommodate actual field conditions and unforeseen problems. Any variances from the *NNIP Study* will be noted in the data resulting from the *NNIP Study*.
- To prevent the introduction and transmittal of amphibian chytrid fungus and invasive aquatic species (e.g., quagga mussels, zebra mussel, and Asian clams), field crews will be trained on, provided with, and use materials (e.g., Quat) for decontaminating their boots, waders, and other equipment when leaving or traveling between water-based study sites. Field crews will follow DWR's Quagga and Zebra Mussel Rapid Response Plan and CDFW's Aquatic Invasive Species Decontamination Protocol which can be found at the following link: (https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=43333). All boats used during the study will follow cleaning protocols, including inspections before and after use. All decontamination requirements in place at Project reservoirs including those of DWR's *Quagga and Zebra Mussel Rapid Response Plan* for the SWP will be strictly followed (DWR 2010).

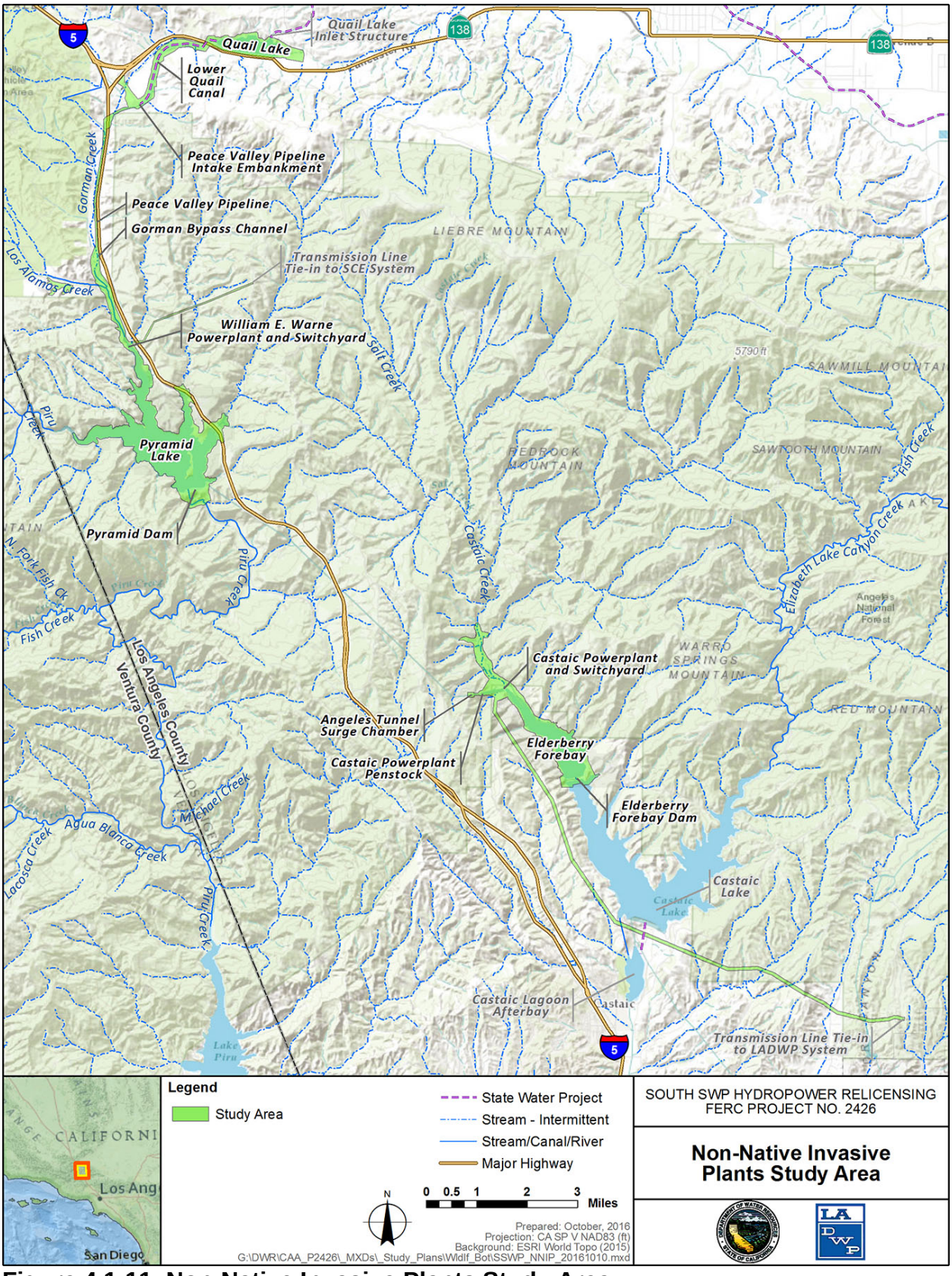

Figure 4.1-11. Non-Native Invasive Plants Study Area

Methods

Fieldwork for the *NNIP Study* will be performed in conjunction with the Licensees' *Botanical Resource Study,* a separate study being undertaken as part of this relicensing effort, which includes a comprehensive floristic survey within the same study area. Floristic surveys require that all species encountered are identified to the extent necessary to determine listing status. The *NNIP Study* will consist of three steps: (1) gather data and prepare for field effort; (2) conduct field surveys; and (3) prepare data. These steps are described below.

Step 1 – Gather Data and Prepare for Field Effort. The Licensees will prepare field maps for use by survey teams. The maps will depict the study area on an aerial imagery base and will include the location of Project features. Pre-field planning activities will include preliminary identification of vegetation and habitats that could support NNIP.

Step 2 – Conduct Field Surveys. Surveys will follow applicable CDFW protocol methodology described in the botanical survey section of the CDFW *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities*. This protocol uses systematic sampling techniques to ensure thorough coverage of plant communities that could support NNIPs. The CDFW protocol states that "the level of effort required per given area and habitat is dependent upon the vegetation and its overall diversity and structural complexity, which determines the distance at which plants can be identified." Staff will conduct surveys by walking all areas of the site that can be safely accessed to ensure thorough coverage, noting all plant taxa observed. When performing NNIP surveys on USFS lands, a qualified team of field staff will follow USFS protocols, excluding treatment protocols (USFS 2014). Special attention will be paid to disturbed areas, including road edges, recreation areas, and maintenance areas (i.e., target areas). Field staff will perform surveys that encompass the period within which most NNIP are expected to flower, with at least two survey visits performed in all target areas to maximize the likelihood of detection of NNIP. Surveyors will be botanists or scientists that are qualified to identify NNIPs likely to occur in the study area for the *NNIP Study*. Taxonomy and nomenclature will be based on *The Jepson Manual* (Baldwin et al. 2012).

Because the field survey will be floristic in nature, all species observed will documented. More extensive data will be collected for target species in Table 4.1-4. For these species that are not listed by CDFA (identified with one asterisk in Table 4.1-4), data will be collected in accordance with USFS protocols (USFS 2014) for any occurrences on USFS lands. For species identified with two asterisks in Table 4.1-4, occurrence data will be collected wherever it is observed within the study area.

Two forms of noxious weed data will be collected and maintained, depending on the type and distribution of weeds located during survey efforts:

- Quantitative data: for discrete occurrences of weeds, data collected will include species, GPS-derived location, and other data, including percent cover, distribution, plant phenology, habitat description, and land use notes. For species

occurrences on USFS lands, data collection will follow USFS protocols (USFS 2014, 2015)

- Qualitative data: for widespread weeds, or for those weeds for which detailed mapping is unlikely to remain accurate (e.g., annual grasses, which change distributions yearly), the Licensees will describe general distribution and extent within the study area

Step 3 – Prepare Data. Following the surveys, the Licensees will develop GIS maps depicting NNIP population occurrences and Project facilities, features, and specific Project-related activities (e.g., hiking or picnicking) and other related information collected during the *NNIP Study*.

Quality Assurance and Quality Control

Field data will be collected in a manner that promotes high quality results and will be subject to appropriate QA/QC procedures, including spot-checks of transcription and comparison of GIS maps with field notes to verify locations of NNIPs. QA/QC will also include measures to prevent spreading the NNIP by survey personnel.

Analysis

Following the surveys, the Licensees will analyze the developed GIS maps and other relevant information collected during the *NNIP Study*.

Reporting

NNIP Study results and other existing and relevant information will be included in the Licensees' ISR, USR, DLA, and FLA to the extent it has been completed at the time needed for each of the aforementioned relicensing milestones.

4.1.6.5 Consistency of Methodology with Generally Accepted Scientific Practices

This *NNIP Study* is generally consistent with the goals, objectives, and methods outlined for the most recent FERC hydroelectric relicensing efforts in California, including the Don Pedro Project (FERC No. 2299), the Yuba River Development Project (FERC No. 2246), and the Merced River Hydroelectric Project (FERC No. 2174), and uses standard botanical survey methods as defined by CDFW.

4.1.6.6 Schedule

The *NNIP Study* will begin after FERC issues its Study Plan Determination. The Licensees anticipate the schedule below will be followed to complete the *NNIP Study*.

Fieldwork Preparation	May 2017 – February 2018
Fieldwork	June 2017 – April 2018
Data QA/QC	July 2017 – September 2018
Data Analysis and Reporting	October 2018 – December 2018

4.1.6.7 Level of Effort and Cost

Based on the work effort described above, the Licensees estimate that the current cost to complete this *NNIP Study* will range between $224,000 and $299,000.

4.1.6.8 References

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4.1.7 Special-Status Terrestrial Wildlife Species – California Wildlife Habitat Relationships Study

4.1.7.1 Project Nexus

Continued Project O&M and Project-related recreation activities have the potential to affect special-status terrestrial wildlife species. For the purpose of this *Special-Status Terrestrial Wildlife Species – CWHR Study*, a special-status terrestrial wildlife species is defined as a terrestrial species that meets one of the following criteria: (1) is listed under CESA as threatened, endangered or a candidate for listing; (2) is classified as Fully Protected by the State of California; (3) is designated by CDFW as SSC; (4) is designated as a USFS Sensitive Species and found on NFS lands; (5) is listed under the MBTA; or (6) is listed by the USFWS as a Bird of Conservation Concern or protected under the Bald and Golden Eagle Protection Act. Terrestrial wildlife species listed under the federal ESA as threatened or endangered, or as a candidate for listing are addressed in a separate study for this relicensing effort that is specific to those resources.

4.1.7.2 Existing Information and Need for Additional Information

Existing, relevant, and reasonably available information regarding special-status terrestrial wildlife species and their habitat within the proposed Project boundary is provided in Section 4.6 of the Licensees' PAD. As a summary, the Licensees found no recent special-status terrestrial wildlife species survey information. The CNDDB is a statewide inventory of special-status species that is continually updated. However, the CNDDB is limited to locations where surveys have been performed and contains only those records that have been submitted to CDFW. Based on available information, there were 56 special-status terrestrial wildlife species identified with the potential to occur on the Project. Of these, bald eagle (*Haliaeetus leucocephalus*), golden eagle (*Aquila chrysaetos*), and burrowing owl (*Athene cunicularia*), will be covered under the *Special-status Raptors Study*. The other 53 species are included in Table 4.1-5.

Table 4.1-5. Special-Status Terrestrial Wildlife Species with the Potential to Occur on the Project

Common Name/ Scientific Name	Status	Habitat Associations	Temporal and Spatial Distribution[1]	Occurrence in Project Area[2]
Yellow-blotched ensatina (*Ensatina eschscholtzii croceator*)	SSC, FSS	Occurs mostly in oak and pine woodlands, chaparral, and talus in the Tehachapi Mountains south to south to Frazier and Alamo Mountains. Found under surface objects, in rodent burrows, and other subterranean retreats.	Yearlong – BOP, COW, CSC, MCH, MCP, MHW, MHC, MRI, SMC, VFR, VOR, WTM	Three records in CNDDB from Project vicinity (LEB quadrangle) northwest to west of Quail Lake. However, no records in Project area, which is beyond this taxon's known range.
Desert night lizard (*Xantusia vigilis vigilis*)	SSC, FSS	Occurs in arid and semi-arid areas, closely associated with Joshua trees. Found in rotted stumps, under logs, leaf litter, and in rodent burrows.	Yearlong – AGS, BOP, BOW, DRI, DSW, JOT, PJN, SGR, VOW	No records.
Coast horned lizard (*Phrynosoma blainvillii*)	SSC	Occurs in scrubland, grassland, coniferous woods, and broadleaf woodlands where there are openings for basking; areas with loamy or sandy soil suitable for burrowing; scattered shrubs or clumps of grass for hiding cover; and ant colonies (a primary food source). Often found on edges of arroyo bottoms, dry washes, and along dirt roads.	Yearlong – AGS, BOP, CRC, COW, CSC, JUN, MCH, MHC, PGS, VFR, VOW	21 records in CNDDB from the Project vicinity (BMT, GRV, LEB, LLR, MTC, NEW, PIR, and WTP quadrangles), one of which is within Project area at Pyramid Lake.
Sagebrush lizard (*Sceloporus graciosus*)	BLM	Occurs in areas dominated by sagebrush and other shrubs, and open forest. Favors open areas with low shrubs. May be confused with western fence lizard (S. occidentalis).	Yearlong – JUN, MCH, MCP, MHW, MHC, PJN, SGB, SMC	No records.
Southern California legless lizard (*Anniella stebbinsi*) and/or northern California legless lizard (*A. pulchra*)	SSC, FSS	Because the taxonomy of California legless lizards was only recently revised, information on distribution and habitats of each species is limited. A. stebbinsii occurs in coastal sand dunes, sandy washes, alluvial fans, desert scrub, and chaparral, and is mostly found within the coastal plain south of the Transverse Ranges into northern Baja California. Legless lizards in extreme northwestern Los Angeles County could be A. pulchraor intergrades of the two species.	Yearlong – BOP, BOW, CRC, COW, CSC, DSW, MCH, PGS, VFR, VOW	Two records in CNDDB from Project vicinity (LEB and NEW quadrangles), including record within 2 miles of Quail Lake. No records in Project area.
Southern rubber boa (*Charina umbratica*)	ST, FSS	The species range is not well documented, but is known to include parts of the San Bernardino and San Jacinto Mountains. Rubber boas found in the Tehachapi Mountains south to Frazier and Alamo Mountains may represent northern rubber boa (Charina bottae) or intergrades of the two species. Found in open coniferous and oak-conifer forests.	Yearlong – MCP, MHW, MHC, MRI, SMC, VFR, WTM	No records and not included on lists for Los Padres and Angeles National Forests. See comments under 'Habitat Associations.'
Northern three-lined rosy boa (*Lichanura orcuttii [trivirgata]*)	FSS	Found in various arid and semi-arid habitats, including rocky deserts, canyons, and shrubby areas, particularly in riparian sites.	Yearlong – BAR, CRC, CSC, DRI, DSW, JOT, MCH, MCP, PJN	One record in CNDDB from the Project vicinity (GRV quadrangle). No records in Project area.
San Bernardino ring-necked snake (*Diadophis punctatus modestus*)	FSS	The species occurs in a wide variety of moist habitats including woodland openings, rocky slopes, chaparral, wet meadows, and farmland, where there is suitable surface cover.	Yearlong – AGS, BOF, BOW, CRC, COW, CSC, FEW, MCH, MCP, MHC, MRI, PAS, PGS, SMC, URB, VFR, VOW	No records.
Coast patch-nosed snake (*Salvadora hexalepis virgultea*)	SSC	Occurs in coastal California from San Luis Obispo County to Baja California in coastal plain, canyons, rocky hillsides, and brushy areas. In Los Angeles County this burrowing snake occurs west of the desert.	Yearlong – AGS, BAR, BOP, BOW, CRC, COW, CSC, DRI, DSW, JOT, MCH, MCP, PJN, SGB, VFR, VOW	No records.
Common loon (*Gavia immer*)	SSC	Winters on lakes, reservoirs, rivers, estuaries, and coastlines. Nests on lakes and other open water areas where there is minimal disturbance. Does not nest in Los Angeles County.	Winter – LAC	No records in CNDDB from Project vicinity (which only includes nesting records). Occasional winter observations near Project (Castaic Lagoon).

Table 4.1-5. Special-Status Terrestrial Wildlife Species with the Potential to Occur on the Project (continued)

Common Name/ Scientific Name	Status	Habitat Associations	Temporal and Spatial Distribution[1]	Occurrence in Project Area[2]
American white pelican (*Pelecanus erythrorhynchos*)	SSC	Wintering and post-breeding pelicans occur (sometimes in large numbers) along the coast, and on lakes, reservoirs, rivers, estuaries, bays, and marshes. Rarely breeds in southern California, except along Colorado River	Summer – BAR Yearlong – LAC	No records.
Least bittern (*Ixobrychus exilis*)	SSC, BCC	Occurs in freshwater or brackish marshes with tall, dense emergent vegetation. A secretive species that can be difficult to document.	Yearlong – FEW Summer – LAC	No records.
Redhead (*Aythya americana*)	SSC	Winters and stops during migration in open water on lakes, ponds, and reservoirs. Nests in emergent wetlands, especially where dense cattails or tule are interspersed with open water.	Yearlong – FEW Winter – LAC	No records in CNDDB from Project vicinity. Occasional nonbreeding observations near Project (Castaic Lagoon).
Northern goshawk (*Accipiter gentilis*)	FP, SSC, FSS, BCC, BLM	Year-round resident of forested habitats, particularly mature coniferous and mixed forests. Few recent records in the mountains of Southern California.	Winter – BOP, BOW, CRC, COW, MCH, SGB, VRI, VOW Yearlong – JUN, MCP, MHW, MHC, MRI, PPN, SMC	No records. Considered unlikely to occur in the Barren Ridge Renewable Transmission Project area, which substantially overlaps the Project area (USFS, BLM and LADWP 2012).
Northern harrier (*Circus cyaneus*)	SSC	Marshes, meadows, grasslands, open rangelands, emergent wetlands, and cultivated fields. Nests on the ground, often in brushy cover near water, but also in grassland, fields, and sagebrush flats.	Winter – CRC, DRI, DSW, MCH Summer – MCP, MHW Yearlong – AGS, BAR, BOP, BOW, COW, CSC, FEW, JUN, LAC, PGS, PJN, SGB, URB, VFR, VOW, WTM	No records.
Ferruginous hawk (*Buteo regalis*)	BCC	Occurs in grasslands, desert scrub, agricultural areas or other areas of sparse shrubs, where there also poles, trees, cliffs, or other elevated features for nesting.		One record in CNDDB from Project vicinity (LEB quadrangle). No records in Project area.
White-tailed kite (*Elanus leucurus*)	FP, BLM	Savanna, open woodland, marshes, partially cleared lands and cultivated fields, mostly in lowland situations. Often near agricultural areas. Nests in groves of deciduous trees.	Yearlong – AGS, BAR, BOP, BOW, CRC, COW, CSC, FEW, MCH, PGS, URB, VRI, VOW, WTM	One record in CNDDB from Project vicinity (NEW quadrangle). No records in Project area.
Prairie falcon (*Falco mexicanus*)	BCC	Savanna, perennial grasslands, rangeland, and desert scrub. Nests on cliff ledges.		Three records in CNDDB from Project vicinity (BMT, LEB, and LIM quadrangles). No records in Project area.
American peregrine falcon (*Falco peregrinus anatum*)	FP, BCC	Breeds in open landscapes with cliffs. Winters in any open habitat, mudflats, coastlines, lake edges and mountain chains, especially in areas where potential prey (other birds) are numerous.	Yearlong – AGS, BAR, BOP, BOW, CRC, COW, CSC, DRI, FEW, JUN, LAC, MCH, MCP, MHW, MHC, MRI, PGS, PJN, SGB, SMC, URB, VRI, VOW, WTM	No records.
Long-eared owl (*Asio otus*)	SSC	Riparian bottomland forest with over story of willows and cottonwoods; riparian forest along stream corridors (often dominated by live oak trees). Wooded areas with dense vegetation needed for roosting and nesting, adjacent open areas needed for hunting.	Yearlong – AGS, BOP, BOW, CRC, COW, DRI, JUN, MCH, MCP, MHW, MWC, PAS, PGS, SGB, SMC, VRI, VOW, WTM Summer -MRI	No records.
California spotted owl (*Strix occidentalis occidentalis*)	SSC, FSS, BCC, BLM	Mixed forests dominated by black oak, lodgepole pine, red fir from 1,200 to 5,500 feet elevation	Yearlong – BOP, COW, MHW, MHC, SMC, VRI Summer – MRI	No records.
Olive-sided flycatcher (*Contopus cooperi*)	SSC, BCC	Non-breeding habitat includes a variety of forest, woodland, and open areas with scattered trees, especially where tall dead snags are present. Primary habitat is mature, evergreen montane forest. Breeds in various forest and woodland habitats.	Migrant – BOP Summer – CRC, MCH, MHW, MHC, MRI, SMC	No records.

Table 4.1-5. Special-Status Terrestrial Wildlife Species with the Potential to Occur on the Project (continued)

Common Name/ Scientific Name	Status	Habitat Associations	Temporal and Spatial Distribution[1]	Occurrence in Project Area[2]
Vermilion flycatcher (*Pyrocephalus rubinus*)	SSC	Occurs in widely scattered locations of scrub desert, cultivated lands, riparian woodlands, usually near water, including ditches, ponds, and irrigation. Trees and tall shrubs used for nesting and roosting.	Yearlong – DRI	No records.
Purple martin (*Progne subis*)	SSC	Found in a wide variety of forest and woodland areas, where open and partly open sites occur, frequently near water or around towns, where dragonflies and other large, aerial insects are prey.	Summer – AGS, BOP, COW, FEW, LAC, MHW, MHC, PGS, MRI, SMC, URB, VRI, VOW, WTM	No records.
Le Conte's thrasher (*Toxostoma leconteil*)	SSC, BCC	Closely associated with saltbrush and found in relatively open areas including desert scrub and dry washes.	Yearlong – DSW, JOT	No records.
Loggerhead shrike (*Lanius ludovicianus*)	SSC, BCC	Open country with scattered trees and shrubs, savanna, desert scrub, and, occasionally, open woodland; often perches on poles, wires or fence posts	Yearlong – AGS, BAR, BOP, BOW, CRC, COW, CSC, DRI, DSW, JOT, JUN, MCH, MHW, MHC, MRI, PGS, PJN, SGB, VRI, VOW, WTM Winter -URB	Six records in CNDDB from the Project vicinity (LLR, MTC, NEW, WSM, and WTP quadrangles), some of which are within 2 miles of Project area. No records in Project area.
Gray vireo (*Vireo vicinior*)	SSC, FSS, BCC, BLM	Dry chaparral; in chamise-dominated habitat and mountains of Mojave Desert; associated with juniper and sagebrush. Requires closed to partly open layer of low shrub cover (1-5 feet tall)	Summer – CRC, JUN, MCH, PJN	No records.
Yellow warbler (*Setophaga petechia*)	SSC, BCC	Open scrub, second-growth woodland, thickets, farmlands, and gardens, especially near water; riparian woodlands, especially areas with willows.	Migrant – CRC, CSC, DSW, MCH Summer – BOP, BOW, COW, DRI, MCH, MHW, MHC, MRI, SMC, URB, VRI, VOW	Three records in CNDDB from the Project vicinity (LEB and VAV quadrangles). Also reported from Pyramid reach downstream of Pyramid Lake, Liebre Gulch, and Gorman Creek (Jones and Stokes 2002).
Yellow-breasted chat (*Icteria virens*)	SSC	Second growth, shrubby old pastures, thickets, bushy areas, scrub, woodland undergrowth, and fence rows, including low wet places near streams, pond edges, or swamps; thickets with few tall trees; early successional stages of forest regeneration; commonly in sites close to human habitation.	Migrant – CSC, MRI Summer – VRI Yearlong – VRI	No records.
Grasshopper sparrow (*Ammodramus savannarum*)	SSC	Prefer grasslands of intermediate height for breeding and often associated with clumped vegetation interspersed with patches of bare ground.	Summer – AGS, PGS, WTM	No records.
Bell's sage sparrow (*Artemisiospiza belli belli*)	BCC	Strongly associated with sagebrush for breeding. Also found in salt-bush brushland, shadscale, antelope brush, rabbitbrush, mesquite, and chaparral.	Yearlong – CRC, CSC, MCH, MCP, SGB Summer – JUN	Four records in CNDDB from the Project vicinity (LEB and VAV quadrangles). No records in Project area.
Vesper sparrow (*Pooecetes gramineus affinis*)	SSC, BCC	Found in various open habitats with grass, including prairie, sagebrush steppe, meadows, pastures and roadsides.	Winter – AGS, MCH, PGS, Summer – JUN, MCP, PJN, SGB	No records.
Summer tanager (*Piranga rubra*)	SSC	Breed near gaps and edges of open forests (deciduous trees, mixed pine-oak woodlands). Found along streams with willows, cottonwoods, mesquite and saltcedar.	Summer – DRI, VRI Migrant – DSW	No records.
Tricolored blackbird (*Agelaius tricolor*)	SSC, BCC, BLM	Fresh-water marshes of cattails, tule, and sedges. Nests in vegetation of marshes or thickets, sometimes nests on the ground. Historically strongly tied to emergent marshes; in recent decades much nesting has shifted to non-native vegetation.	Yearlong – AGS, FEW, PGS, URB, VRI, WTM	Four records in CNDDB from the Project vicinity (LEB and LLR quadrangles), including record at Quail Lake as recently as 2011, but not found in the 2014 survey.

Table 4.1-5. Special-Status Terrestrial Wildlife Species with the Potential to Occur on the Project (continued)

Common Name/ Scientific Name	Status	Habitat Associations	Temporal and Spatial Distribution[1]	Occurrence in Project Area[2]
Yellow-headed blackbird (*Xanthocephalus xanthocephalus*)	SSC	Fresh-water marshes of cattail, tule, or bulrushes. Nests in wet grasses, reeds, cattails. Also in open cultivated lands, pastures and fields.	Summer – AGS, PGS, WTM Yearlong – FEW, LAC, PAS	No records.
Pallid bat (*Antrozous pallidus*)	SSC, FSS	Arid deserts and grasslands, often near rocky outcrops and water. Less abundant in evergreen and mixed conifer woodland. Usually roosts in rock crevice or building, less often in cave, tree hollow, mine, etc.	Yearlong – AGS, BAR, BOP, BOW, CRC, COW, CSC, DRI, DSW, JOT, JUN, MCH, MCP, MHW, MHC, MRI, PAS, PGS, PJN, SGB, SMC, VRI, VOW, WTM Summer -URB	Two records in CNDDB from the Project vicinity (COB and NEW quadrangles) No records in Project area.
Townsend's big-eared bat (*Corynorhinus townsendii*)	SSC, FSS	Maternity and hibernation colonies typically are in caves and mine tunnels. Prefers relatively cold places for hibernation, often near entrances and in well-ventilated areas.	Yearlong – AGS, BAR, BOP, BOW, CRC, COW, CSC, DRI, DSW, JOT, JUN, MCH, MCP, MHW, MHC, MRI, PAS, PGS, PJN, SGB, SMC, URB, VRI, VOW, WTM Summer – AGS,	Three records in CNDDB from the Project vicinity (BUP, MTC, and LEB quadrangles). No records in Project area.
Spotted bat (*Euderma maculatum*)	SSC, BLM	Solitary bat found in arid deserts, grasslands, and conifer forests where there are suitable roots, including crevices in cliffs, caves, and building. Possibly occupies coniferous stands in summer and migrates to lower elevations in late summer/early fall.	Yearlong – AGS, BOP,BOW, COW, CSC, DRI, DSW, JOT, JUN, MCP, MHC, MRI, PGS, PJN, SGB, SMC, URB, VRI, VOW, WTM	One record in CNDDB from the Project vicinity (NEW quadrangle). No records in Project area.
Western mastiff bat (*Eumops perotis*)	SSC, BLM	Roosts in crevices and shallow caves on the sides of cliffs and rock walls, and occasionally buildings. Roosts usually high above ground with unobstructed approach. Most roosts are not used throughout the year. May alternate between different day roosts.	Yearlong – AGS, BAR, BOP, BOW, CRC, COW, CSC, DRI, DSW, FEW, JOT, JUN, MCH, MCP, MHW, MHC, MRI, PAS, PGS, PJN, URB, VRI, VOW, WTM	Two record in CNDDB from the Project vicinity (COB quadrangle), in vicinity of Blue Point Campground north of Lake Piru. No records in Project area.
Western red bat (*Lasiurus blossevillii*)	SSC	Roosts in foliage (mostly in trees), forages in open areas (not including deserts) from sea level up through mixed conifer forests. Typically occurs near edges and in habitat mosaics. Migrates between summer and winter ranges.	Yearlong – AGS,BOP, BOW, CRC, COW, CSC, MCP, MHC, MRI, PAS, PGS, PJN, URB, VRI, VOW, WTM Summer – FEW, JUN, LAC, MCH, MHW, SMC	No records.
Western small-footed myotis (*Myotis ciliolabrum*)	BLM	Roosts in crevices and cracks in canyon walls, caves, mine tunnels, behind loose tree bark. Found in deserts, chaparral, riparian zones, and coniferous forests.	Yearlong – AGS, BAR, BOP, BOW, CRC, COW, CSC, DRI, FEW, JOT, JUN, LAC, MCH, MCP, MHW, MHC, MRI, PAS PGS, PJN, SGB, SMC, URB, VRI, VOW, WTM	No records.
Long-eared myotis (*Myotis evotis*)	BLM	Mostly forested areas, especially those with broken rock outcrops; also shrubland, over meadows near tall timber, along wooded streams, over reservoirs. Often roosts in buildings, also in hollow trees, mines, caves, fissures, etc.	Yearlong – BAR, BOP, BOW, CRC, COW, CSC, FEW, JUN, LAC, MCH, MCP, MHW, MHC, MRI, PAS, PGS, PJN, SMC, VFR, VOW, WTM Migrant -DSW, JOT Summer –SGB	No records.
Fringed myotis (*Myotis thysanodes*)	BLM	Primarily at middle elevations in desert, grassland, and woodland habitats. Roosts in caves, mines, rock crevices, buildings, and other protected sites. Nursery colonies occur in caves, mines, and sometimes buildings.	Yearlong – AGS, BAR, BOP, BOW, CRC, COW, CSC, JOT, JUN, MCH, MCP, MHW, MHC, MRI, PAS, PGS, PJN, SGB, SMC, URB, VFR, VOW Summer – DRI, DSW, LAC,	One record in CNDDB from the Project vicinity (LIM quadrangle). No records in Project area.
Yuma myotis *(Myotis yumaensis*)	BLM	Open forests and woodlands with nearby sources of water over which to forage. Nursery colonies occur in buildings, caves, mines, and under bridges. Hibernates in winter.	Yearlong – AGS, BOP, BOW, CRC, COW, CSC, FEW, JUN, MCH, MCP, MHW, MHC, MRI, PAS, PGS, PJN, SGB, SMC, URB, VRI, VOW, WTM Summer – DRI, DSW, JOT, LAC,	Two records in CNDDB from the Project vicinity (LEB and LIM quadrangles). No records in Project area.
San Diego black-tailed jackrabbit (*Lepus californicus bennetti*)	SSC	The species occurs in open country with scattered thickets or patches of shrubs, including open plains, fields, and deserts. The sub-species is restricted to the South Coast bioregion.	Yearlong – AGS, BOP, BOW, CRC, COW, CSC, DRI, DSW, JOT, JUN, MCH, MCP, MHW, MHC, PAS, PGS, PJN, SGB, SMC, URB, VRI, VOW, WTM Summer -MRI	No records.
Tehachapi white-eared pocket mouse (*Perognathus alticolus inexpectatus*)	SSC, FSS	Documented in various open grassy or weedy habitats within sagebrush, coastal sage scrub, desert scrub, and open forests at elevations above 3,500 feet.	Yearlong – MCH, SB	11 records in CNDDB from the Project vicinity (BMT, LEB), including record within 2 miles of Quail Lake. No records in Project area.

Table 4.1-5. Special-Status Terrestrial Wildlife Species with the Potential to Occur on the Project (continued)

Common Name/ Scientific Name	Status	Habitat Associations	Temporal and Spatial Distribution[1]	Occurrence in Project Area[2]
San Joaquin pocket mouse (*Perognathus inornatus*)	SSC	Found in open sandy grasslands and scrub areas in the interior valleys at 1,100 to 2,000 feet elevation.	Yearlong – AGS, BAR, BOW, COW, MCH, PAS, PGS, VOW	One record in CNDDB from the Project vicinity (BMT quadrangle). No records in Project area, which may be largely or entirely outside of this species' range.
Los Angeles pocket mouse (*Perognathus longimembris brevinasus*)	SSC	Occurs in low elevation grassland, alluvial sage scrub and coastal sage scrub within coastal basins of Southern California. Few records in Los Angeles County where much of its potential habitat may have been lost to development.	Yearlong – CRC, COW, CSC, DRI, DSW, JOT, MCH, MCP, SGB, VOW	No records. Project area may be outside of this taxon's range.
Southern grasshopper mouse (*Onychomys torridus*)	SSC	Most common in arid desert habitats, including desert scrub and alkali desert scrub, but also occurring in coastal scrub, sagebrush, chaparral, and other habitats.	Yearlong – AGS, CSC, DRI, DSW, MCH, MRI, PGS, SGB, VRI	No records in CNDDB. Observed in Project area (Aspen Environmental Group 2007).
Monterey dusky-footed woodrat (*Neotoma macrotis luciana*)	SSC	The species is generally found in dense chaparral, coastal sage-scrub, pinyon-juniper, oak and riparian woodlands and mixed conifer forest habitats that have a well-developed understory. Distribution of subspecies is uncertain.	Yearlong – BOP, BOW, CRC, COW, CSC, MCH, MCP, MHW, MHC, MRI, PGS, SGB, SMC, VRI, VOW, WTM	No records in CNDDB. Species reported in Project area (Aspen Consulting Group 2007); however, subspecies not indicated.
San Diego desert woodrat (*Neotoma lepida intermedia*)	SSC	The species occurs over a large part of the arid western U.S. and Mexico, whereas the sub-species is evidently limited to coastal areas from San Luis Obispo County south where populations have declined. The species is found in Joshua tree woodlands, pinyon-juniper woodlands, mixed chaparral, sagebrush, and desert habitats.	Yearlong – BOP, CRC, CSC, DRI, DSW, JOT, MCH, MCP, MHC, PJN, SGB	No records.
Ringtail (*Bassariscus astutus*)	FP	Associated with areas with a mixture of forest and shrub-dominated habitats, with rock recesses, hollows, and other sites suitable for nesting and cover and within 0.6-mile of water.	Yearlong – AGS, BAR, BOP, BOW, CRC, COW, CSC, DRI, DSW,JOT, JUN, MCH, MCP, MHW, MHC, MRI, PAS, PGS, PJN, SGB, SMC, VRI, VOW, WTM	No records.
American badger (*Taxidea taxus*)	SSC	Occurs in open or brushy habitats, including early successional stages of forests, with dry, friable, often sandy, soils for burrowing.	Yearlong – AGS, BAR, BOP, BOW, CRC, COW, CSC, DRI, DSW, JOT, JUN, MCH, MCP, MHW, MRI, PAS, PGS, PJN, SGB, VRI, VOW, WTM	No records.
Total	56			

[1]Temporal and Spatial Distribution derived from WHR
[2]Records from CNDDB and other sources.
Key:
AGS = Annual Grassland
BAR = Barren
BCC = Bird of Conservation Concern
BLM = Bureau of Land Management
BMT = Black Mountain
BOP = Blue Oak-Foothill Pine
BOW = Blue Oak Woodland
BUP = Burnt Peak
CDFW FP = Fully Protected
CESA = California Endangered Species Act
CNDDB = California Natural Diversity Database
CRC = Chamise-redshank chaparral
CT = Candidate Threatened
COB = Cobblestone Mountain
COW = Coastal Oak Woodland
CSC = Coastal Scrub
DRI = Desert Riparian
DSW = Desert Wash
FEW = fresh Emergent Wetland
FSS = Forest Service Sensitive
GRV = Green Valley
JOT = Joshua Tree
JUN = Juniper

LAC = Lacustrine
LLR = La Liebre Ranch
LEB = Lebec
LIM = Liebre Mountain
MCH = Mixed Chaparral
MCP = Montane Chaparral
MHC = Montane Hardwood-Conifer
MHW = Montane Hardwood
MRI = Montane Riparian
MTC = Mint Canyon
NEW= Newhall
PAS = Pasture
PGS = Perennial Grassland
PIR= Piru
PJN = Pinyon-Juniper
SE = State Endangered
SGB = Sagebrush
SMC = Sierran Mixed Conifer
ST = State Threatened,
SSC = Species of Special Concern
URB = Urban WHR = Wildlife Habitat Relationship System
VFR = Valley Foothill Riparian
VOW = Valley Oak Woodland
WSM = Warm Springs Mountain
WTM = Wet Meadow
WTP = Whittaker Peak
VAV = Val Verde

In order to meet the goals of the Study, the Licensees have identified the following additional information needs: (1) collection of further CWHR data that may occur in the proposed Project boundary; and (2) a list of Project O&M activities that includes location and duration of the activity.

4.1.7.3 Study Goals and Objectives

The goals of this *Special-Status Terrestrial Wildlife Species – CWHR Study* are to: (1) determine the quality and suitability of potential habitat for special-status terrestrial wildlife species within the proposed Project boundary; and (2) determine if either the Lower Quail Canal or Castaic Penstocks constitute barriers to wildlife movement.

The objective of this *Special-Status Terrestrial Wildlife Species – CWHR Study* is to gather sufficient data necessary to fill recognized gaps in existing information regarding the potential for special-status terrestrial wildlife species to occur within the proposed Project boundary and to determine if Project penstocks and canals are barriers to wildlife movement.

4.1.7.4 Study Methods

Study Area

The study area for the *Special-Status Terrestrial Wildlife Species – CWHR Study* consists of the area within the proposed Project boundary. The lands overlying the Angeles Tunnel are not included, because the Licensees do not perform any Project-related maintenance activities nor allow any recreation there. The study area for the *Special-Status Terrestrial Wildlife Species – CWHR Study* is shown below in Figure 4.1-12.

General Concepts and Procedures

- Personal safety is the most important consideration of each fieldwork team. Fieldwork will only occur in safely accessible areas and under conditions deemed safe by the field crews. Locations within the study area that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed; these areas will be identified in the data summary and an explanation for survey exclusion will be provided.

- The *Special-Status Terrestrial Wildlife Species – CWHR Study* will begin after FERC issues its Study Plan Determination.

- The *Special-Status Terrestrial Wildlife Species – CWHR Study* does not plan to include the development of requirements for the new license, which will be addressed outside the Study.

- The *Special-Status Terrestrial Wildlife Species – CWHR Study* focuses specifically on special-status terrestrial wildlife within the proposed Project boundary, but the study area for the *Special-Status Terrestrial Wildlife Species – CWHR Study* is specific to locations that can support that resource.

- If required for the performance of the *Special-Status Terrestrial Wildlife Species – CWHR Study*, the Licensees will make a good faith effort to obtain permission to access private property well in advance of initiating the study. The Licensees will only enter private property if permission has been provided by the landowner.

- The Licensees will acquire all necessary agency permits and approvals prior to beginning fieldwork for the *Special-Status Terrestrial Wildlife Species – CWHR Study*.

- Field crews may make variances to the *Special-Status Terrestrial Wildlife Species – CWHR Study* in the field to accommodate actual field conditions and unforeseen problems. Any variances from the *Special-Status Terrestrial Wildlife Species – CWHR Study* will be noted in the data resulting from the *Special-Status Terrestrial Wildlife Species – CWHR Study*.

- To prevent the introduction and transmittal of amphibian chytrid fungus and invasive aquatic species (e.g., quagga mussels, zebra mussel, and Asian clams), field crews will be trained on, provided with, and use materials (e.g., Quat) for decontaminating their boots, waders, and other equipment when leaving or traveling between water-based study sites. Field crews will follow DWR's Quagga and Zebra Mussel Rapid Response Plan and CDFW's Aquatic Invasive Species Decontamination Protocol which can be found at the following link: (https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=43333). All boats used during the study will follow cleaning protocols, including inspections before and after use. All decontamination requirements in place at Project reservoirs including those of DWR's *Quagga and Zebra Mussel Rapid Response Plan* for the SWP will be strictly followed (DWR 2010).

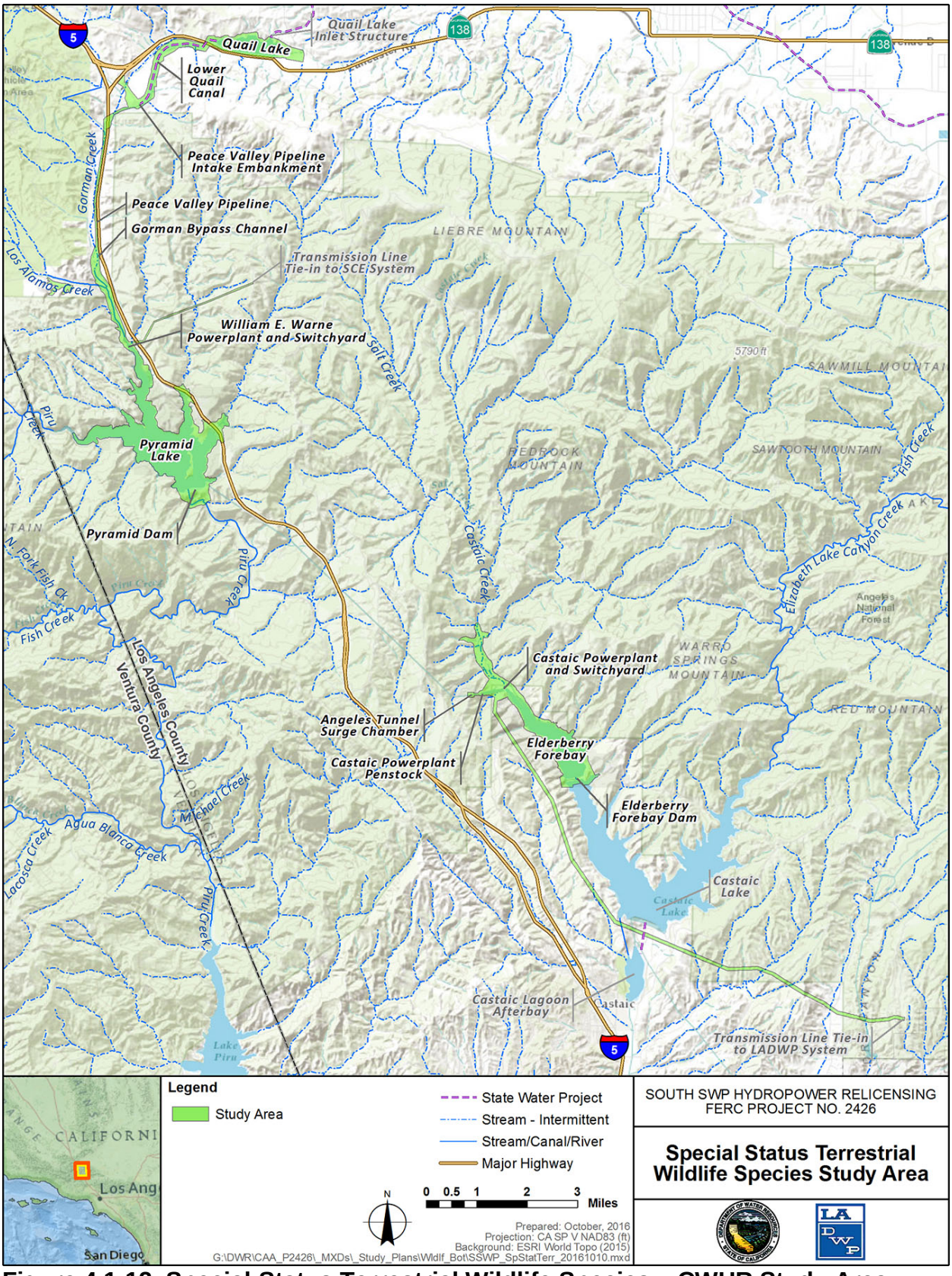

Figure 4.1-12. Special-Status Terrestrial Wildlife Species – CWHR Study Area

Methods

This *Special-Status Terrestrial Wildlife Species – CWHR Study* consists of two steps: (1) select sampling locations and create field study maps; and (2) conduct field habitat assessments to evaluate habitat, document potential movement barriers at the Lower Quail Canal and Castaic Penstocks, and incidentally document special-status terrestrial wildlife. These steps are described below.

Step 1 – Select Sampling Locations and Create Field Study Maps. There were 15 terrestrial CWHR vegetation types identified in the proposed Project boundary, as shown in Table 4.1-6 below. Of these, the most common are Mixed Chaparral (563 acres), Coastal Scrub (545 acres), and Sagebrush (286 acres). There are also four riparian and wetland vegetation types identified in the proposed Project boundary: Montane Riparian (39 acres), Valley Foothill Riparian (54 acres), Wet Meadow (53 acres), and Freshwater Emergent Wetland (39 acres) (USFS 2014). Using GIS, the Licensees will select sampling points in representative habitats, with more points in areas with higher potential for special-status wildlife species or considered sensitive natural communities (e.g., Wet Meadow and Montane Riparian) and larger acreage inside the proposed Project boundary. Table 4.1-6 shows the 15 terrestrial vegetation types and the number of sampling points for each.

Table 4.1-6. California Wildlife Habitat Relationship Acreages in the Proposed Project Boundary and Sampling Points

California Wildlife Habitat Relationship Type	Acreage[1]	Percentage of Study Area	Number of Sampling Points[2]
Tree-Dominated Habitats			
Pinyon-Juniper (PJN)	5	<1	2
Montane Hardwood (MHW)	<1	<1	1
Coastal Oak Woodland (COW)	3	<1	1
Montane Riparian (MRI)	39	2	2
Valley Foothill Riparian (VRI)	54	2	2
Shrub-Dominated Habitats			
Sagebrush (SGB)	286	11	4
Mixed Chaparral (MCH)	563	22	5
Chamise-Redshank Chaparral (CRC)	130	5	3
Coastal Scrub (CSC)	545	22	5
Desert Wash (DSW)	63	2	2
Herbaceous-Dominated Habitats			
Annual Grassland (AGS)	208	8	3
Wet Meadow (WTM)	53	2	2
Freshwater Emergent Wetland (FEW)	39	2	2
Developed Habitats			
Urban (URB)	293	12	3
Non-vegetated Habitats			
Barren (BAR)	226	9	3
Total	2,507	100	40

[1]Acreages include underground features.
[2]Sampling points are the same as those in the ESA-listed Terrestrial Wildlife Species – CWHR Study and information collected will be used for both studies.

The Licensees will produce field maps that will include CWHR habitat types, sampling points, CNDDB occurrences or other known locations of special-status wildlife species, Protected Activity Centers and Home Range Areas, and all Project facilities, including the Lower Quail Canal and Castaic Penstocks.

Step 2 – Conduct Field Habitat Assessments to Evaluate Habitat, Document Potential Movement Barriers at the Lower Quail Canal and Castaic Penstocks, and Incidentally Document Special-Status Terrestrial Wildlife. Field habitat assessments and characterizations will be conducted at representative sampling points, using the CDFW's CWHR System data forms (CDFW 2016). Information collected on these forms includes plant species composition, stages, structure, percent cover, and habitat elements, as well as diameter at breast height of wooded habitats. Evidence of Project O&M activities and Project-related recreation activities in the vicinity of the sampling points will also be documented. Photographs of all sampling points will be taken in each cardinal direction from the center point of the plot.

Two Project facilities will be surveyed for their potential to inhibit wildlife passage: (1) the two-mile-long Lower Quail Canal; and (2) the six 2,400-foot-long Castaic Penstocks. The length of these features will be walked and areas with at least a 2.5 foot clearance will be marked by GPS. (A 2.5 foot clearance is a height all known large mammals can pass under.) A photograph of each passage feature will also be collected. Other Project features that could potentially be barriers to wildlife movement (roads, fences, transmission line corridors, developed recreation sites, maintenance areas, parking lots, and proposed construction/staging areas) will be included on the updated map during analysis, as well.

If a special-status terrestrial wildlife species is incidentally identified, the survey team will prepare a California Native Species Field Survey Form, which records data for submittal to CDFW for addition to the CNDDB.

Quality Assurance and Quality Control

Field data will be collected in a manner that promotes high quality results, and will be subject to appropriate QA/QC procedures, including spot-checks of transcription and comparison of GIS maps with field notes.

Analysis

Field data will be used in conjunction with CWHR to correct and update the map created in Step 1 and refine the list and habitats of special-status terrestrial wildlife potentially occurring in the study area for the *Special-Status Terrestrial Wildlife Species – CWHR Study*. The Licensees will then use the updated map to identify areas within the study area for the *Special-Status Terrestrial Wildlife Species – CWHR Study* in which special-status wildlife habitat and Project facilities, including potential barriers to wildlife movement, and O&M overlap.

For the Lower Quail Canal and Castaic Penstocks, a separate map will be developed showing any areas that would restrict large mammal passage for more than a 0.5-mile stretch along the facilities.[46]

Reporting

The Licensees will compile and summarize results of this *Special-Status Terrestrial Wildlife Species – CWHR Study*, as well as other existing and relevant information, to the extent completed and ready for incorporation, in the Licensees' ISR, USR, DLA, and FLA.

4.1.7.5 Consistency of Methodology with Generally Accepted Scientific Practices

This *Special-Status Terrestrial Wildlife Species – CWHR Study* is consistent with the goals, objectives, and methods outlined for the most recent FERC hydroelectric relicensing efforts in California, including the Yuba River Development Project (FERC Project No, 2246), French Meadows Transmission Line Project (FERC Project No. 2479), Camp Far West Transmission Line Project (FERC Project No. 10821), Drum-Spaulding Project (FERC Project No, 2310) and Yuba-Bear Hydroelectric Project (FERC Project No. 2266).

4.1.7.6 Schedule

The *Special-Status Terrestrial Wildlife Species – CWHR Study* will begin after FERC issues its Study Plan Determination. The Licensees anticipate the schedule below will be followed to complete the *Special-Status Terrestrial Wildlife Species – CWHR Study*.

Fieldwork Preparation	January 2018 – March 2018
Fieldwork	April 2018 – Sept 2018
Data QA/QC	October 2018
Data Analysis & Reporting	October 2018 – December 2018

4.1.7.7 Level of Effort and Cost

Based on the work effort described above, the Licensees estimate the current cost to complete this *Special-Status Terrestrial Wildlife Species – CWHR Study* will range between $212,000 and $318,000.

4.1.7.8 References

CDFW. 2016. California Wildlife Habitat Relationships. Available online: <https://www.wildlife.ca.gov/Data/CWHR>. Accessed December 16, 2016. Last updated 2016. CDFW, Sacramento, CA.

[46] Height and distance per 2016 Forest Service November 21, 2016 comment letter, Study request 14: Wildlife Study Plan: Large Mammal Movement, p. 184.

DWR. 2010. The Quagga and Zebra Mussel Rapid Response Plan for the State Water Project. 93 pp. CONFIDENTIAL/PRIVILEGED – Not for Public Distribution.

USFS. 2014. Classification and Assessment with Landsat of Visible Ecological Groupings (CalVeg) data. Updated in 2014. Available on-line: <http://www.fs.usda.gov/detail/r5/landmanagement/resourcemanagement/?cid=stelprdb5347192>.

4.1.8 ESA-Listed Plants Study

4.1.8.1 Project Nexus

Continued Project O&M and Project-related recreation activities have potential to affect plants listed as FT or FE under the ESA, or as candidates for listing under the ESA. There are species proposed for listing under the ESA with a potential to occur within the proposed Project boundary.

This *ESA-listed Plants Study* does not address other types of special-status plants (e.g. CESA-listed plants), which are addressed in the *Botanical Resources Study,* a separate study being undertaken by the Licensees as part of this relicensing effort. If a plant is listed under the ESA and also meets another definition of a special-status plant, that plant species is addressed under this *ESA-listed Plants Study*.

4.1.8.2 Existing Information and Need for Additional Information

Existing and relevant information regarding ESA-listed plants known or with the potential to occur within the proposed Project boundary is available from the CNPS online Inventory of Rare and Endangered Vascular Plants of California (CNPS 2015), the CNDDB (CDFW 2015), and the CalFlora website. Based on this information, as summarized in Section 4.8 of the Licensees' PAD, the Licensees identified six plant species listed as FT or FE and one candidate plant species with a potential to occur within the proposed Project boundary, if suitable habitat occurs (Table 4.1-7). As detailed in Section 4.8 of the PAD, there are no known records of these or other ESA-listed plants within the proposed Project boundary, although most have been documented in some form in the areas covered by USGS 7.5-minute topographic quadrangle maps in which the proposed Project boundary is located as well as adjacent quadrangle maps.

Additional information, which will be provided by this *ESA-listed Plants Study*, is needed to identify whether ESA-listed plant species or candidate plant species occur in the proposed Project boundary and to determine if those species could be affected by the Project O&M and/or Project-related recreation activities.

Table 4.1-7. ESA-listed and Candidate Plant Species Potentially Occurring Within the South SWP Hydropower Proposed Project Boundary

Common Name Scientific Name	Status	Habitat	Flowering Period	Known Occurrences in Project Vicinity Quadrangle Maps
Slender-horned spineflower (*Dodecahema leptoceras*)	FE, SE	Floodplain terraces and sandy benches which flood infrequently; associated with alluvial fan scrub between about 650 to 2,470 feet elevation.	Apr - Jun	CNDDB occurrences in Mint Canyon
San Fernando Valley spineflower (*Chorizanthe parryi* var. *fernandina*)	FC, SE, FSS	Mostly in openings within coastal sage scrub (500 - 4,000 feet elevation).	Apr - Jul	CNDDB occurrences in Newhall, Val Verde
Marsh sandwort (*Arenaria paludicola*)	FE, SE	Historically in scattered sites in swamps and freshwater marshes (sea level to 1,480 feet).	May - Aug	None
Nevin's barberry (*Berberis nevinii*)	FE, SE	Chaparral, cismontane woodland, coastal and riparian scrub in sandy or gravelly soils between about 1,400 to 1,700 feet elevation (rarely to 2,000 feet). Also occurs from transplants.	Feb - Jun	CNDDB occurrences in Newhall, Warm Springs Mountain
Gambel's watercress (*Nasturtium* [*Rorippa*] *gambelii*)	FE, ST	Found historically at scattered sites in freshwater marshes and near streams in southern California (from near sea level to 1,100 feet elevation).	Apr - Oct	None
Spreading navarretia (*Navarretia fossalis*)	FT	Vernal pools and poorly drained, seasonally flooded, alkali playas (100 to 2,200 feet elevation).	Apr - Jun	CNDDB occurrences in Mint Canyon
California orcutt grass (*Orcuttia californica*)	FE, SE	Deep vernal pools with clay soils in Ventura, Los Angeles, Riverside, and San Diego counties (50-2,150 feet elevation).	Mar - Aug	CNDDB occurrences in Mint Canyon

Key:
FE = federal endangered
FT = federal threatened
FC = federal candidate
FSS = listed by USFS as Sensitive
SE = California State endangered
ST = California State threatened

4.1.8.3 Study Goals and Objectives

The goals of the *ESA-listed Plants Study* are to: (1) perform surveys to identify locations of ESA-listed or candidate plant species in the proposed Project boundary; and (2) collect ancillary data related to these occurrences, including geographic extent of each occurrence and indications of potential threats.

The objective of this *ESA-listed Plants Study* is to gather sufficient data necessary to fill recognized gaps in existing information for ESA-listed plant species.

4.1.8.4 Study Methods

Study Area

The study area for the *ESA-listed Plants Study* consists of certain habitat types within the proposed Project boundary that have potential to contain ESA-listed or candidate plant species, excluding lands overlying the Angeles Tunnel on which the Licensees do not perform any Project O&M (Figure 4.1-13). This survey will include staging areas; construction areas; upstream maintenance areas above reservoirs; fuel modification requirement areas; areas cleared for access to transmission line poles and access routes to these areas; Quail Canal, Quail Lake, and associated maintenance roads/areas and recreational features; and Gorman Bypass Channel and associated maintenance roads/access.

General Concepts and Procedures

- Personal safety is the most important consideration of each fieldwork team. Fieldwork will only occur in safely accessible areas and under conditions deemed safe by the field crews. Locations within the study area that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed; these areas will be identified in the data summary and an explanation for survey exclusion will be provided.

- The *ESA-listed Plants Study* will begin after FERC issues its Study Plan Determination.

- The *ESA-listed Plants Study* does not include the development of requirements for the new license, which will be addressed outside the study.

- This *ESA-listed Plants Study* specifically focuses on plants listed as FT or FE, or candidates for listing under the ESA within the proposed Project boundary, but the study area for the *ESA-listed Plants Study* is specific to locations that may contain those resources.

- If required for the performance of the *ESA-listed Plants Study*, the Licensees will make a good faith effort to obtain permission to access private property well in advance of initiating the study. The Licensees will only enter private property if permission has been provided by the landowner.

- The Licensees will acquire all necessary agency permits and approvals prior to beginning fieldwork for the *ESA-listed Plants Study*.

- Field crews may make variances to the *ESA-listed Plants Study* in the field to accommodate actual field conditions and unforeseen problems. Any variances from the *ESA-listed Plants Study* will be noted in the data resulting from the *ESA-listed Plants Study*.

- To prevent the introduction and transmittal of amphibian chytrid fungus and invasive aquatic species (e.g., quagga mussels, zebra mussel, and Asian clams), field crews will be trained on, provided with, and use materials (e.g., Quat) for decontaminating their boots, waders, and other equipment when leaving or traveling between water-based study sites. Field crews will follow DWR's Quagga and Zebra Mussel Rapid Response Plan and CDFW's Aquatic Invasive Species Decontamination Protocol which can be found at the following link: (https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=43333). All boats used during the study will follow cleaning protocols, including inspections before and after use. All decontamination requirements in place at Project reservoirs including those of DWR's *Quagga and Zebra Mussel Rapid Response Plan* for the SWP will be strictly followed (DWR 2010).

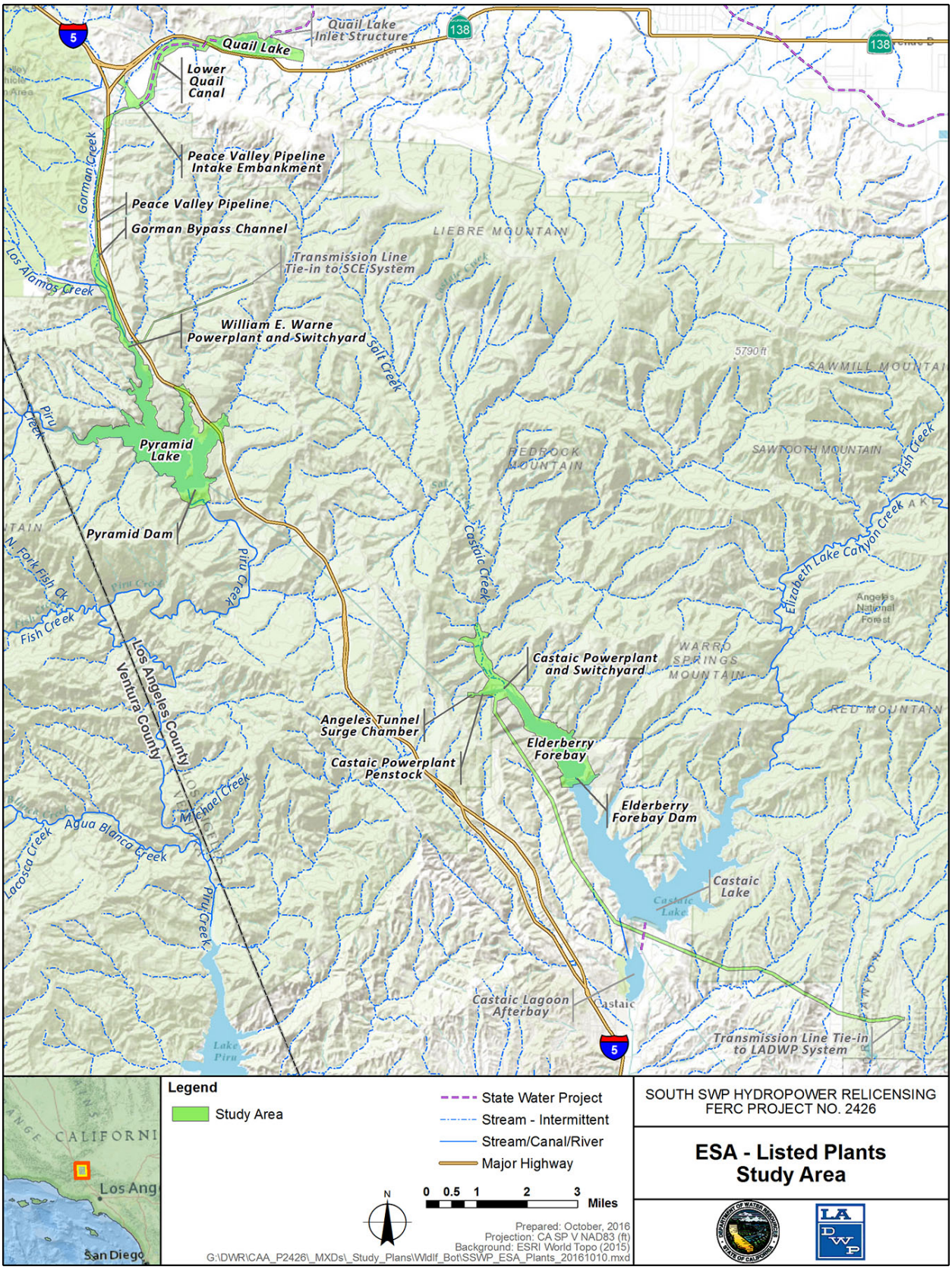

Figure 4.1-13. ESA-listed Plants Study Area

Methods

The *ESA-listed Plants Study* will consist of three steps: (1) gather data and prepare for field effort; (2) conduct field surveys; and (3) prepare data. These steps are described below.

Step 1 – Gather Data and Prepare for Field Effort. The Licensees will prepare field maps for use by field survey teams. The maps will depict aerial imagery, Project features, and the area boundary. Field planning will include preliminary identification of habitats that could support ESA-listed and candidate plant species that may occur in the area and a review of existing herbarium specimen collection dates and floristic data regarding the seasonal life stages of the vegetation being surveyed to develop an appropriate survey schedule.

Step 2 – Conduct Field Surveys. A qualified team of field staff will conduct ESA-listed plant surveys that will generally follow the methodology described in the botanical survey section of CDFW's *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* and be consistent with USFWS (2000) guidelines for surveys. Field staff will visit reference sites, if available, for ESA-listed plants most likely to occur in the proposed Project area (i.e. those known from CNDDB reports in the Project or surrounding quadrangles or with other known occurrences nearby). The protocol uses systematic field techniques to ensure thorough coverage of each plant community that could support ESA-listed and candidate plant species. Documentation of surveys on NFS lands will include completion of Plant Survey Field Forms (USFS 2015), as specified in the USFS Threatened, Endangered, and Sensitive Plants Element Occurrence Protocol and Field Guide (USFS 2014) and Threatened, Endangered and Sensitive Plants Element Occurrence Protocol and Field Guide (USFS 2015).

Field staff will conduct surveys between June 2017 and May 2018, encompassing the period within which the potential ESA-listed and candidate plant species flower, with at least two survey visits of suitable habitats to maximize the likelihood of detection of all ESA-listed and candidate plant species. Surveyors will include botanists or other scientist and biologists qualified to identify ESA-listed and candidate plant species likely to occur in the area. Taxonomy and nomenclature will be based on *The Jepson Manual* (Baldwin et al., 2012). If an ESA-listed or candidate plant species is identified, the survey team will prepare a California Native Species Field Survey Form and record the following data associated with the occurrence to the edge of the occurrence, or to the edge of the proposed Project boundary, whichever is less, though surveyors will estimate the size of the occurrence outside of the study boundary to the extent possible):

- Digital photographs to document the occurrence, phenology, and reproductive state, associated habitat, and indications of potential threats

- Location and approximate extent of the ESA-listed or candidate plant species population delineated using a handheld GPS and the estimated number of plants in the population

- Habitat description, including dominant and subdominant vegetation in the area

- Activities or evidence of human activities observed in the area that have a potential to adversely affect the population (e.g., recreational trails and uses)

The Licensees will notify USFWS and CDFW within three working days if ESA-listed or candidate plant species are detected.

Step 3 – Prepare Data. Following the surveys, the Licensees will develop GIS maps depicting ESA-listed and candidate plant species occurrences, Project facilities, features, specific Project-related activities (e.g., user-created dispersed hiking or day-use), and other related information collected during the *ESA-listed Plants Study*. The data will be included in the documents discussed below.

Quality Assurance and Quality Control

Field data will be collected in a manner that promotes high quality results and will be subject to appropriate QA/QC procedures, including spot-checks of transcription for accuracy and completeness and comparison of GIS maps with field notes to verify locations of sensitive habitats and species.

Analysis

Once the locations of ESA-listed and candidate plant species occurrences in the study area for the *ESA-listed Plants Study* are determined, the Licensees will describe known Project-related potential threats to these species, including NNIP, Project O&M activities, and Project-related recreation activities.

Reporting

ESA-listed Plants Study methods and results will be prepared and included, to the extent completed and ready for inclusion, in the Licensees' ISR, USR, DLA, and FLA. If any ESA-listed or candidate plants are found, a report will be developed and considered Privileged, and will be provided only to FERC, USFWS, and CDFW. If any of these occurrences are found on NFS lands, this Privileged report will also be provided to the USFS and reported using the USFS TES Plant Element Occurrence Field Guide (USFS 2008, as may be updated).

4.1.8.5 Consistency of Methodology with Generally Accepted Scientific Practices

This *ESA-listed Plants Study* is consistent with the goals, objectives, and methods outlined for most recent FERC hydropower relicensing efforts in California, including the Don Pedro Project (FERC No. 2299), the Yuba River Development Project (FERC No.

2246), and the Merced River Hydroelectric Project (FERC No. 2174), and will use standard botanical survey methods as defined by CDFW, USFWS, and USFS.

4.1.8.6 Schedule

This *ESA-listed Plants Study* will begin after FERC issues its Study Plan Determination. The Licensees anticipate the schedule below will be followed to complete the Study.

Fieldwork Preparation	May 2017
Fieldwork	June 2017 – May 2018
Data QA/QC	July 2017 – September 2018
Data Analysis and Reporting	October 2018 – December 2018

4.1.8.7 Level of Effort and Cost

Based on the work effort described above, the Licensees estimate the current cost to complete this study will range between $54,000 and $72,000.

4.1.8.8 References

Baldwin, B. G., D. H. Goldman, D. J. Keil, R. Patterson, T. J. Rosatti, and D. H. Wilken, editors. 2012. The Jepson manual: vascular plants of California, second edition. University of California Press, Berkeley.

California Department of Fish and Game. 2009. Protocols for surveying and evaluating impacts to special status native plant populations and natural communities. November 24, 2009. Available online at: https://www.dfg.ca.gov/biogeodata/cnddb/pdfs/Protocols_for_Surveying_and_Evaluating_Impacts.pdf.

CDFW. 2015. CNDDB. RareFind Version 5. Available online: nrmsecure.dfg.ca.gov/cnddb/view/query.aspx. Accessed July 31, 2015. Last updated July 7, 2015. CDFW, Biogeographic Data Branch. Sacramento, CA.

CNPS, Rare Plant Program. 2015. Inventory of Rare and Endangered Plants (online edition, v8-02). CNPS, Sacramento, California. Available online at: http://www.rareplants.cnps.org. Accessed: August 2015.

DWR. 2010. The Quagga and Zebra Mussel Rapid Response Plan for the State Water Project. 93 pp. CONFIDENTIAL/PRIVILEGED – Not for Public Distribution.

USFS 2008. USFS' Threatened, Endangered and Sensitive Plants Element Occurrence Field Guide.

USFS 2015. Plant Survey Field Form.

USFWS. 2000. Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants. January 2000. Available on-line at: http://www.fws.gov/ventura/speciesinfo/protocols_guidelines/.

4.1.9 ESA-Listed Amphibians, California Red-legged Frog Study

4.1.9.1 Project Nexus

Continued Project O&M and Project-related recreation activities may have potential to affect CRLF, an amphibian listed as threatened under the federal ESA.

4.1.9.2 Existing Information and Need for Additional Information

Existing, relevant, and reasonably available information regarding CRLF within the proposed Project boundary is provided in Section 4.8 of the Licensees' PAD. In summary, CRLF is an aquatic-breeding frog primarily associated with perennial ponds or pools, and slow-moving perennial or seasonal streams or pools within streams where water remains continuously for a minimum of 20 weeks beginning in the spring (i.e., sufficiently long enough for breeding to occur and larvae to complete development) (Jennings and Hayes 1994; 71 Federal Register [FR] 19244). Suitable aquatic habitats include natural and manmade ponds, backwaters within streams and creeks, marshes, lagoons, and dune ponds. Deep lacustrine habitats larger than 50 acres do not represent breeding or dispersal habitat (75 FR 12816). Juvenile and adult CRLF also utilize terrestrial (riparian and upland) habitats for foraging, aestivation, and seasonal dispersal, particularly where vegetation and other structural features provide hiding cover and cool, moist sites. Under suitable wet conditions, long-distance dispersal of one mile or more may occur between aquatic habitats, including movement through upland habitats or ephemeral drainages (71 FR 19244). Table 4.1-8 summarizes CRLF habitat requirements by life stage.

Table 4.1-8. California Red-legged Frog Habitat Requirements by Life Stage

Egg Masses	Larvae	Juveniles and Adults
In ponds or backwater pools within streams, usually attached to emergent vegetation (cattail [*Typha* spp.] and bulrush [*Schoenoplectus* spp.]. Sometimes found at sites without emergent vegetation (e.g., some stock ponds). The presence of dense riparian vegetation (particularly willows [*Salix* spp.]) 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 submerged vegetation or organic debris. Emergent vegetation, undercut banks, and semi-submerged root wads may provide hiding cover. Larvae typically metamorphose between July and September	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; cattail, bulrush, and willow are good indicators for suitable habitat. Associated with deep (<0.7 – 1.5 meters), still or slow-moving water. Juveniles prefer open, shallow aquatic habitats with dense submerged vegetation. In seasonally dry areas, frogs may aestivate in moist spaces (e.g., under boulders, logs, watering troughs, and small-mammal burrows). Juveniles and adults also utilize riparian and adjacent upland areas for foraging and shelter, often where upland shrubs and grasses occur.

CRLF has not been reported to occur within the proposed Project boundary. However, USFWS (2002) indicates the presence of CRLF in Pyramid reach and describes the population as being in decline. Hubbartt and Murphey (2005) did not detect CRLF in Pyramid reach or its tributary, Agua Blanca Creek, about 16.5 miles downstream of Pyramid Lake during surveys performed for the USGS from 1999 to 2000. Critical habitat unit VEN-2 is located in the Pyramid reach and its tributary Agua Blanca Creek. Sandburg (2006) reported observing larval CRLF in 2005 in a 7-foot-deep pool with cattails in Pyramid reach more than 10 miles downstream of Pyramid Lake and in a 3-foot-deep pool in Agua Blanca Creek. Annual arroyo toad and sensitive species surveys performed by the Licensees from 2010 to present have not resulted in observations of the CRLF in the 1.3 mile section of Agua Blanca Creek, or the 4.5 mile segment of the Pyramid reach between Ruby Canyon and the Blue Point Campground. Methods for these surveys meet most of the conditions for CRLF presence/absence surveys (USFWS 2005), with intensive surveys during the breeding season, including four or more night surveys, but do not include surveys during the non-breeding season (i.e., July 1 to September 30).

Information in addition to that provided by the Licensees' annual surveys is needed and will be gathered during this *ESA-listed Amphibians, CRLF Study* to determine locations of habitat suitable for CRLF that could be affected by the Project within the proposed Project boundary.

4.1.9.3 Study Goals and Objectives

The goals of this *ESA-listed Amphibians, CRLF Study* are to: (1) identify and map known CRLF locality records and the distribution of suitable habitats for CRLF within the proposed Project boundary and aquatic habitat within the surrounding one-mile radius from the proposed Project boundary; (2) perform a desktop site assessment to characterize mapped aquatic habitats and surrounding upland habitats, supplemented by field reconnaissance; and (3) evaluate the likelihood that CRLF may occur at locations within the proposed Project boundary based on the final reporting of the descriptive site assessment and historical records.

The objective of this *ESA-listed Amphibians, CRLF Study* is to gather sufficient data necessary to fill these recognized information gaps.

4.1.9.4 Study Methods

Study Area

The study area for the *ESA-listed Amphibians, CRLF Study* consists of the area within the proposed Project boundary, excluding lands overlying the Angeles Tunnel on which the Licensees do not perform any Project O&M activities. For the purpose of developing the desktop assessment map described below, aquatic habitats and existing locality records will also be mapped within a one-mile radius of the proposed Project boundary. The study area for the *ESA-listed Amphibians, CRLF Study* is shown in Figure 4.1-14 below.

General Concepts and Procedures

- Personal safety is the most important consideration of each fieldwork team. Fieldwork will only occur in safely accessible areas and under conditions deemed safe by the field crews. Locations within the study area that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed; these areas will be identified in the data summary and an explanation for survey exclusion will be provided.

- The *ESA-listed Amphibians, CRLF Study* will begin after FERC issues its Study Plan Determination.

- The *ESA-listed Amphibians, CRLF Study* does not include the development of requirements for the new license, which will be addressed outside the study.

- This *ESA-listed Amphibians, CRLF Study* focuses on CRLF within the proposed Project boundary, but the study area for the *ESA-listed Amphibians, CRLF Study* is specific to the locations providing suitable habitat for this species.

- If required for the performance of the *ESA-listed Amphibians, CRLF Study*, the Licensees will make a good faith effort to obtain permission to access private

property well in advance of initiating the study. The Licensees will only enter private property if permission has been provided by the landowner.

- The Licensees will acquire all necessary agency permits and approvals prior to beginning fieldwork for the *ESA-listed Amphibians, CRLF Study*.

- Field crews may make variances to the *ESA-listed Amphibians, CRLF Study* in the field to accommodate actual field conditions and unforeseen problems. Any variances in the *ESA-listed Amphibians, CRLF Study* will be noted in the data resulting from the *ESA-listed Amphibians, CRLF Study*.

- To prevent the introduction and transmittal of amphibian chytrid fungus and invasive aquatic species (e.g., quagga mussels, zebra mussel, and Asian clams), field crews will be trained on, provided with, and use materials (e.g., Quat) for decontaminating their boots, waders, and other equipment when leaving or traveling between water-based study sites. Field crews will follow DWR's Quagga and Zebra Mussel Rapid Response Plan and CDFW's Aquatic Invasive Species Decontamination Protocol which can be found at the following link: (https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=43333). All boats used during the study will follow cleaning protocols, including inspections before and after use. All decontamination requirements in place at Project reservoirs including those of DWR's *Quagga and Zebra Mussel Rapid Response Plan* for the SWP will be strictly followed (DWR 2010).

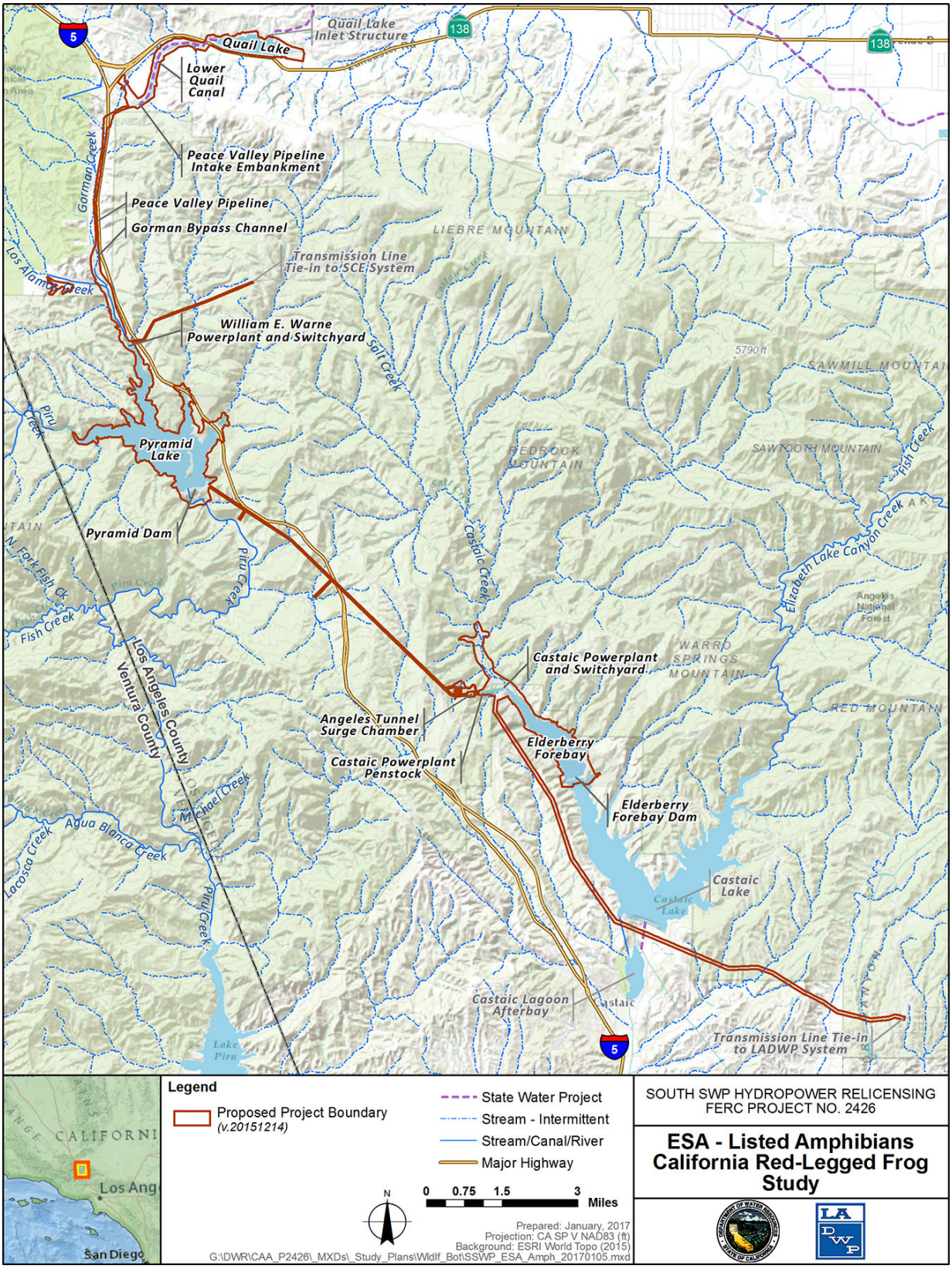

Figure 4.1-14. ESA-listed Amphibians, CRLF Study Area (i.e., Proposed Project Boundary, with a One-mile Radius for the Desktop Assessment)

Methods

The *ESA-listed Amphibians, CRLF Study* will consist of three steps: (1) identify and map locality records and potential aquatic habitat for CRLF; (2) desktop site assessment and field reconnaissance; and (3) prepare data. These steps are described below.

Step 1 – Identify and Map Locality Records and Potential Aquatic Habitat for CRLF. Prior to conducting the field assessments, the Licensees will identify and map known locality records of CRLF and locations of aquatic habitats in the study area for the *ESA-listed Amphibians, CRLF Study* potentially suitable for CRLF breeding. In addition to the CNDDB, sources of locality records may include inquiries 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" (USFWS 2005). Potential CRLF breeding habitat will be identified from existing aerial imagery, NWI maps, and any existing on-the-ground photographs, along with observations of aquatic areas from the Licensees' relicensing *Botanical Resources Study*. Other aquatic habitats potentially affected by the Project that may be utilized by CRLF for dispersal, foraging, or predator avoidance will also be identified and mapped.

Step 2 – Desktop Site Assessment and Field Reconnaissance. The Licensees will complete a desktop site assessment to characterize aquatic habitats mapped in Step 1, as well as the surrounding upland habitats, supplemented by field reconnaissance of aquatic sites and adjacent riparian and upland habitats in accordance with USFWS (2005) guidelines. Sites for field reconnaissance at locations within the proposed Project boundary will be selected based on accessibility and where additional information on site characteristics is needed. Field reconnaissance surveys will be completed by biologists or scientists with experience performing CRLF habitat assessments and who are qualified to identify amphibians and their habitats. A Habitat Site Assessment Data Sheet (USFWS 2005) will be completed at each site that is examined, and photographs will be taken depicting habitat and other notable findings. Data to be collected during field reconnaissance will include water flow and depth at the time of the site assessment, bank-full depth, stream gradient (i.e., percent slope), substrate, description of bank, and associated aquatic, riparian vegetation, and adjacent uplands. Consistent with the USFWS (2005) guidelines, field reconnaissance will not include formal surveys for CRLF or repeated visits to sites, and will not include activities that will require federal or state permits (e.g., dip-netting or use of traps, or handling CRLF) unless directed or authorized by USFWS to collect additional information. However, observation of CRLF of any life stage will be noted and documented by photographs if possible. USFWS decontamination guidelines will be implemented. Detections of any life stage of CRLF will be reported within three days to CDFW and USFWS. The presence of fish, non-native crayfish, and American bullfrog will also be noted during the site assessments. Aquatic habitats will be mapped and characterized by habitat type (e.g., pond, creek, or pool) and apparent seasonality. Upland habitats within the study area for the *ESA-listed Amphibians, CRLF Study* will be characterized based on description of upland vegetation communities, land uses, and any potential barriers to CRLF movement.

Once the site assessment has been completed, the Licensees will note Project O&M and Project-related recreation that typically occurs in the area.

Step 3 – Prepare Data. Following the field reconnaissance, the Licensees will develop summary text from field notes describing survey results and GIS maps depicting survey locations, locations of CRLF observations, Project facilities, features, and specific Project-related activities that may have an effect on CRLF.

Quality Assurance and Quality Control

Field data gathered during this *ESA-listed Amphibians, CRLF Study* will be collected in a manner that promotes high quality results, and will be subject to appropriate QA/QC procedures including checking field data sheets for accuracy and completeness.

Analysis

Once the locations of potentially suitable upland and aquatic habitats in the study area for the *ESA-listed Amphibians, CRLF Study* are determined, the Licensees will identify continuing Project O&M and Project-related recreation activities that occur in these areas.

Reporting

ESA-listed Amphibians, CRLF Study methods and results will be prepared and included, to the extent that they are completed, in the Licensees' ISR, and all results reported in the USR, DLA, and FLA. If any CRLF are found during this *ESA-listed Amphibians, CRLF Study* or observed incidentally during other relicensing studies being performed by the Licensees, a report considered "Privileged" will be developed and provided only to FERC, USFWS, and CDFW. If any CRLF are found on NFS lands, this Privileged report will also be provided to USFS. The report will also include a summary of historical records of CRLF from agency records, museum records, and other existing information.

4.1.9.5 Consistency of Methodology with Generally Accepted Scientific Practices

This *ESA-listed Amphibians, CRLF Study* is consistent with the goals, objectives, and methods outlined for most recent FERC hydropower relicensing efforts in California, including the Yuba River Development Project (FERC No. 2246) and the Merced River Hydroelectric Project (FERC No. 2174), and will use methodology recommended for site assessments by USFWS.

4.1.9.6 Schedule

The *ESA-listed Amphibians, CRLF Study* will begin after FERC issues its Study Plan Determination. The Licensees anticipate the schedule below will be followed to complete the study.

Fieldwork Preparation	January 2018 – April 2018
Fieldwork	April 2018 – July 2018
Data QA/QC	July 2018 – August 2018
Data Analysis and Reporting	August 2018 – June 2019

4.1.9.7 Level of Effort and Cost

Based on the work effort described above, the Licensees estimate the current cost to complete this *ESA-listed Amphibians, CRLF Study* will range between $60,000 and $80,000.

4.1.9.8 References

DWR. 2010. The Quagga and Zebra Mussel Rapid Response Plan for the State Water Project. 93 pp. CONFIDENTIAL/PRIVILEGED – Not for Public Distribution.

Hubbartt, V.K. and T.G. Murphey. 2005. Surveys for California red-legged frog and arroyo toad on the Los Padres National Forest. USFS General technical report PSW-GTR-195.

Jennings, M.R. and M.P. Hayes. 1994. Amphibian and reptile species of special concern in California. Report to the California Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California. 255 pp.

Sandburg, N.H. 2006. Middle Piru Creek arroyo toad (*Bufo californicus*) clutch surveys 2005. Report to DWR. February 2006.

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4.1.10 ESA-Listed Riparian Bird Species, Southwestern Willow Flycatcher, Least Bell's Vireo, and Yellow-billed Cuckoo Riparian Habitat Evaluations Study

4.1.10.1 Project Nexus

Continued Project O&M and Project-related recreation activities may have an effect on southwestern willow flycatcher (*Empidonax traillii extimus*), least Bell's vireo (*Vireo bellii pusillus*), and the western DPS of yellow-billed cuckoo (*Coccyzus americanus*). These are riparian-breeding birds listed as threatened under the federal ESA.

4.1.10.2 Existing Information and Need for Additional Information

Existing, relevant, and reasonably available information regarding southwestern willow flycatcher, least Bell's vireo, and yellow-billed cuckoo within the proposed Project boundary is provided in Section 4.8 of the Licensees' PAD. In summary, all three

species are closely associated with dense riparian habitats (especially during nesting), but with differences in structure and composition as detailed below.

Least Bell's vireo breeding habitat is typically dominated by willows (*Salix* spp.), with dense cover within 3-6 feet of the ground, and a structurally diverse, dense canopy (USFWS 1998). Nests are often in openings or near habitat edges in understory shrubs, including wild rose (*Rosa californica*) and mulefat (*Baccharis salicifolia*) beneath willows and cottonwoods (*Populus* spp.) (USFWS 1998). Home ranges of least Bell's vireo during the nesting season may also include adjacent non-riparian habitats such as chaparral and coastal scrub (Kus and Minor 1989).

Southwestern willow flycatcher's breeding habitat requires the presence of dense vegetation cover, usually willows or tamarisk, which is dense from the ground to 9.8 feet or more in height, and may occur as shrub stands or broadleaf trees with a dense shrub layer 6.5 to 16.4 feet in height. Habitats may be associated with either low gradient streams or lentic habitat. Other characteristic species include boxelder (*Acer negundo*), Russian olive (*Elaeagnus angustifolia*), cottonwood, ash (*Fraxinus* spp.), alder (*Alnus* spp.), and buttonbush (*Cephalanathus occidentalis*). Breeding territories may be as small as 0.25-acre, but most are at least 0.5-acre.

The western DPS yellow-billed cuckoo nests in low- to moderate-elevation, riparian woodlands, mostly comprised of native broadleaf trees and shrubs of various species in patches that are 50 acres or more in extent within arid to semiarid landscapes. Breeding habitat in California occurs mostly in patches of Fremont cottonwood (*P. fremontii*) and willows greater than 200 acres in size, reflecting the large home ranges characteristic of this species. As summarized by Halterman et al. (2016), nesting has not been documented in small, isolated riparian patches of 2 acres or less, and linear patches less than 30 feet in width, although smaller patches may be used as stop-over habitat during migration. CDFW (2016) summarizes the general habitat for this species as "broad, lower flood-bottoms of larger river systems" and micro-habitats as "riparian jungles of willow, often mixed with cottonwoods, with lower story of blackberry, nettles, or wild grape." Yellow-billed cuckoo, western DPS was not included in the PAD as a species potentially affected by the Project because of the apparent limited extent and small patch size of riparian habitats in the proposed Project boundary. However, more information is needed on the structure and composition of riparian habitat in the proposed Project boundary to validate this conclusion.

The Licensees found no existing, recent information regarding the presence of these species within the proposed Project boundary, where the most recent known surveys were performed in 2002 and 2003 for southwestern willow flycatcher and least Bell's vireo. No surveys are known to have been conducted for yellow-billed cuckoo. The nearest known occurrences of each species are a record of least Bell's vireos in the Castaic Lagoon Recreation Area approximately 4 miles south of Elderberry Forebay (multiple years, most recently in 2005); a breeding pair of least Bell's vireos in San Francisquito Canyon in 2015 (L.R. Welsh, Forest Service, personal communication); non-breeding, migrating willow flycatchers (sub-species not determined) on Liebre Gulch north of Pyramid Lake; and a sighting of a single yellow-billed cuckoo

approximately 19 miles south of Pyramid Lake along the Santa Clara River, 3 to 4 miles east of the town of Piru in 1979. No yellow-billed cuckoos were detected at the latter location in subsequent surveys between 1999 and 2006 (CDFW 2015). All of these locations are outside the proposed Project boundary. Additional information, which will be provided by this *ESA-listed Riparian Bird Species Study*, is needed to determine locations of suitable habitat for each of the three species and whether the species occur there during the breeding season.

4.1.10.3 Study Goals and Objectives

The goals of this *ESA-listed Riparian Bird Species Study* are to: (1) identify the location of any suitable habitat for southwestern willow flycatcher, least Bell's vireo, or yellow-billed cuckoo western DPS in the study area for the *ESA-listed Riparian Bird Species Study*; (2) document the presence/absence of each of these species by surveys in suitable habitat within the study area for the *ESA-listed Riparian Bird Species Study* during their breeding seasons; and (3) incidental to the presence/absence surveys, document any incidental observations of breeding activities or nest locations of the three species in the study area for the *ESA-listed Riparian Bird Species Study*.

The objective of this *ESA-listed Riparian Bird Species Study* is to gather sufficient data necessary to fill recognized gaps in the information available about habitat suitability and the species' likely presence or absence.

4.1.10.4 Study Methods

Study Area

The study area for the *ESA-listed Riparian Bird Species Study* consists of the area within the proposed Project boundary that includes suitable habitat for the three species of ESA-listed birds, excluding lands overlying the Angeles Tunnel on which the Licensees do not perform any Project O&M activities. The study area for the *ESA-listed Riparian Bird Species Study* is shown in Figure 4.1-15.

General Concepts and Procedures

- Personal safety is the most important consideration of each fieldwork team. Fieldwork will only occur in safely accessible areas and under conditions deemed safe by the field crews. Locations within the study area that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed; these areas will be identified in the data summary and an explanation for survey exclusion will be provided.

- The *ESA-listed Riparian Bird Species Study* will begin after FERC issues its Study Plan Determination.

- The *ESA-listed Riparian Bird Species Study* does not include the development of requirements for the new license, which will be addressed outside the study.

- This *ESA-listed Riparian Bird Species Study* focuses on ESA-listed bird species, specifically the southwestern willow flycatcher, least Bell's vireo, and yellow-billed cuckoo western DPS within the proposed Project boundary, but the study area for the *ESA-listed Riparian Bird Species Study* is specific to the locations providing suitable habitat for each of those species.

- If required for the performance of the *ESA-listed Riparian Bird Species Study*, the Licensees will make a good faith effort to obtain permission to access private property well in advance of initiating the study. The Licensees will only enter private property if permission has been provided by the landowner.

- The Licensees will acquire all necessary agency permits and approvals prior to beginning fieldwork for the *ESA-listed Riparian Bird Species Study*.

- Field crews may make variances to the *ESA-listed Riparian Bird Species Study* in the field to accommodate actual field conditions and unforeseen problems. Any variances from the *ESA-listed Riparian Bird Species Study* will be noted in the data and final report resulting from this study.

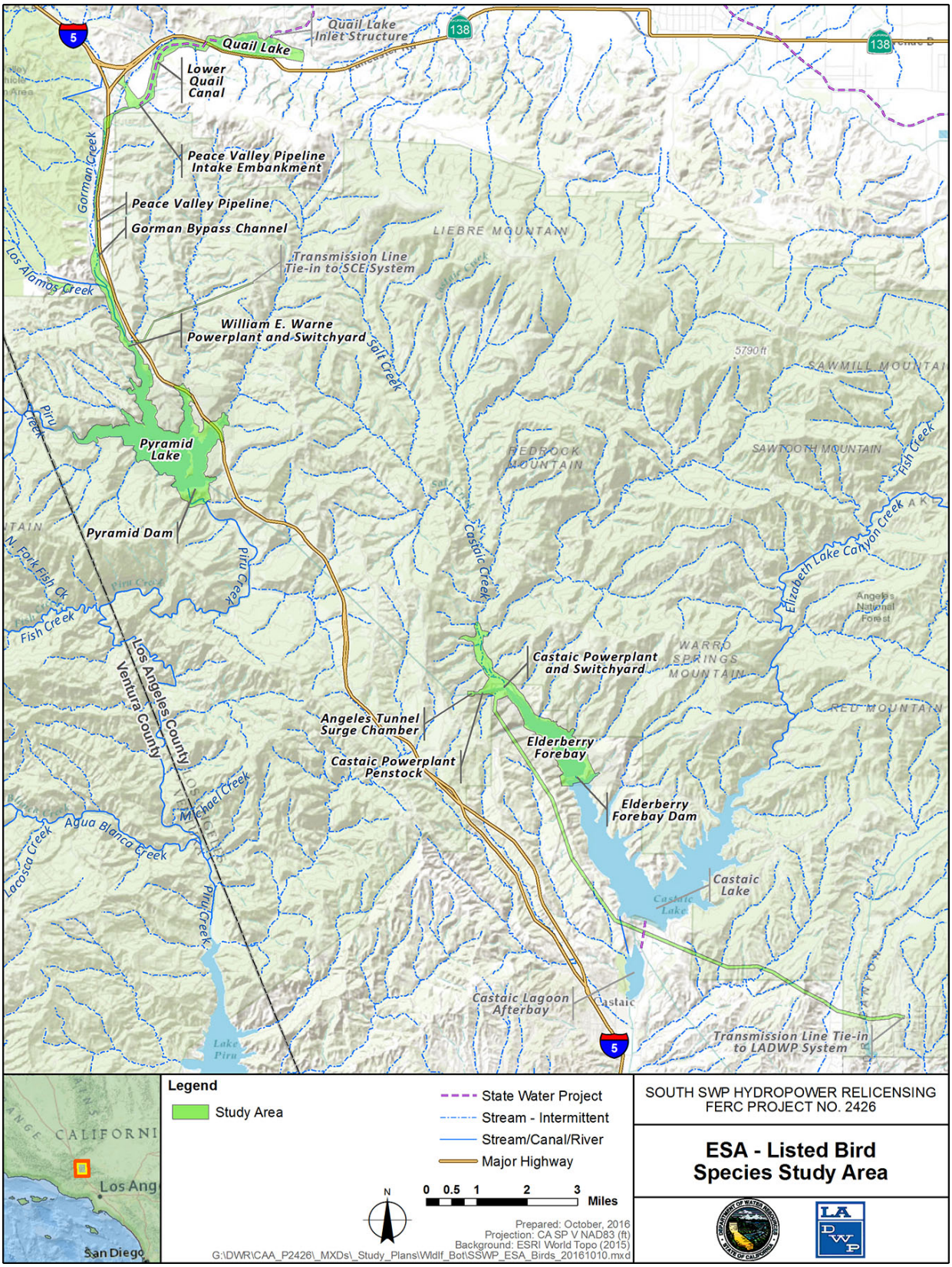

Figure 4.1-15. ESA-listed Riparian Bird Species, Southwestern Willow Flycatcher, Least Bell's Vireo, and Yellow-billed Cuckoo Study Area

Methods

The *ESA-listed Riparian Bird Species Study* will focus on areas containing appropriate habitat, as identified in vegetation mapping for the Project in the PAD, the CWHR studies and the riparian component of the Licensees' relicensing *Botanical Resources Study*. As described below, the lead biologists performing the surveys for southwestern willow flycatcher and yellow-billed cuckoo for this Study will possess the necessary USFWS Section 10(a)(1)(A) species recovery permits for these species allowing the use of pre-recorded willow flycatcher and yellow-billed cuckoo vocalizations. Call-playbacks will not be used for the least Bell's vireo surveys and will not require a USFWS permit. The lead biologists will be qualified to identify each of the three species by sight and sound. The *ESA-listed Riparian Bird Species Study* will consist of three steps: (1) identify survey areas; (2) conduct field surveys; and (3) prepare data. These steps are described below.

Step 1 – Identify Survey Areas. The Licensees will use maps and descriptive habitat information from the *Botanical Resources Study* associated with riparian habitat areas to identify specific areas where southwestern willow flycatcher, least Bell's vireo, and yellow-billed cuckoo, western DPS could occur in the study area for the *ESA-listed Riparian Bird Species Study*. Using this information, new maps will be created to guide the field teams during the assessments.

Step 2 – Conduct Field Surveys. The Licensees will visit identified potentially suitable riparian habitat within the study area for the *ESA-listed Riparian Bird Species Study* and evaluate its suitability for each of the target species based on vegetation species composition, habitat structure, and patch size. Based on this evaluation, locations for presence/absence surveys will be determined. Where possible, the results from the Licensees' relicensing *ESA-listed Terrestrial Wildlife – California Wildlife Habitat Relationships Study* will be incorporated into the evaluation.

The Licensees will perform presence/absence surveys for the three target species within suitable riparian habitat. A minimum patch size of 2 acres will be used to define potential habitat for yellow-billed cuckoo that merits presence/absence surveys. These surveys are not intended to locate territories or nests, or to obtain precise information on the number of birds present. Surveys will follow protocols accepted by USFWS for southwestern willow flycatcher (Sogge 2010), least Bell's vireo (USFWS 2001), and yellow-billed cuckoo, western DPS (Halterman et al. 2016).

Southwestern Willow Flycatcher

Prior to the start of surveys, lead survey staff will familiarize themselves with each site. Southwestern willow flycatcher surveys rely on a call-playback technique in which certain pre-recorded vocalizations (i.e., the "fitz-bew" song and the "whitt" alarm call) are broadcast to elicit a song response from the target species. Determining "presence" of territorial southwestern willow flycatchers requires hearing the "fitz-bew" song during the non-migrant period (generally between June 15 to July 20), which may be supported by signs of breeding activity (e.g., observations of willow flycatchers carrying nesting

material). Recordings of these and other vocalizations are available online from the USGS Colorado Plateau Research Station (http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/wiflvocl.asp). Surveyor teams will include biologists or scientists that are qualified to identify each of the target species and the methodologies to survey for them. Qualifications to lead the southwestern willow flycatcher surveys include a USFWS Section 10(a) species recovery permit allowing for use of call-playback. In addition, the lead surveyor will be familiar with identification of other bird species likely to occur in the study area for the *ESA-listed Riparian Bird Species Study* with similar calls and songs, and capable of visually identifying species that could be confused with the southwestern willow flycatcher. Surveys will be distributed across three survey periods related to nesting phenology, with one survey in period 1 (May 15-31), two surveys in period 2 (June 1-24), and two surveys in period 3 (June 25 to July 17). During the third survey period, any southwestern willow flycatchers detected are likely to be territorial.

Least Bell's Vireo

The presence/absence surveys for least Bell's vireo will follow the USFWS (2001) survey protocols for least Bell's vireo, which are based on visual and auditory detection. The surveys will not include call-playbacks and will not require a USFWS species recovery permit. Minimum qualifications of the lead surveyors include familiarity with the characteristic vocalizations and visual identification features of the species, and related demonstrated experience and skills performing bird surveys, particularly surveys of least Bell's vireo. Surveys will be distributed across the April 10 to July 31 survey season with a total of eight surveys, conducted at least 10 days apart. Surveyors will note the location and status of each detection (e.g., age, sex and pairing of birds encountered; and foraging or calling).

Yellow-billed Cuckoo

The presence/absence surveys for yellow-billed cuckoo will follow the USFWS survey protocols (Halterman et al. 2016), which are based on broadcasting a prerecorded yellow-billed cuckoo contact call to elicit a response. Qualifications to lead the surveys include a USFWS Section 10(a) species recovery permit allowing for use of call-playback and attendance at a yellow-billed cuckoo protocol workshop, which will also provide the contact call recordings. The lead surveyor will be familiar with identification of other bird species likely to occur in the study area for the *ESA-listed Riparian Bird Species Study* with similar calls and songs, and capable of visually identifying species that could be confused with the yellow-billed cuckoo.

Prior to the start of surveys, lead survey staff will familiarize themselves with each site. The number and timing of surveys will be distributed across three survey periods: period 1 (June 15 – June 30), a minimum of one survey; period 2 (July 1 – July 31), a minimum of 2 surveys; and period 3 (August 1 – August 15). This survey frequency has been shown to have a 95 percent probability of detecting the species if present (Halterman 2016). Yellow-billed cuckoos detected during survey period 2 are likely to be breeders, whereas detections at other times could be breeders or migrants. Surveys will be

separated by 12-15 days and will be performed independently of surveys for southwestern willow-flycatcher. The surveyors will record the locations of any yellow-billed cuckoo detections and complete a Yellow-billed Cuckoo Survey Seasonal Form (Halterman et al. 2016).

Survey detections of southwestern willow flycatcher, least Bell's vireo, and yellow-billed cuckoo will be reported to CDFW and USFWS. Surveyors will also note any presence and general distribution of brown-headed cowbirds (*Molothrus ater*) in the study area for the *ESA-listed Riparian Bird Species Study*.

Step 3 – Prepare Data. Following the surveys, the Licensees will develop summary text from field notes describing habitat evaluation and survey results, GIS maps of survey locations, southwestern willow flycatcher, least Bell's vireo, and yellow-billed cuckoo occurrences, and any breeding activities. The summary will also include Project facilities, features, and specific Project-related activities (e.g., recreation trails) in the area where southwestern willow flycatcher, least Bell's vireo, and yellow-billed cuckoos are observed and will identify where suitable habitat for any of the three species is located.

Quality Assurance and Quality Control

Field data will be collected in a manner that promotes high quality results, and will be subject to appropriate QA/QC procedures, including spot-checks of transcription and comparison of GIS maps with field notes to verify locations of southwestern willow flycatcher, least Bell's vireo and yellow-billed cuckoo occurrences.

Analysis

If any suitable habitat for the three species and/or locations of southwestern willow flycatcher, least Bell's vireo, or yellow-billed cuckoo are determined, the Licensees will describe potential Project-related disturbances, including continued Project O&M and Project-related recreation activities.

Reporting

ESA-listed Riparian Bird Species Study methods and results will be prepared and included, to the extent completed and ready for inclusion, in the Licensees' ISR, and all results will be reported in the USR, DLA, and FLA. If any occurrences of southwestern willow flycatcher, least Bell's vireo, or yellow-billed cuckoo western DPS are found, the report will be considered "Privileged," and will be provided to FERC, USFWS, and CDFW. If any occurrences of southwestern willow flycatcher, least Bell's vireo or yellow-billed cuckoo western DPS are found on NFS lands, the privileged report will also be provided to the USFS.

4.1.10.5 Consistency of Methodology with Generally Accepted Scientific Practices

This *ESA-listed Riparian Bird Species Study* follows survey protocols that are recommended by USFWS and CDFW. Therefore, this *ESA-listed Riparian Bird Species Study* is consistent with standard methods accepted by the scientific community and regulatory agencies for evaluating habitat and assessing the presence and breeding activities of southwestern willow flycatcher, least Bell's vireo, and yellow-billed cuckoo, western DPS.

4.1.10.6 Schedule

The *ESA-listed Riparian Bird Species Study* will begin after FERC issues its Study Plan Determination. The Licensees anticipate the schedule below will be followed to complete the *ESA-listed Riparian Bird Species Study*.

Fieldwork Preparation	October 2017 – November 2017
Fieldwork	April 2018 – August 2018
Data QA/QC	August 2018 – September 2018
Data Analysis and Reporting	September 2018 – June 2019

4.1.10.7 Level of Effort and Cost

Based on the work effort described above, the Licensees estimate the current cost to complete this *ESA-listed Riparian Bird Species Study* will range between $$238,000 and $299,000.

4.1.10.8 References

CDFW. 2016. CNDDB. RareFind Version 5. Available online: <https://www.wildlife.ca.gov/Data/CNDDB/Maps-and-Data >. Accessed December 15, 2016. Last updated December 2016. CDFW, Biogeographic Data Branch. Sacramento, CA.

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Kus, B.E. and K.L. Minor. 1989. Use of non-riparian habitat by least Bell's vireo. USFS General Technical Report, PSW-110.

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USFWS. 1998. Draft Recovery Plan for the Least Bell's Vireo (*Vireo bellii pusillus*). Region 1 USFWS, Portland, Oregon.

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Welsh, L.R. 2015. Personal communication. U.S. Forest Service.

4.1.11 Recreation Facilities Demand Analysis and Condition Assessment Study

4.1.11.1 Project Nexus

Continued recreation is an important benefit of most hydropower projects, and FPA regulations require consideration for protection and enhancement of recreational opportunities. FERC's policies include ensuring that the ultimate development of recreation resources at licensed projects is consistent with area recreation needs and with the primary Project purpose. To plan for future needs for recreation within the proposed Project boundary, data on existing recreation facilities and their respective conditions is necessary to make informed decisions about the development needs required through the term of the new Project FERC license.

4.1.11.2 Existing Information and Need for Additional Information

Existing, relevant, and reasonably available information regarding recreational resources within the proposed Project boundary is provided in Section 4.9 of the Licensees' PAD. Existing data includes a basic inventory of Project-related recreation facilities, maps showing locations of existing recreational trails, statistics on visitor use, and management guidelines and regional needs assessments from relevant regional resource management plans, including the State Comprehensive Outdoor Recreation Plan and the Angeles and LPNF's Land and Resource Management Plan. The Licensees also have historical annual occupancy information for the Pyramid Lake recreation facilities. Project recreation use information is collected every six years for FERC Form 80 reporting and the most recent reporting year was 2014. Recreation user data is continuously collected every year. The Licensees also filed an updated *Recreation Plan* in May 2016.

In addition, the Licensees have been continuously working with the Pyramid Lake concessionaire to improve and maintain existing Project recreation facilities in a safe and functional manner. However, there may be additional opportunities to provide accessibility or other upgrades to meet future user needs. Typically, accessibility evaluations follow guidelines associated with the Architectural Barriers Act Accessibility Standards (ABAAS), the Forest Service Outdoor Recreation Accessibility Guidelines (FSORAG), and the Forest Service Trail Accessibility Guidelines (FSTAG) on NFS lands as well as the Americans with Disabilities Act on other lands. The accessibility assessment will also follow the U.S. Forest Service FERC relicensing conditions from section 4(e) of the FPA, which guide development of recreational facilities and require consideration of the needs of people with disabilities in the design and construction of project facilities and access. Information, which will be provided by this *Recreation*

Study, will include a detailed condition assessment and inventory of Project recreation facilities. Additionally, an overnight camping demand analysis has recently been performed for the Pyramid Lake area as part of the removal of Hardluck Campground from the Project Recreation Plan. FERC's letter, dated February 22, 2017, to DWR approved the filing of the August 2016 Hardluck Campground Demand Analysis. FERC also noted that development of a replacement campground for Hardluck Campground was not required at this time. However, FERC recognized that since this Project is currently undergoing relicensing, the need for recreation opportunities previously provided at Hardluck Campground should be explored within the context of the ongoing relicensing process. The recreation demand analysis proposed in this *Recreation Study* will augment the information gathered in the Hardluck Campground Demand Analysis study and expand the geographic scope to identify user preferences and recreation needs within the proposed Project boundary and downstream of Pyramid Dam in and around the Frenchman Flat's Day Use area.

4.1.11.3 Study Goals and Objectives

The goal of this *Recreation Study* is to develop a detailed condition assessment and inventory of Project-related recreation facilities to evaluate the facility offerings, configurations and conditions to help establish whether recreation needs are being met within the proposed Project boundary and to identify the areas with barrier free access. A demand analysis will contribute to the *Recreation Study* and be compared to the condition assessment and inventory to further evaluate existing and projected recreation needs within the *Recreation Study* area. This *Recreation Study* will comprise the following elements: (1) Project Existing Recreational Facility Inventory, Condition, and Carrying Capacity Assessment; (2) Project Existing Recreational Facilities Accessibility Assessment; and (3) Project Recreation Demand Analysis. The information from the condition assessment, accessibility assessment, and demand analysis will be evaluated to determine potential future improvements to or expansion of recreation facilities within the proposed Project boundary. Additional information, which will be provided by this *Recreation Study*, will include an inventory and comprehensive assessment of Project-related recreation facilities.

The objective of this *Recreation Study* is to gather sufficient data necessary to fill recognized gaps in available information about the existing recreational facilities. This information will be used to determine whether potential future improvements to recreational facilities within the proposed Project boundary, such as additional opportunities for providing accessibility, are warranted.

4.1.11.4 Study Methods

Study Area

The area of focus for the recreation facilities condition assessment and demand analysis consists of existing Project recreation areas within the proposed Project boundary surrounding Quail Lake and Pyramid Lake. The *Recreation Study* area will also include the non-Project day use area, Frenchman's Flat, downstream of Pyramid

Lake in the assessment of recreation demand. Project facilities will be assessed within the context and categorization outlined in FERC's Project Recreation Facilities Tables and As-Built Site Plan Drawing Guidance (FERC 2014).

The Project lands around Elderberry Forebay are not part of this *Recreation Study* since the Forebay is closed to the public due to safety concerns posed by fluctuating water levels. Figures 4.1-16 to 4.1-19 show the areas and facilities that will be studied. For the recreation demand component, the analysis area will expand to include relevant recreation demand studies for California, and make some use of national data sets on user trends and preferences.

Study Sites

Pyramid Lake is popular with boaters and fishermen. In addition, the lake, its surrounding shorelines, and adjacent areas are popular with swimmers, hikers, and picnickers, particularly during the summer months. As shown in Figure 4.1-17 and described below, recreation facilities on and around Pyramid Lake include: boat-in sites, a visitor center, picnic areas, boat launches and public docks, and swim beaches. Los Alamos Campground provides overnight and group campgrounds for Pyramid Lake visitors.

Recreational facilities at Quail Lake are owned and operated solely by DWR. A large, graveled parking area with portable restrooms, signage, and trash receptacles are located at the west end of the lake, adjacent to State Route 138 and the outlet structure. Project lands surrounding Quail Lake are fenced and recreational access to the lake is walk-in only. Natural surface trails lead to the lake from the parking area. A graveled service road, which is closed to privately-owned vehicles but open to hikers and fishermen, surrounds the lake (Figure 4.1-18). Quail Lake provides only non-contact recreation opportunities; no boating or swimming is permitted there.

The following recreation-related facilities will be evaluated as part of this *Recreation Study*. Existing inventory, condition, capacity, and accessibility assessments will be conducted for each facility listed below. All of the facilities and amenities listed in Table 2b of the Project's Recreation Plan Update filed with FERC May 20, 2016 (FERC 2016) will be inventoried (see Table 4.1-9). In addition, Frenchman's Flat recreation facilities and amenities, downstream of Pyramid Dam, will be inventoried in the same manner as Project facilities (Figure 4.1-19). Updated recreation facilities tables for facilities within the proposed Project boundary will be prepared and included as part of the license application documents. Observed use information will also be documented during visits to each of these individual facilities and amenity locations.

Pyramid Lake Recreation Facilities:

- Emigrant Landing Boat Launch
- Emigrant Landing Swim and Picnic Area

- Emigrant Landing Picnic and Fishing Area No. 1
- Emigrant Landing Picnic and Fishing Area No. 2
- Vista Del Lago Visitor Center
- Vaquero Day Use Area
- Spanish Point Boat-in Picnic Area
- Serrano Boat-in Picnic Area
- Bear Trap Boat-in Picnic Area
- Yellow Bar Boat-in Picnic Area

Other Recreation Facilities:

- Quail Lake access point (parking, temporary restrooms, shoreline fishing)
- Los Alamos Campground and Group Campground
- Frenchman's Flat Day Use Area

Table 4.1-9. Approved Recreation Facilities for Pyramid Power Drop

Project Number	Development	Recreation Amenity Name	Recreation Amenity Type	Recreation Status	Notes
P2426	Pyramid Power Drop	Bear Trap Day Use Area	Picnic Area	Constructed	3 shade ramadas, typically 1 picnic table per ramada; 1 restroom with vault toilet; typically 1-2 barbecues; trash receptacle; boat dock; shoreline fishing
P2426	Pyramid Power Drop	Emigrant Landing Day Use Area	Boat Launch Area	Constructed	8-lane boat launch ramp; 2 public boat docks; 1 sheriff boat dock; administrative building; 7 shade ramadas with typically 2 picnic tables per ramada; 2 restrooms with flush toilets; parking for approximately 24-26 single vehicles with trailers; 1 interpretive display; parking for 55-60 single vehicles, typically 2-3 ADA; 2 floating restrooms that are deployed on the lake as needed; 5 portable ramadas that are deployed to recreation areas as needed
P2426	Pyramid Power Drop	Emigrant Landing Day Use Area	Interpretive Display	Constructed	Informational sign
P2426	Pyramid Power Drop	Emigrant Landing Day Use Area	Picnic & Fishing Area 1	Constructed	6 shade ramadas, with typically 2 picnic tables and typically 1 barbecue per ramada; shoreline fishing; restroom with flush toilets; parking for approximately 53-55 single vehicles with trailer; parking for approximately 45-50 single vehicles, typically 2-3 ADA
P2426	Pyramid Power Drop	Emigrant Landing Day Use Area	Picnic & Fishing Area 2	Constructed	16 shade ramadas, with typically 2 picnic tables and typically 1 barbecue per ramada; shoreline fishing; restroom with flush toilets; parking for approximately 70-75 single vehicles with trailers, typically 4-5 ADA
P2426	Pyramid Power Drop	Emigrant Landing Day Use Area	Swim & Picnic Area	Constructed	Swim beach; 24 shade ramadas, with typically 2 picnic tables and 1 barbecue per ramada; 2 restrooms with flush toilets; parking for approximately 130- 135 single vehicles, approximately 1 ADA
P2426	Pyramid Power Drop	Los Alamos Campground	Campground	Constructed	93 camp sites, with typically 1 picnic table and 1 fire ring per site, 4 ADA; 4 restrooms with flush toilets; 5 portable ramadas that are deployed to recreation areas as needed; trailer dump station; potable water; trash receptacles

Table 4.1-9. Approved Recreation Facilities for Pyramid Power Drop (continued)

Project Number	Development	Recreation Amenity Name	Recreation Amenity Type	Recreation Status	Notes
P2426	Pyramid Power Drop	Los Alamos Campground	Group Camps	Constructed	3 group sites with maximum occupancy of 40 people and parking for typically 8- 10 vehicles per site; each site includes a large shade ramada, typically containing 4-5 picnic tables, fire pits, and trash receptacles; restroom with flush toilets
P2426	Pyramid Power Drop	Serrano Day Use Area	Picnic Area	Constructed	6 shade ramadas, typically 1-2 picnic tables and typically 1 barbecue per ramada; restroom with vault toilets; trash receptacles; boat dock; shoreline fishing
P2426	Pyramid Power Drop	Spanish Point Day Use Area	Picnic Area	Constructed	12 shade ramadas, typically 1-2 picnic tables and typically 1 barbeque per ramada; restroom with vault toilets; trash receptacles; shoreline fishing
P2426	Pyramid Power Drop	Vaquero Day Use Area	Picnic Area	Constructed	15 shade ramadas with typically 1 picnic table and typically 1 barbecue per site, one ADA site; trash receptacles; 2 restrooms with flush toilets, ADA; parking for 140-150 single vehicles, typically 8 ADA
P2426	Pyramid Power Drop	Vaquero Day Use Area	Boat Launch Area	Constructed	2-lane, non-motorized watercraft launch ramp; boat dock
P2426	Pyramid Power Drop	Vaquero Day Use Area	Swim Area	Constructed	Swim beach
P2426	Pyramid Power Drop	Vista del Lago Visitors Center	Visitor Center	Constructed	18,500 square-foot visitor building; exhibits and displays; parking for 150- 160 single vehicles, typically 5 ADA, and 10 busses; potable water within facility
P2426	Pyramid Power Drop	Yellow Bar Day Use Area	Picnic Area	Constructed	10 shade ramadas with typically 1-2 picnic tables per site, 3 sites are ADA; restroom with vault toilets, ADA; boat dock; trash receptacle; shoreline fishing
P2426	Quail Lake	Quail Lake	Access Point	Constructed	Access point with gravel parking lot and 2 temporary/portable restrooms; shoreline fishing

Source: FERC 2016
Key:
ADA = Americans with Disabilities Act

General Concepts and Procedures

- Personal safety is the most important consideration of each fieldwork team. Fieldwork will only occur in safely accessible areas and under conditions deemed safe by the field crews. Locations within the study area that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed; these areas will be identified in the data summary and an explanation for survey exclusion will be provided.

- The *Recreation Study* will begin after FERC issues its Study Plan Determination.

- The *Recreation Study* does not include the development of requirements for the new license, which will be addressed outside of this study.

- The *Recreation Study* specifically focuses on the recreation resources within the proposed Project boundary surrounding Pyramid and Quail Lakes and the study area for the *Recreation Study* is specific to that resource.

- If required for the performance of the *Recreation Study*, the Licensees will make a good faith effort to obtain permission to access private property well in advance of initiating the study. The Licensees will only enter private property if permission has been provided by the landowner.

- The Licensees will acquire all necessary agency permits and approvals prior to beginning fieldwork for the *Recreation Study*.

- Field crews may make variances to the *Recreation Study* in the field to accommodate actual field conditions and unforeseen problems. Any variances from the *Recreation Study* will be noted in the data resulting from the *Recreation Study*.

- To prevent the introduction and transmittal of amphibian chytrid fungus and invasive aquatic species (e.g., quagga mussels, zebra mussel, and Asian clams), field crews will be trained on, provided with, and use materials (e.g., Quat) for decontaminating their boots, waders, and other equipment when leaving or traveling between water-based study sites. Field crews will follow DWR's Quagga and Zebra Mussel Rapid Response Plan and CDFW's Aquatic Invasive Species Decontamination Protocol which can be found at the following link: (https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=43333). All boats used during the study will follow cleaning protocols, including inspections before and after use. All decontamination requirements in place at Project reservoirs including those of DWR's *Quagga and Zebra Mussel Rapid Response Plan* for the SWP will be strictly followed (DWR 2010).

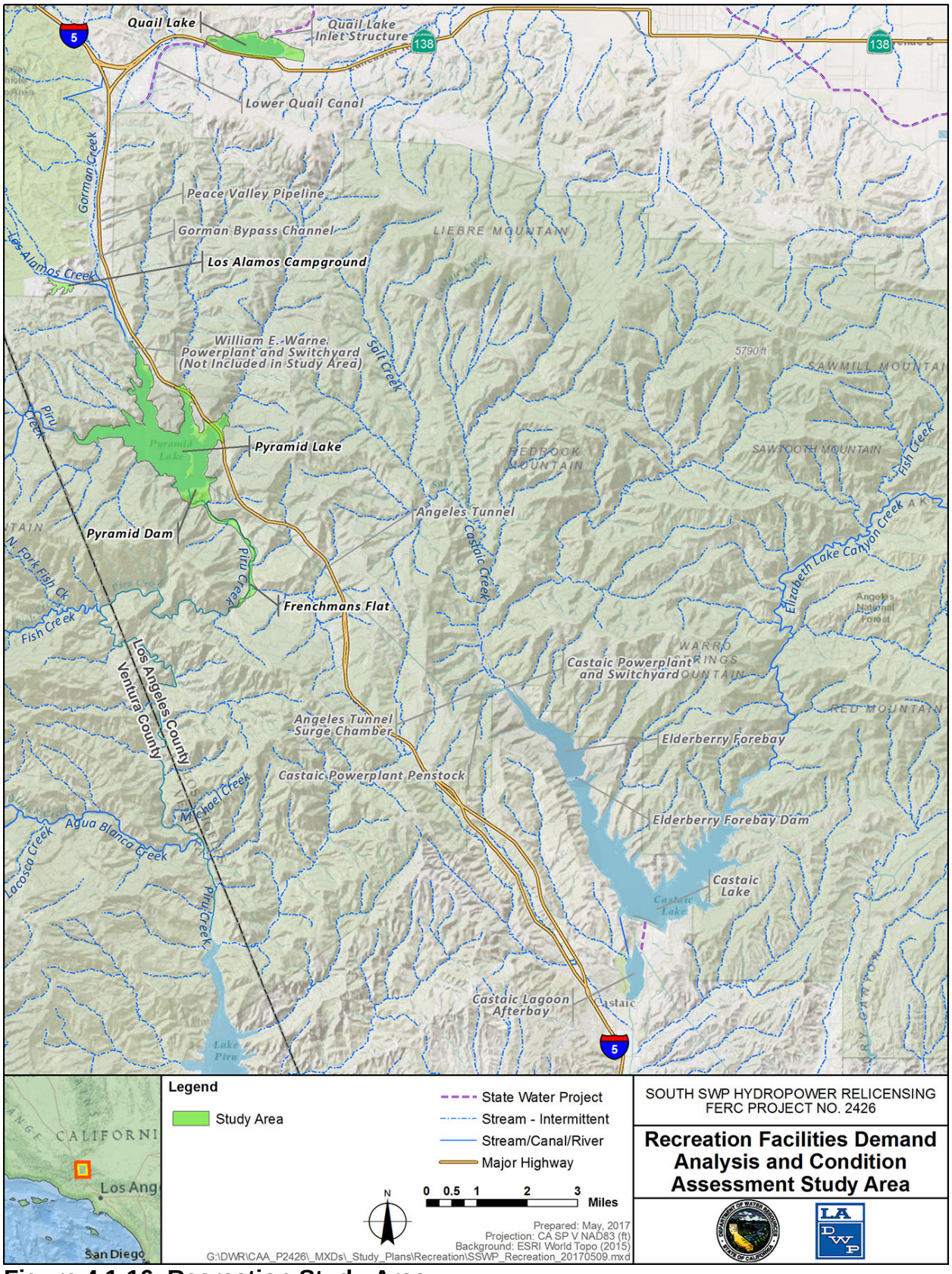

Figure 4.1-16. Recreation Study Area

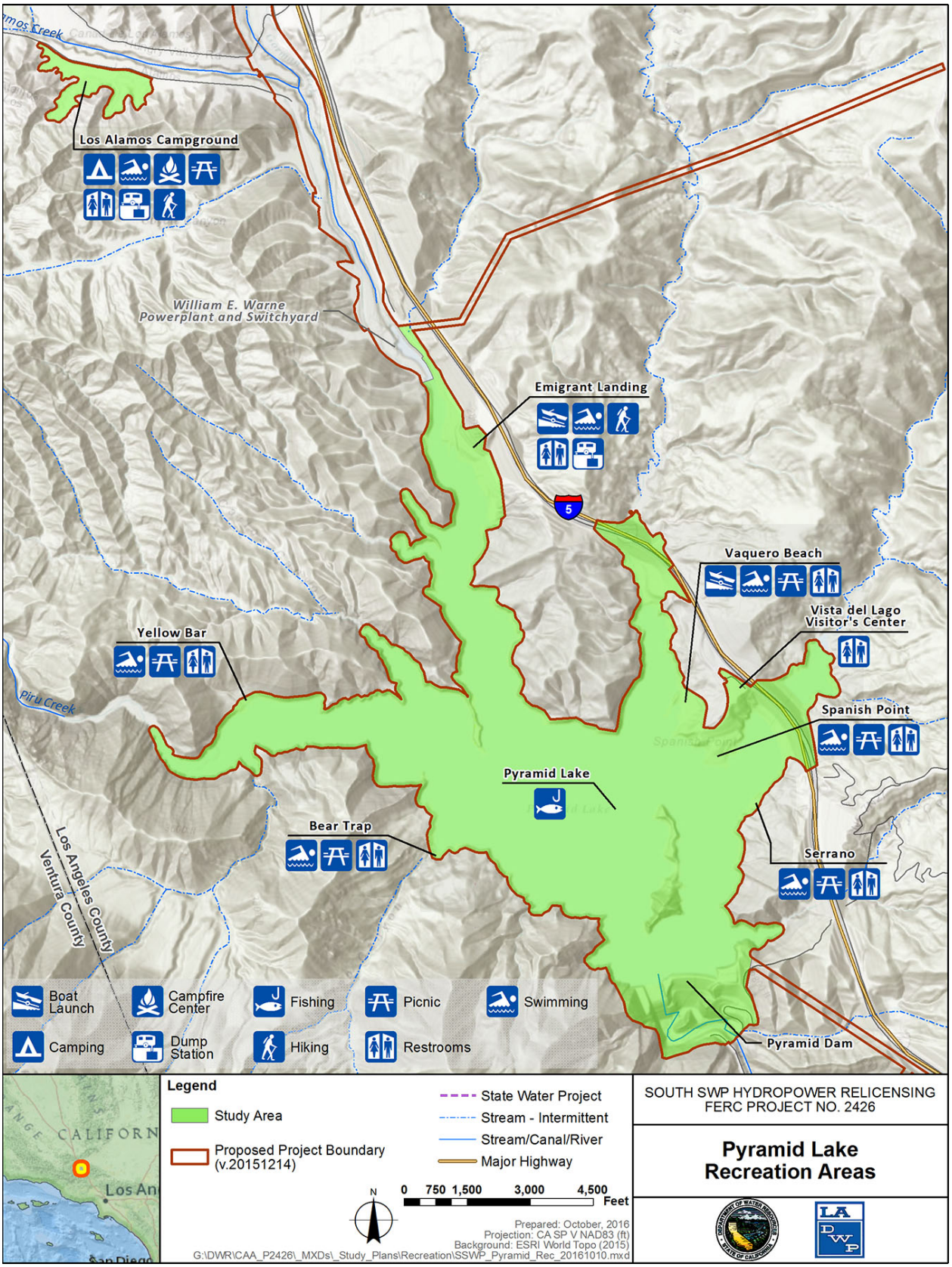

Figure 4.1-17. Pyramid Lake Recreation Areas

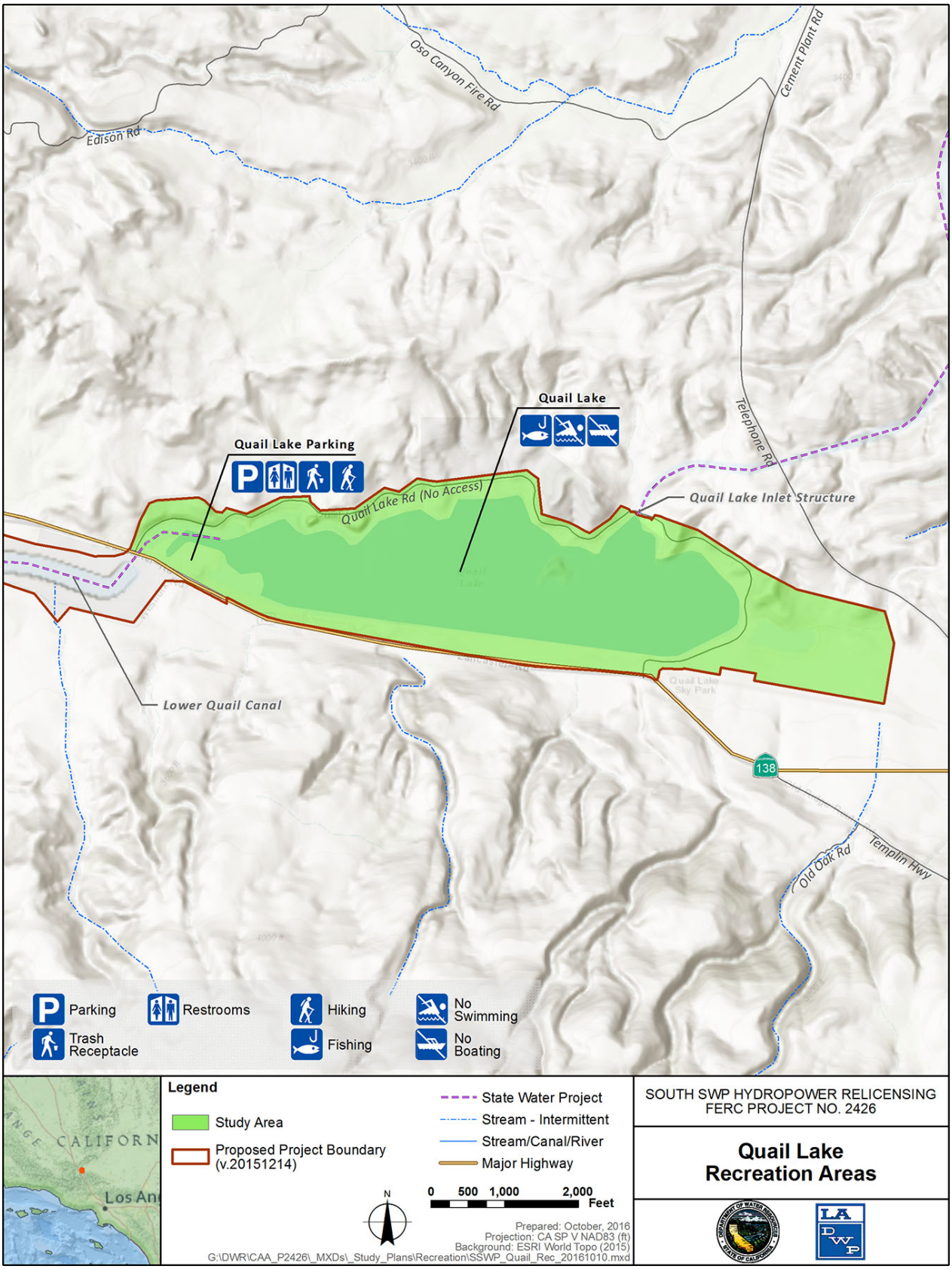

Figure 4.1-18. Quail Lake Recreation Areas

Figure 4.1-19. Frenchman's Flat Study Area

Methods

This *Recreation Study* has three components: (a) existing facility inventory, condition assessment, and carrying capacity analysis; (b) recreational facilities accessibility assessment; and (c) a recreation demand analysis.

Existing Facility Inventory, Condition Assessment, and Carrying Capacity Analysis

The Existing Facility Inventory, Condition Assessment, and Carrying Capacity Analysis portion of this *Recreation Study* will consist of three steps: (1) conduct site condition assessments; (2) field reconnaissance; and (3) carrying capacity analysis. These steps are described in more detail below.

Step 1 – Conduct Site Condition Assessments. This *Recreation Study* will inventory the number and type of components that are provided at the recreation facilities listed in Section 4.1.11.4 above, and will provide updated information with respect to what is described in the Project's *Updated Recreation Plan* (May 2016). The facility inventory and carrying capacity analysis will inform the demand analysis and will also evaluate the condition of each of the listed facilities.

The existing facility inventory will include assessments of parking areas, and the location and number of parking spaces, picnic and camping units, boat and trailer parking spaces, accessible parking spaces, and facility components. Trailheads and trails will be inventoried for signage, types of improvements, general widths, and general trail conditions. Trails will be mapped at 1:24,000-scale using the National Map Accuracy Standard of +/- 40 feet based on aerial imagery and existing GIS datasets.

Buildings within the *Recreation Study* area will be evaluated for accessibility, health and safety needs, and general energy efficiency (obvious insulation or air exchange issues, existing renewable energy, etc.). Table 4.1-10 lists the buildings that will be evaluated as part of this *Recreation Study*.

Table 4.1-10. Buildings within the *Recreation Study* Area

Building ID	Building Name	Category	Building Type	Ownership	Square Feet	Year Constructed
A3017R	Bear Trap Boat In Site	Service	Basic	National Forest (FS)	55	1974
A3019ES	Emigrant Landing Entrance Station	Service	Complex	National Forest (FS)	267	1984
A3019K	Emigrant Landing Kiosk Building	Service	Complex	National Forest (FS)	110	1975
A3019A D	Emigrant Landing Office Building	Office	Complex	National Forest (FS)	1717	1984

Table 4.1-10. Buildings within the Recreation Study Area (continued)

Building ID	Building Name	Category	Building Type	Ownership	Square Feet	Year Constructed
A3019ST 1	Emigrant Landing Storage Building 1	Storage	Basic	National Forest (FS)	190	1984
A3019ST 2	Emigrant Landing Storage Building 2	Storage	Basic	National Forest (FS)	0	1975
A3019ST 3	Emigrant Landing Storage Building 3	Storage	Basic	National Forest (FS)	0	1975
A4032R	Fishermans Point Restroom	Service	Basic	National Forest (FS)	525	1995
A4013R1	Lake Restroom 1 (floating)	Service	Basic	National Forest (FS)	154	1927
A3011R4	Los Alamos Campground 4	Service	Basic	National Forest (FS)	270	1973
A3011R1	Los Alamos Campground Restroom 1	Service	Basic	National Forest (FS)	270	1974
A3011R2	Los Alamos Campground Restroom 2	Service	Basic	National Forest (FS)	270	1974
A3011R3	Los Alamos Campground Restroom 3	Service	Basic	National Forest (FS)	270	1974
A3020R1	Los Alamos Group Campground	Service	Basic	National Forest (FS)	270	1984
2340	Los Alamos Office / Garage	Storage	Complex	National Forest (FS)	2814	1983
A3018R	Serrano Boat In Site	Service	Basic	National Forest (FS)	55	1974
A3014R	Spanish Point Restroom	Service	Basic	National Forest (FS)	540	1973
A3034ES	Vaquero Entrance Station	Service	Complex	National Forest (FS)	96	1997
A3034R1	Vaquero Restroom	Service	Basic	National Forest (FS)	240	1997
A3034R2	Vaquero Restroom	Service	Basic	National Forest (FS)	240	1997
A3034ST	Vaquero Storage	Storage	Basic	National Forest (FS)	161	1997
A3015R	Yellow Bar Restroom	Service	Basic	National Forest (FS)	55	1974

Source: USFS Comments on PSP, April 2017, Engineering Study Request (Study 21)

Paved roads leading to the Project-related recreation amenities that are identified in Table 4.1-9 will be inventoried to document road surface and condition, pull-outs, intersections, and other information about any obvious road conditions or features. GPS data of the locations of road maintenance problems on these roads will be collected and photographs will be taken to show representative conditions and problem areas.

Step 2 – Field Reconnaissance. The field reconnaissance will include a physical condition inspection of existing Project recreation facilities, designated Project trails, user-created trails, and general trail conditions. The reconnaissance will also identify observable use patterns and field verify if recreation amenities are constructed and in a condition that serves user needs with common access points and travel routes. Observable resource impacts at developed and dispersed user created Project recreational sites will be noted.

Field reconnaissance surveys to gather facility information at each of the recreation sites in the Pyramid Lake and Quail Lake areas will take several days. User created sites (sites that are frequented by recreation users but not identified as an established facility) will be identified for observable use and wear patterns.

The following steps will be taken to complete the facilities inventory:

1. Gather background data: Compile and map current facilities and upload data to GPS unit or GPS enabled application. Develop a data dictionary template for data collection to streamline collection methods, and create organization and consistency of collected data. Prepare field maps.

2. Orient the field crew with the study area for the *Recreation Study*, review field research techniques to ensure consistent inventory methods and coordinate logistics and field crew mobilization.

3. Complete reconnaissance level field research: Conduct fieldwork to create a detailed inventory on the conditions of existing recreation facilities and other user created sites within the study area for the *Recreation Study* with observable wear patterns.

4. Assemble the results and create maps of data collected in the field.

5. Prepare data and perform quality assurance.

Step 3 – Carrying Capacity Analysis. A component of the *Recreation Study* provides an overall assessment of the types and levels of recreational use in the study area for the *Recreation Study* to determine if use levels are compatible with the capacity of existing Project recreation facilities. Maintaining use levels within a recreation site's capacity is important in terms of protecting natural, cultural, and recreation resources, as well as helping to assure public safety, providing predictability and helping to assess management alternatives.

Recreation carrying capacity can be evaluated by considering several factors together to estimate a level of use beyond which impacts exceed common recreation industry and Forest Service standards. Three types of capacity will be evaluated: (1) biophysical/ecological; (2) social; and (3) physical/spatial aspects including management components. These primarily qualitative analyses focus on the capacity of existing developed recreation facilities in the study area for the *Recreation Study*. To develop capacity conclusions, this assessment will evaluate each developed site with respect to:

- Biophysical/Ecological Capacity – Relative impacts on the ecosystem, such as impacts to wetlands or riparian communities, observed soil erosion, vegetation damage, and observed trash accumulation and sanitary problems, among others. By design, developed/hardened recreation sites typically have fewer ecological concerns compared to dispersed use areas. The relative level of this factor can be noted and elaborated on in the condition assessment component.

- Social Capacity – Reported social impacts of recent and past visitor's recreation experience, such as perceived crowding, actual and/or perceived conflict, and overall satisfaction.

- Physical/Spatial Capacity – Identification of the number of units from the inventory component combined with recreation management considerations (including law enforcement) that will inform physical capacity (the number of people who can typically use a site at one time), and include a spatial capacity component. The Licensees will evaluate the general ability to enhance a site through new amenities or enlarge the site beyond its existing boundaries, including aspects related to law enforcement, visitor safety, and others.

The concept of recreation carrying capacity was originally developed out of biological models that attempted to determine the capability of a given environment (e.g., range, pasture) to sustain a specific number of animals over time. While density-related information is an important factor in capacity, in actuality, many management issues regarding recreation carrying capacity decision-making are not necessarily density dependent. Rather, recreation carrying capacity issues are also related to the ecological, social, and managerial aspects of recreational opportunities.

The full suite of recreation carrying capacity types will be assessed at each developed recreation site in the study. For each developed site in the study area for the *Recreation Study*, qualitative and quantitative data will be used to identify ecological, social, and/or management capacity impacts and establish an existing capacity parameter (expressed in qualitative terms including "below," "approaching," "at," or "exceeding" capacity). Additionally, where appropriate, any primary limiting factors for each site will be noted.

The Carrying Capacity Analysis methods will include:

- Utilize physical information from the site assessments and field reconnaissance.

- Gather Form 80 data
- Gather visitation data from concessionaire
- Use visitor questionnaire and interviews (from the demand analysis described in Section 3.1.4.7) to gather information about social capacity and perceived crowding
- Interviews with recreation providers and law enforcement officials to gather information about use levels, user patterns, and issues related to law enforcement and road traffic considerations including any parking concerns, traffic management and periodic road backups outside of entry points. Concerns related to existing levels of peak use will be documented during these interviews.
- Use information developed by other studies to understand other potential constraints around the immediate area (e.g. biological, cultural, etc.).
- Combine quantitative information on physical capacity, user data with management information and more qualitative information regarding user needs to establish an existing capacity parameter for each developed site.

Existing Facility Accessibility Assessment

Project-related recreation facilities (see Section 4.1.11.4 above) and signs at Project-related recreation facilities will be assessed for applicable accessibility requirements. Evaluating outdoor recreation facilities per the ABAAS, the FSORAG, and the FSTAG will be a common technique to establish the level of accessibility at the recreation facilities, most of which are on Federal lands.

The facility inventory assessment and facility accessibility assessment field work will be completed concurrently. Information will be collected using digital technology. A GPS unit or tablet GPS application will be used to gather facility information that has been pre-loaded with all known existing features. A data dictionary designed to provide an inventory on existing conditions of all recreation facilities within the *Recreation Study* area will be created and used to maintain consistency and organization of data collected. The condition assessment will be qualitative based on a range of repair/replacement/ maintenance needs to acceptable appearance and function to evaluate the condition of recreation facilities. Travel routes within and between recreation areas will be evaluated to determine how well they meet the U.S. Access Board criteria for Outdoor Recreation Access Routes. Photos will be taken of facilities, signs, trailheads, etc. and cataloged based on feature type or location. Other user created sites with observable wear patterns within the *Recreation Study* area will also be cataloged for further evaluation within the *Recreation Study*.

The USFS Accessibility Database will be checked prior to conducting field reconnaissance for any existing accessibility data that has been previously collected within the proposed Project boundary.

Recreation Demand Component

The Recreation Demand Component of this *Recreation Study* will consist of 6 steps: (1) observational survey; (2) visitor use questionnaire; (3) review of research publications and existing information; (4) assessment of regional uniqueness and significance of the primary recreation opportunities within the *Recreation Study* area; (5) interviews with user groups and recreation providers; and (6) a regional demand assessment. The steps are described in more detail below.

Step 1 – Observational Survey. Observed recreation use occurring in the *Recreation Study* area based on observational surveys will be used to estimate existing use. The observational surveys will be conducted during at least three different use periods (weekday, weekend and holiday weekend/or opening of fishing season) spread evenly across the March – October recreation season with each facility being visited twice in a survey day, morning and afternoon. Surveys will be conducted at the following facilities).

- Emigrant Landing Boat Launch
- Emigrant Landing Swim and Picnic Area
- Emigrant Landing Picnic and Fishing Area No. 1
- Emigrant Landing Picnic and Fishing Area No. 2
- Vista Del Lago Visitor Center
- Vaquero Day Use Area
- Quail Lake access point (parking, temporary restrooms, shoreline fishing)
- Los Alamos Campground and Group Campground
- Frenchman's Flat Day Use Area

The observation data that will be recorded includes but is not limited to vehicle counts, vehicle, boat ramp or other observed facility crowding or line ups, angler counts, boat counts, trail user counts, campground usage, and day use area usage.

Step 2 – Visitor Use Questionnaire. A concise visitor use and experience questionnaire will be fielded at Emigrant Landing, Vista Del Lago, Los Alamos Campground, Frenchman's Flat day use area, and Quail Lake recreation sites where people are present. Survey instruments will include the questions from the 2005 satisfaction "gold" form from the U.S. Forest Service National Visitor Use Monitoring (NVUM) program. Survey staff will perform surveys at each location in the morning and afternoon, for up to two hours per visit. The survey will be conducted at least three times; once on a mid-summer weekday, once on a holiday weekend and once on a typical summer weekend. The survey form will be available in English, Spanish and Mandarin Chinese languages and bi-lingual Spanish/English and Mandarin/English speaking staff (if possible) will be

available to assist with obtaining participant input from recreationists and visitors. A review of past visitor data will be assessed to determine appropriateness of target survey dates with considerations for current season use patterns and any potential unexpected conditions considered. The questionnaire will be crafted to collect information from recreationists about recreation, activity participation, accessibility needs, areas visited, group size, user conflicts, perceived crowding, visitor profile (i.e., male/female, age, race) and preferences, visual impressions, and satisfaction with or desire for recreational opportunities and facilities in the *Recreation Study* area. The questionnaire will provide an opportunity for visitors to express any potential concerns over the current state of, and future possibilities for, recreation in the *Recreation Study* area.

Step 3 – Review of Research Publications and Existing Information. Recent relevant California-based user preference surveys and other outdoor recreation surveys about recreation demand will be gathered and reviewed. These reviews include but are not limited to the 2007 California Outdoor Recreation Survey and 2012 *Survey of Public Opinions and Attitudes on Outdoor Recreation in California*, as well as more current surveys that analyze the project outdoor recreation participation rates and growth trends in the greater Los Angeles area to help address how the Project recreation facilities are helping to meet demands of the greater area. Demand and user preference studies at various scales, covering California, but especially those addressing southern California, will be reviewed for their applicability to the *Recreation Study* area. Recreation activity and participation trends information will be examined from the existing demand studies and reports, as well as USFS reports, FERC Form 80 filings, and data collected by the Licensees.

Existing use data of recreation occurring in the *Recreation Study* area from current and previous concessionaires will be collected for use in the regional demand assessment.

Step 4 – Assessment of Regional Uniqueness and Significance of the Primary Recreation Opportunities within the Recreation Study Area. Regional uniqueness and significance of the *Recreation Study* area's primary recreation opportunities will be evaluated. Site specific factors that contribute to the uniqueness of the *Recreation Study* area can inform the demand analysis and needs assessment. Within the region of the area generally covered by the ANF and LPNF, an inventory of water based recreation facilities will be compiled using Forest Planning and other recreation planning documents. The strategies, goals, and objectives established in the LMP will be reviewed to guide the assessment. Where available, information will be gathered for sites including types of designation, types of recreation opportunities available, visitation statistics (including information on visitor's origin), and general popularity for regional outdoor recreation areas. NVUM results (from the visitor use questionnaire) and methods will be used to establish user patterns in the National Forest to further inform the assessment.

Step 5 – Interviews with User Groups and Recreation Providers. Interviews will be conducted with a variety of identified regional and local recreation providers and user groups associated with recreation in the *Recreation Study* area and in the Project

vicinity. These entities, where willing, will then be interviewed to gather additional information on current use, user preferences and needs, perceived regional uniqueness and significance of recreation opportunities within the *Recreation Study* area, existing data, and observations in the *Recreation Study* area for both existing and potential future users.

Structured interviews with recreation providers and user groups will include Rocky Mountain Recreation Company, local recreation user groups (including those representing anglers, people with accessibility needs, mountain bikers, and hikers), boating vendors, rental agencies, and local landowners. In addition, an attempt will be made to interview the former concessionaire for Pyramid Lake, Parks Management Company. Some of these interviews will be done as focus group sessions where applicable. Interviews will also be conducted with key recreation management personnel, such as law enforcement officers, USFS personnel, police and fire prevention officials, and others that are closely associated with management or participation in recreation activities in the region. The interviews will provide an opportunity for representatives to provide any additional information on current or projected future recreational use within the *Recreation Study* area.

Step 6 – Regional Demand Assessment. The recreation demand analysis will compare demand with the existing supply of recreation opportunities and use patterns. This study will attempt to project recreation use and demand within the *Recreation Study* area through the term of the new license. This projection will be made using projected growth rates of the *Recreation Study* area's primary activities, projected growth rates of populations of the South Coast counties from which most of the *Recreation Study* area visitors originate, and historical trends of existing recreation use within the *Recreation Study* area. A gap analysis will be performed by comparing relative demand to supply, with consideration for trends and cultural variations in user groups based on research and forecasts of population growth. By comparing this information to a detailed inventory of existing recreation opportunities and utilizing information gathered in the observational surveys, visitor use questionnaires, carrying capacity assessment, structured interviews, and focus groups, it will be possible to determine whether there is a need for modifications to existing facilities or for the development of additional facilities and recreation amenities.

Quality Assurance and Quality Control

Field data will be collected in a manner that promotes high quality results and shall be subject to appropriate QA/QC procedures. Utilizing a small field crew for the existing facilities inventory and condition assessment (approximately 4 people each day) that work together will eliminate potential errors in data collection. All GIS data used in the field will be verified prior to the start of the field survey and field checked for accuracy and completeness. Existing recreation facilities that will be included in the reconnaissance field survey are those included in Tables 2b and 2c of the *Updated Recreation Plan* (May 2016) for South SWP Hydropower FERC Project No. 2426. These tables are comprised of recreation amenities within the *Recreation Study* area as

defined in the FERC issued document, *Project Recreation Facilities Tables, and As-Built Site Plan Drawing Guidance* (July 2014).

Analysis

The information gathered by the *Recreation Study* will be evaluated and compared to what is described in the *Updated Recreation Plan* (May 2016). The information will assess the suitability of facilities in terms of meeting the changing needs of recreation users in the *Recreation Study* area. The analysis will include developing existing and projected visitor-use estimates, along with existing and projected demand (including unmet demand) for recreational opportunities and the *Recreation Study* sites listed in section 4.1.11.4 above. The facility inventory assessment data collected will be analyzed to identify short- and long-term improvements needs over the term of the new license. For example, the Existing Facility Accessibility Assessment will be analyzed to determine if potential improvements to existing facilities are needed to improve barrier-free opportunities and if there are opportunities to better conform to current accessibility standards. The Recreation Demand Analysis will provide relevant information about user preferences and needs as related to recreation facilities provided by the Project.

Reporting

Recreation Study results, as well as other existing and relevant information will be included, to the extent completed and ready for inclusion, in the Licensees' ISR, USR, DLA, and FLA.

Consistency of Methodology with Generally Accepted Scientific Practices

An inventory of recreation opportunities and facilities, and using existing and collected information during a site visit, is consistent with generally accepted practices employed during hydropower relicensing proceedings in California including Bucks Creek (FERC Project No. 619) and Southern California Edison's Big Creek Hydroelectric Project (FERC Project No. 2175). Evaluating outdoor recreation facilities per the Architectural Barriers Act Accessibility Guidelines is a common technique to establish the level of accessibility at outdoor recreation areas and recreation facilities on NFS lands.

4.1.11.5 Schedule

The *Recreation Study* will begin after FERC issues its Study Plan Determination. The Licensees anticipate the schedule below will be followed to complete the *Recreation Study*.

Fieldwork Preparation	August – October 2017
Fieldwork	March – October 2018
Data QA/QC Review	March 2018 – February 2019
Data Analysis and Reporting	February 2018 – June 2019

4.1.11.6 Level of Effort and Cost

Based on the work effort described above, the Licensees estimate the current cost to complete this *Recreation Study* will range between $460,000 and $630,000.

4.1.11.7 References

DWR. 2016. Updated Recreation Plan. South SWP Hydropower. FERC Project No. 2426

DWR. 2010. The Quagga and Zebra Mussel Rapid Response Plan for the State Water Project. 93 pp. CONFIDENTIAL/PRIVILEGED – Not for Public Distribution.

FERC. 2014. Project Recreation Facilities Tables, and As-Built Site Plan Drawing Guidance.

United States Access Board. Architectural Barriers Act Standards Chapter 10: Recreation Facilities. <https://www.access-board.gov/guidelines-and-standards/buildings-and-sites/about-the-aba-standards/aba-standards/chapter-10-recreation-facilities>

USFS. Accessibility documents: Forest Service Outdoor Recreation Accessibility Guidelines and Forest Service Trail Accessibility Guidelines. <http://www.fs.fed.us/recreation/programs/accessibility/>

4.1.12 Cultural Resources Study

4.1.12.1 Project Nexus

Continued Project O&M and Project-related recreation activities have potential to affect historic properties. Under 36 Code of Federal Regulations (C.F.R.) Section (§) 800.16(l)(1), “historic properties” are defined as prehistoric or historic sites, buildings, structures, objects, districts, or properties of traditional religious and cultural importance that are included in, or eligible for inclusion in, the NRHP. Historic properties are identified through a process of evaluation against specific criteria found at 36 C.F.R. § 60.4. Therefore, Project O&M also has the potential to affect properties not yet evaluated for listing on the NRHP, referred to in this *Cultural Resources Study* as cultural resources, and defined herein as any prehistoric or historic district, site, building, structure, or object, regardless of its NRHP eligibility.

This *Cultural Resources Study* does not address ethnographic or TCP resources, which are addressed in the *Tribal Resources Study*, a separate study being undertaken as part of this relicensing effort.

4.1.12.2 Existing Information and Need for Additional Information

Existing, relevant, and reasonably available information regarding cultural resources within the proposed Project boundary is provided in Section 4.11 of the Licensees’ PAD.

As a summary, the Licensees reviewed approximately 100 previous cultural resources investigations and other documents.

The majority of the previous cultural resources investigations within the proposed Project boundary were performed more than ten years ago. Professional standards may change over time, as may site and field conditions. This *Cultural Resources Study* includes a field survey, because the existing and relevant information indicates that the lands within the proposed Project boundary may contain both prehistoric and historic built cultural resources, as well as potentially undocumented cultural resources.

4.1.12.3 Study Goals and Objectives

The goal of the *Cultural Resources Study* is to determine if continued Project O&M and Project-related recreation could affect cultural resources that have not been previously evaluated for the NRHP, or that are already listed on or eligible for listing on the NRHP.

The objective of this *Cultural Resources Study* is to gather sufficient information necessary to fill recognized information gaps to help determine if continued Project O&M and Project-related recreation activities could and cultural resources.

4.1.12.4 Study Methods

Study Area

The study area for the *Cultural Resources Study* generally consists of all lands within the proposed Project boundary, as defined by the known or potential locations of Project O&M (including direct and indirect disturbances) and Project facilities and features, including dams, spillways, powerhouses, Project-related recreation areas, transmission lines, access roads, staging areas, and other appurtenant facilities. The *Cultural Resources Study* excludes lands overlying the Angeles Tunnel on which the Licensees do not perform any Project-related activities.

It is anticipated that the study area and the Area of Potential Effect (APE) are synonymous, pending the SHPO's concurrence on the APE. As defined in 36 C.F.R. Section 800.16(d), the APE is:

> ...the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking.

The study area (proposed APE) for the *Cultural Resources Study* is shown in Figure 4.1-20. If, following SHPO's concurrence on the proposed APE, potential Project-related effects are identified outside of the APE, Licensees will expand the APE in consultation with tribes and agencies, and seek additional concurrence on the modifications from the SHPO.

General Concepts and Procedures

- Personal safety is the most important consideration of each fieldwork team. Fieldwork will only occur in safely accessible areas and under conditions deemed safe by the field crews. Locations within the study area that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed; these areas will be identified in the Privileged Report and an explanation for survey exclusion will be provided.

- The *Cultural Resources Study* will begin after FERC issues its Study Plan Determination.

- The *Cultural Resources Study* does not include the development of requirements for the new license, which will be addressed outside the study.

- The *Cultural Resources Study* focuses specifically on the proposed APE. Resources that extend beyond the APE may be documented in full, to include portions extending outside the APE, if found to be necessary to evaluate the resource and/or to assess Project-related effects on the resource.

- If required for the performance of the *Cultural Resources Study*, the Licensees will make a good faith effort to obtain permission to access private property well in advance of initiating the *Cultural Resources Study*. The Licensees will only enter private property if permission has been provided by the landowner.

- The Licensees will acquire all necessary agency permits and approvals prior to beginning fieldwork for the *Cultural Resources Study* (i.e., Archaeological Resources Protection Act permits to survey NFS lands and necessary permits from BLM to survey on BLM lands).

- Field crews may make variances to the *Cultural Resources Study* in the field to accommodate actual field conditions and unforeseen problems. Any variances from the *Cultural Resources Study* will be noted in the subsequent study report described below under *Methods*.

- To prevent the introduction and transmittal of amphibian chytrid fungus and invasive aquatic species (e.g., quagga mussels, zebra mussel, and Asian clams), field crews will be trained on, provided with, and use materials (e.g., Quat) for decontaminating their boots, waders, and other equipment when leaving or traveling between water-based study sites. Field crews will follow DWR's Quagga and Zebra Mussel Rapid Response Plan and CDFW's Aquatic Invasive Species Decontamination Protocol which can be found at the following link: (https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=43333). All boats used during the study will follow cleaning protocols, including inspections before and after use. All decontamination requirements in place at Project reservoirs

including those of DWR's *Quagga and Zebra Mussel Rapid Response Plan* for the SWP will be strictly followed (DWR 2010).

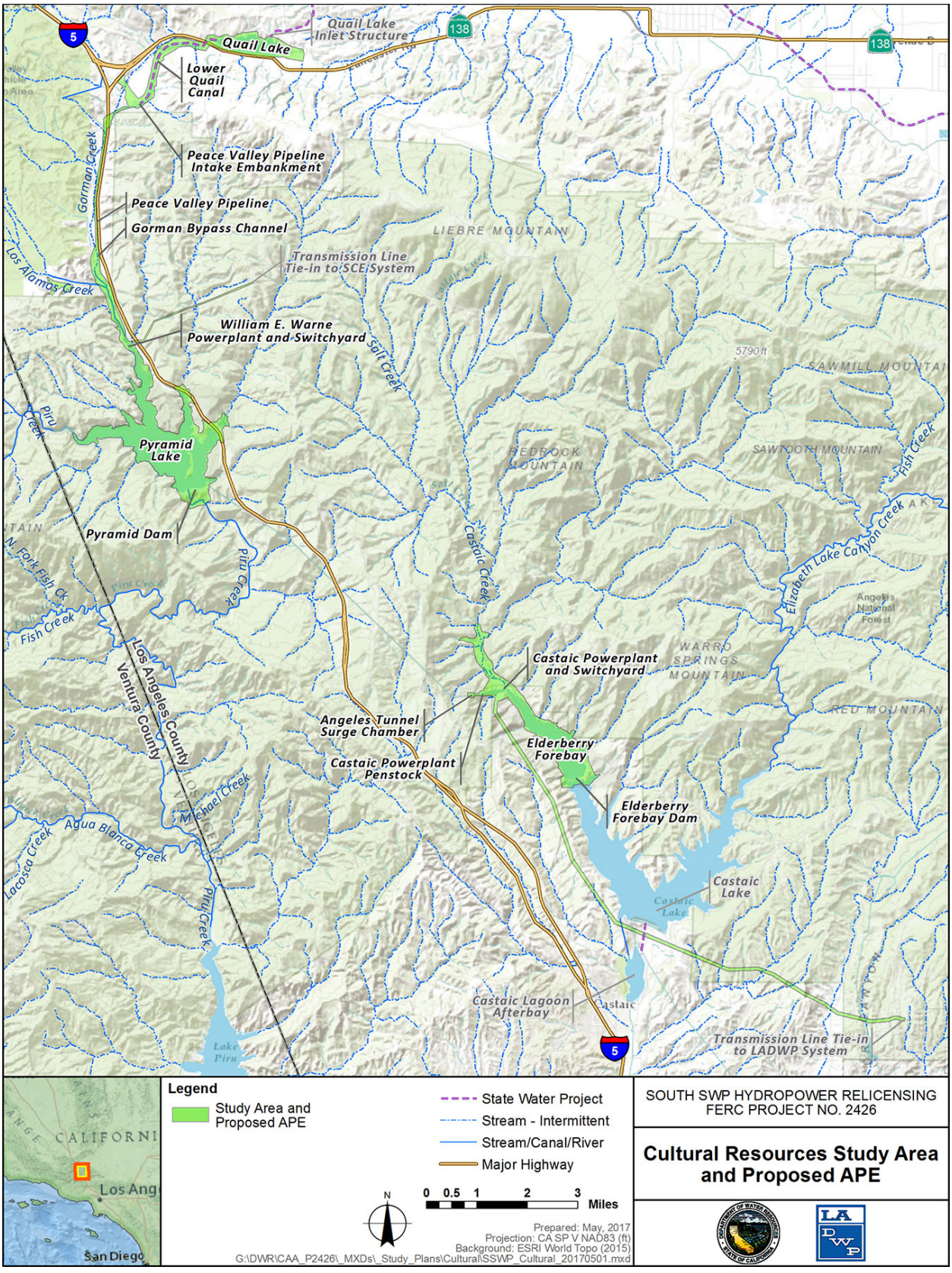

Figure 4.1-20. Cultural Resources Study Area and Proposed APE

Methods

The *Cultural Resources Study* will consist of three steps: (1) perform archival research; (2) conduct field survey and identify resources; and (3) identify and assess potential Project effects on identified cultural resources. These steps are described below.

Step 1 – Perform Archival Research. Additional archival research, beyond that already completed during the PAD development, will be conducted under this *Cultural Resources Study*. Appropriate repositories to be visited during this effort may include those listed below, if relevant information is found to be archived at these locations, as well as other sources as they are identified during the course of the *Cultural Resources Study.* These repositories will be visited to obtain additional information specific to known cultural resources in the study area and cultural resources that may potentially be present in the study area. The results of the archival research will serve as the basis for preparing the prehistoric and historic contexts against which cultural resources identified during the *Cultural Resources Study* may be understood and potentially evaluated for the NRHP, and will provide detailed background information to facilitate the field survey portion of this study.

Potential places, repositories, or other sources that may provide relevant background information include:

- Oral histories, as applicable
- California State Library, California Room
- Local historical societies
- Local museums
- Local universities and college libraries including the South Central Coastal Information Center at California State University, Fullerton
- Relevant federal, State, or local agency documents not accessed or made available during the PAD data gathering

Step 2 – Conduct Field Survey and Identify Resources

Archaeological Field Survey

Following completion of Step 1, the Licensees will conduct a field survey to verify locations of and document any changes to previously recorded cultural resources and to identify and document previously unknown cultural resources, if present, in the study area for the *Cultural Resources Study*. This will be completed by examining all accessible lands within the study area for the *Cultural Resources Study*. Locations within the study area for the *Cultural Resources Study* that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed; these areas will be

identified in the *Cultural Resources Study* report and an explanation for survey exclusion will be provided. The field survey and recording of cultural resources will follow the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation* (NPS 1983) and the State of California Office of Historic Preservation (OHP) publication *Instructions for Recording Historical Resources* (OHP 1995).

Field methods will include crew members walking parallel transects spaced 15-20 meters apart. In areas containing moderately dense vegetation or moderately steep terrain, the survey strategy may employ 20- to 40-meter transects. Topographical features considered to be sensitive for cultural resources (e.g., springs, benches, terraces, ridgelines, knobs, and drainages) will be thoroughly inspected. Lands typically inundated by the Project reservoirs that become accessible during the survey season as a result of normal reservoir drawdown or other O&M activities will be surveyed when feasible. Although the reservoirs are normally kept at or close to full pool, drawdowns happen occasionally for maintenance and other purposes. To the extent possible and to take advantage of low water levels during drawdowns, the field surveys of the reservoirs will be scheduled to occur as close to the periods of low reservoir levels as possible. Additionally, each site identified during the *Cultural Resources Study* will be assessed for potential Project-related effects including, but not limited to, water fluctuation, wave action, recreational impacts, and vegetation management activities. The areas examined during the field survey will be plotted onto the appropriate USGS 1:24,000 scale topographic maps. The Licensees will not collect artifacts during the survey. All encountered artifacts will be left in place, diagnostic artifact locations will be documented using a GPS receiver with sub-meter accuracy, or if diagnostic artifacts are concentrated within certain locations of the study area for the *Cultural Resources Study*, the artifact concentrations and overall site areas will be documented as described below. The GPS data will be based on the North American Datum of 1983 and utilize the Universal Transverse Mercator system. No subsurface testing will be conducted as part of this study. Additional fieldwork or evaluation may be required subsequent to this study based on consultation with Native American tribes, land managing agencies, FERC and SHPO. Should subsequent activities be planned in consultation with these parties, in which materials will be collected, the disposition of these materials, and any selected curation facility, will be determined as part of the consultation.

Previously recorded cultural resources will be located and their records updated to document their current condition, to note any changes from their previous documentation, and/or to bring their existing resource records up to current OHP standards for recording resources (OHP 1995). Sites documented during the survey will be evaluated for their NRHP eligibility at the survey level if the results of the archival research and field survey provide adequate information (e.g., surface sites with no potential for subsurface deposits, few or no diagnostic artifacts, no discernible historic associations or data potential, etc.) to make the assessments.

Newly discovered cultural resources, including isolated finds, will be fully documented on State of California Department of Parks and Recreation 523 Forms A-L following the procedures outlined in the *Instructions for Recording Historical Resources* (OHP 1995).

A sketch map will be drawn to-scale for re-documented archaeological sites, if needed, and for newly discovered sites. Sites, historic built resources, and isolates will be photographed using digital color photography. The locations of archaeological sites, historic built resources, and isolates documented during the field survey will be plotted onto the appropriate USGS 1:24,000 scale topographic map by hand at the time of discovery, and the locations recorded using a GPS receiver.

In the event that human remains are encountered during the survey, the provisions outlined in Section 7050.5 of the California Health and Safety Code and Section 5097.98 of the Public Resources Code will be followed, and pertinent agency staff will be notified, in addition to the Advisory Council on Historic Preservation's (ACHP) policy for the treatment of human remains (ACHP 2007). If the remains are found on federal lands and determined to be of Native American ancestry, the provisions provided in the Native American Graves Protection and Repatriation Act, 43 C.F.R. 10.6 *Inadvertent discoveries*, will also be followed. Upon discovery, the field crew will immediately contact the Licensees. The Licensees will notify the federal land managing agency or county coroner, as appropriate. The field crew will cease all work within 100 feet of the discovery and secure the location to the extent possible. All remains and artifacts associated with the discovery will be left undisturbed and the location recorded using a GPS receiver. Field crew members will keep notes on any calls and events that occur during this process. Field crew members and other Project personnel will keep the location of the discovery confidential and will not publically disclose the location. Work will resume in the immediate vicinity of the find after the appropriate actions have been implemented. All resource locations are considered to be confidential and will only be included in Privileged documents provided on a need-to-know basis (e.g., to FERC, tribes, USFS, BLM, and SHPO for reviews).

Built Environment Inventory

A field inspection and documentation of historic built-environment resources (i.e., buildings and structures 45 years in age and older) located within the study area for the *Cultural Resources Study* will be conducted. Historic built-environment resources will be recorded or re-recorded to meet current OHP standards for documentation (OHP 1995). This will include digital color photography and sketch maps of individual features that show the relationship between buildings and structures. The historic built environment resources within the proposed Project boundary identified during the *Cultural Resources Study* will be assessed individually and, where appropriate, as a potential historic district for inclusion on the NRHP. These resources will be evaluated within an appropriate historic context to assess their importance.

Step 3 – Identify and Assess Potential Project Effects on Identified Cultural Resources.
During Step 2, the Licensees will document any potential Project-related effects to cultural resources identified in the study area for the *Cultural Resources Study*. This information will be analyzed in Step 3 to determine whether any unevaluated or NRHP listed or eligible resources are being affected by ongoing Project O&M or Project-related recreation activities, thereby informing the need to conduct NRHP evaluations for any resources that are potentially affected. Cultural resources that can be evaluated for the

NRHP based on archival research and field observations and documentation, regardless of whether or not they are experiencing Project-related effects, will be evaluated for the NRHP under Step 3. The Licensees will consult with the tribes, agencies, and SHPO regarding these evaluations, the need for any additional studies that may be necessary to evaluate other cultural resources experiencing Project effects, and to develop a schedule to conduct any subsequent evaluations[47]. Minimally, the Licensees will include the results of this consultation, including the schedule, in the cultural resources report, DLA, and FLA.

Quality Assurance and Quality Control

Field data gathered during this *Cultural Resources Study* will be collected in a manner that promotes high quality results, and will be subject to appropriate QA/QC procedures to check for accuracy and completeness. Data gathering during the field survey will be overseen by qualified archaeologists and architectural historians who meet the Secretary of the Interior's Qualification Standards to ensure that data gathering techniques, documentation, and other efforts meet current professional standards. Cultural resources specialists will provide oversight and reviews of cultural resources document preparation.

Analysis of Potential Project Effects

The data gathered during the *Cultural Resources Study* will be used to determine whether Project O&M or Project-related recreational activities are affecting any identified cultural resources in the study area for the *Cultural Resources Study*; to identify the need for NRHP evaluations of affected, unevaluated resources; and to determine if there is a need to implement treatment to mitigate potential Project effects on NRHP-eligible or listed properties. This information will be provided in the report discussed below, and the DLA and FLA.

Reporting

Cultural Resources Study results, excluding confidential information, will be included in the Licensees' ISR, USR, DLA and FLA. In addition, the Licensees will prepare a Privileged report that includes the following sections: (1) Study Goals and Objectives; (2) Methods; (3) Results of the survey (i.e., descriptions of the cultural resources documented during the study, their NRHP status, and any Project-related effects identified); and (4) NRHP evaluations of Project-affected cultural resources and the schedule to conduct subsequent evaluations. Documentation of all tribal, agency, and

[47] 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 concludes its Section 106 responsibilities for the relicensing by issuing a Programmatic Agreement that requires Licensees develop and implement an HPMP that considers and manages effects on historic properties throughout the term of the license. While not a part of this study, it is anticipated that the information developed by this and other relicensing studies will be used to develop a HPMP in consultation with interested parties after the Cultural Resources Study has been completed.

SHPO consultation conducted during the study, including correspondences, will be appended to the report.

The Privileged report will include documentation that clearly depicts the following on USGS 1:24,000 topographic maps: the APE; survey coverage (i.e., which areas could be accessed safely and which areas could not and why); and intensity of the survey coverage. The report will contain sensitive, confidential, and privileged information. As such, the report will only be distributed to interested tribes, FERC, land managing agencies as appropriate (e.g., USFS, BLM, etc.), and SHPO for review and comment as part of the NHPA Section 106 consultation process. The Licensees will seek SHPO's concurrence on historic property identification efforts and any NRHP eligibility evaluations conducted during the study. Following that review, the report will be filed with FERC as Privileged.

4.1.12.5 NHPA Section 106 Consultation

The PAD and draft *Cultural Resources Study* were provided to potentially-affected Indian tribes, land managing agencies, and the SHPO for review and comment. Additionally, FERC initiated consultation with the tribes and SHPO for purposes of the undertaking, and designated the Licensees as FERC's non-federal representative for purposes of day-to-day consultation. The day-to-day consultation serves to assist FERC in meeting its compliance requirement under Section 106 of the NHPA, though FERC maintains its responsibility for formal government-to-government consultation. The Licensees will consult with the tribes, agencies, and SHPO throughout the study and the relicensing process.

4.1.12.6 Consistency of Methodology with Generally Accepted Scientific Practices

This *Cultural Resources Study* is consistent with the goals, objectives, and methods outlined for the most recent FERC hydropower relicensing efforts in California, including the Don Pedro Project (FERC No. 2299), the Yuba River Development Project (FERC No. 2246), and the Merced River Hydroelectric Project (FERC No. 2174). The methods are consistent with the NPS guidelines (1983).

4.1.12.7 Schedule

The Licensees anticipate scheduling field surveys at a time when the weather permits. Surveys in the area below the NMWSE of the Project reservoirs will be scheduled to make use of, to the extent possible, normal drawdowns and low water levels. The Licensees anticipate the schedule below will be followed to complete the study.

Fieldwork Preparation	July 2017
Fieldwork	August 2017 – October 2017
Data QA/QC	October 2017 – June 2018
Data Analysis and Reporting	July 2018 – December 2018

4.1.12.8 Level of Effort and Cost

Based on the work effort described above, the Licensees estimate the current cost to complete this *Cultural Resources Study* will range between $387,000 and $516,000.

4.1.12.9 References

Advisory Council on Historic Preservation. 2007. Policy Statement Regarding Treatment of Burial Sites, Human Remains, and Funerary Object. Washington, D.C.

DWR. 2010. The Quagga and Zebra Mussel Rapid Response Plan for the State Water Project. 93 pp. CONFIDENTIAL/PRIVILEGED – Not for Public Distribution.

NPS. 1983. Archaeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines in the Federal Register, September 29, 1983 (48 FR 44716). Department of the Interior, Washington, D.C.

OHP. 1995. Instructions for Recording Historical Resources. Sacramento, CA.

4.1.13 Tribal Resources Study

4.1.13.1 Project Nexus

Continued Project O&M and Project-related recreation activities have potential to affect tribal resources. For the purpose of this *Tribal Resources Study*, tribal resources include Indian Trust Assets (ITA), TCPs, and other potential resources and interests important to Indian tribes (e.g., ethnographic sites, economic interests and other tribal cultural interests). Agreements that may exist between tribes and other entities may be useful in identifying potentially undocumented tribal resources (e.g. tribal plant gathering areas on lands where USFS has granted permission). Many of these tribal resources have the potential to be a historic property. Historic properties are defined under 36 C.F.R. § 800.16(l) as any prehistoric or historic sites, buildings, structures, objects, districts, or properties of traditional religious and cultural importance that are included in, or eligible for inclusion in, the NRHP. This *Tribal Resources Study* does not address other cultural resources, which are addressed in the *Cultural Resources Study*, a separate relicensing study.

4.1.13.2 Existing Information and Need for Additional Information

Existing, relevant, and reasonably available information regarding tribal resources within the proposed Project boundary is provided in Section 4.13 of the Licensees' PAD. As a summary, the Licensees identified approximately 100 previous cultural resources investigations and other documentation, of which 41 previous studies occurred directly within the proposed Project boundary. None of the previous studies identified any TCPs, ITAs, sacred lands, Indian reservations, or tribal agreements that pertain to Indian tribal land use within the proposed Project boundary. Previous studies did not include ethnographic or TCP investigations. A list of potentially interested tribes is provided below in Table 4.1-11.

This *Tribal Resources Study* will augment existing, relevant, and reasonably available information by providing current information regarding tribal resources that could be affected by the Project.

Table 4.1-11. Tribal Contacts Provided by the Native American Heritage Commission and FERC

Barbareno/Ventureno Band of Mission Indians Raudel Joe Banuelos, Jr. 331 Mira Flores Court Chumash Camarillo, CA 93012	Barbareno/Ventureno Band of Mission Indians Kathleen Pappo 2762 Vista Mesa Drive Rancho Pales Verdes, CA 90275
Barbareno/Ventureno Band of Mission Indians Julie Lynn Tumamait-Stennslie, Chair 365 North Poli Avenue Ojai, CA 93023	Coastal Band of the Chumash Nation Michael Cordero, Chairperson P.O. Box 4464 Santa Barbara, CA 93140
Fernandeno Tataviam Band of Mission Indians Rudy Ortega Jr., President 1019 2nd Street San Fernando CA 91403	Gabrielino Band of Mission Indians - Kizh Nation Andrew Salas, Chairperson P.O. Box 393 Covina, CA 91723
Gabrielino Tongva Indians of California Tribal Council Robert F. Dorame, Tribal Chair/Cultural Resources P.O. Box 490 Bellflower, CA 90707	Gabrielino/Tongva Nation Sam Dunlap, Cultural Resources Director P.O. Box 86908 Los Angeles, CA 90086
Gabrielino/Tongva Nation Sandonne Goad, Chairperson 106 1/2 Judge John Aiso Street Los Angeles, CA 90012	Gabrielino/Tongva San Gabriel Band of Mission Indian Anthony Morales, Chairperson P.O. Box 693 San Gabriel, CA 91778
Gabrielino-Tongva Tribe Bernie Acuna, Co-Chairperson 1999 Avenue of the Stars, Suite 1100 Los Angeles, CA 90067	Gabrielino-Tongva Tribe Conrad Acuna 1999 Avenue of the Stars, Suite 1100 Los Angeles, CA 90067
Gabrielino-Tongva Tribe Linda Candelana, Co-Chairperson 1999 Avenue of the Stars, Suite 1100 Los Angeles, CA 90067	Randy Guzman-Folkes 4676 Walnut Avenue Simi Valley, CA 93063
LA City/County Native American Indian Commission Ron Andrade, Director 3175 West 6th Street, Rm. 403 Los Angeles, CA 90020	Melissa M. Parra-Hernandez 119 North Balsam Street Oxnard, CA 93030
PeuYoKo Perez 5501 Stanford Street Ventura, CA 93003	Carol A. Pulido 165 Mountain View Street Oak View, CA 93022
San Fernando Band of Mission Indians John Valenzuela, Chairperson P.O. Box 221838 Newhall, CA 91322	Patrick Tumamait 992 El Camino Corte Ojai, CA 93023

Table 4.1-11. Tribal Contacts Provided by the Native American Heritage Commission and FERC (continued)

Tongva Ancestral Territorial Tribal Nation John Tommy Rosas, Tribal Admin. 712 Admiralty Way, Suite 172 Marina Del Rey, CA 90292	Tejon Indian Tribe Octavio Escobedo, Tribal Chair 1731 Hasti Drive, #108 Bakersfield, CA 93309
Kern Valley Indian Council Robert Robinson, Co-Chairperson P.O. Box 401 Weldon , CA 93283	Kitanemuk & Yowlumne Tejon Indians Delia Dominguez, Chairperson 115 Radio Street Bakersfield , CA 93305

[1]Santa Ynez Band of Chumash Indians was included in the Native American Heritage Commission's list of contacts but declined FERC's invitation to participate in the relicensing and is, therefore, not included in Table 4.1-11 (FERC 2016).

4.1.13.3 Study Goals and Objectives

The goal of the *Tribal Resources Study* is to identify resources and interests important to Indian tribes within the proposed Project boundary and identify continued Project O&M and Project-related recreation activities that may potentially affect these tribal resources.

The objective of this *Tribal Resources Study* is to gather sufficient data necessary to fill recognized information gaps using current field and research methods to identify tribal resources.

4.1.13.4 Study Methods

Study Area

The study area for the *Tribal Resources Study* consists of the area within the proposed Project boundary, as defined by the known or potential locations of Project O&M (including direct and indirect disturbances) and Project facilities and features. This study does not include lands overlying the Angeles Tunnel on which the Licensees do not perform any Project O&M activities. The study area for the *Tribal Resources Study* is shown below in Figure 4.1-21.

It is anticipated that the study area and the Area of Potential Effect (APE) are synonymous, pending the SHPO's concurrence on the APE. As defined in 36 C.F.R. Section 800.16(d), an APE is:

> ...the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking.

If potential Project-related effects are identified outside of the study area, the Licensees will expand the study area and APE, in consultation with tribes and agencies, and seek concurrence from the SHPO on the expanded APE.

General Concepts and Procedures

- Personal safety is the most important consideration of each fieldwork team. Fieldwork will only occur in safely accessible areas and under conditions deemed safe by the field crews. Locations within the study area that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed; these areas will be identified in the Privileged Report and an explanation for survey exclusion will be provided.

- The *Tribal Resources Study* will begin after FERC issues its Study Plan Determination.

- The *Tribal Resources Study* does not include the development of requirements for the new license, which will be addressed outside of the *Tribal Resources Study*.

- This *Tribal Resources Study* focuses specifically on tribal resources within the proposed Project boundary and APE. Resources that extend beyond the APE may be documented in full, including portions extending outside the APE, if found to be necessary to evaluate the resource and/or to assess Project-related effects on the resource.

- If required for the performance of the *Tribal Resources Study*, the Licensees will make a good faith effort to obtain permission to access private property well in advance of initiating the *Tribal Resources Study*. The Licensees will only enter private property if permission has been provided by the landowner.

- The Licensees will acquire all necessary agency permits and approvals prior to beginning fieldwork for the *Tribal Resources Study*.

- Field crews may make variances to the *Tribal Resources Study* in the field to accommodate actual field conditions and unforeseen problems. Any variances from the *Tribal Resources Study* will be noted in the subsequent study report described below under *Methods.*

- To prevent the introduction and transmittal of amphibian chytrid fungus and invasive aquatic species (e.g., quagga mussels, zebra mussel, and Asian clams), field crews will be trained on, provided with, and use materials (e.g., Quat) for decontaminating their boots, waders, and other equipment when leaving or traveling between water-based study sites. Field crews will follow DWR's Quagga and Zebra Mussel Rapid Response Plan and CDFW's Aquatic Invasive Species Decontamination Protocol which can be found at the following link: (https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=43333). All boats used during the study will follow cleaning protocols, including inspections before and after use. All decontamination requirements in place at Project reservoirs

including those of DWR's *Quagga and Zebra Mussel Rapid Response Plan* for the SWP will be strictly followed (DWR 2010).

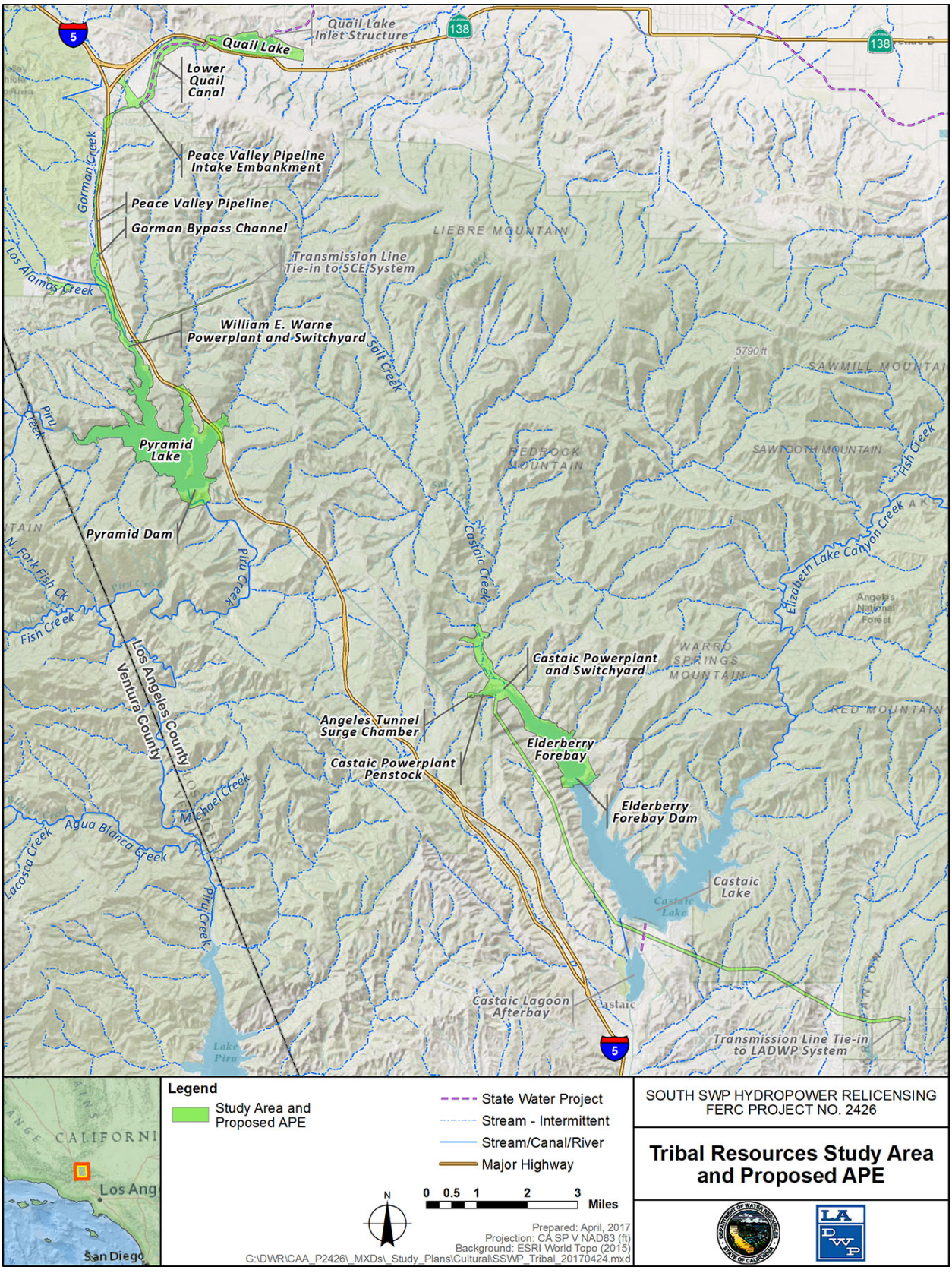

Figure 4.1-21. Tribal Resources Study Area and Proposed APE

Methods

The *Tribal Resources Study* will consist of three steps: (1) perform ethnographic literature review; (2) consult with Indian tribes and identify resources; and (3) conduct site visits. Each of these steps is described below.

Step 1 – Perform Archival Research. The Licensees will augment existing, relevant, and reasonably available information described in the PAD by performing additional archival research at various repositories across the state that contain pertinent ethnographic and ethnohistorical records, such as those listed below, as well as other relevant repositories that may be identified during the study:

- University of California, Berkeley, the Bancroft Library
- California State Library, California Room
- South Central Coastal Information Center, California State University, Fullerton
- National Archives and Records Administration, Pacific Region, San Francisco
- National Park Service Preservation Brief 36
- Phoebe Hearst Museum of Anthropology

Step 2 – Consult with Indian Tribes and Identify Resources. Following the ethnographic literature review discussed in Step 1, the Licensees will identify potential tribal resources by consulting and interviewing tribal representatives. Consultation, fieldwork, and potential tribal resources documentation will be consistent with National Register Bulletin No. 38, *Guidelines for Evaluating and Documenting Identification of Traditional Cultural Properties* (Parker and King 1998).

In order to facilitate tribal consultation, the Licensees will retain a qualified, professional ethnographer. This *Tribal Resources Study* will include contacting the tribal representatives identified above in Table 4.1-11. Additionally, Licensees and the ethnographer will work with these tribal contacts and the appropriate land managing agencies (i.e., ANF, LPNF, BLM, etc.) to identify other potential, local tribal contacts and informants not listed in Table 4.1-11 who might be able to provide significant information to the *Tribal Resources Study*.

The Licensees and the ethnographer will coordinate with tribal representatives (i.e., tribal chairs, or his or her delegate, as directed by the tribal chairs) to define the scope and breadth of interviews as well as establish any needed administrative and process requirements including any applicable confidentiality agreements. The ethnographer will arrange for interviews with identified tribal representatives to establish times and locations acceptable to the tribal representatives. The Licensees will arrange for an initial introductory meeting between the Licensees, tribal representatives, and the ethnographer.

Interviews with tribal representatives may be conducted on a one-on-one basis and/or in group settings with the ethnographer. The oral traditions and information collected during the interviews will be used to help define potential tribal resources in the study area for the *Tribal Resources Study*.

If a participating tribe does not wish to disclose the locations of potential tribal resources, the Licensees and the ethnographer will work with the tribe to identify the general issues and concerns that the tribe may have regarding potential impacts of the Project upon resources identified by the tribe.

Step 3 – Conduct Site Visits. Tribal members, or a physically capable designated tribal representative, the Licensees' ethnographer, and the Licensees' cultural resources specialist may visit the general study area and/or specific cultural resource sites and other locations (i.e., locations containing artifacts, features, or other physical remains from past human activities) identified during this *Tribal Resources Study* or during the Licensees*' Cultural Resources Study*. The purpose of the visit will be to provide tribal representatives the opportunity to examine any sites of tribal interest that were encountered during the *Cultural Resources Study* fieldwork, and to enable the ethnographer to obtain additional information on potential tribal resources that may be associated with the sites. The Licensees and the Licensees' ethnographer will cooperatively make a reasonable effort to reach out to interested tribes to invite participation in *Tribal Resources Study* site visits by calling, sending letters by way of the United States Postal Service, or through electronic mail to the tribal chair or his or her designee. If any ethnographic sites (e.g., locations of tribal resources or activities that may or may not contain the physical remains from past or present activities) are identified during background research, tribal representatives may also wish to visit those locations. Depending on the tribes' wishes, the ethnographer may also visit the ethnographic sites.

Places of tribal interest will be mapped. Documentation will include descriptions of the resources, the sources of tribal information, NRHP eligibility status, any Project-related effects, and any correlations to archaeological sites identified in the *Cultural Resources Study.*

Quality Assurance and Quality Control

Field data will be collected in a manner that promotes high quality results, and will be subject to appropriate QA/QC procedures including checking field data for accuracy and completeness. The Licensees' ethnographer will meet the professional qualifications included in National Register Bulletin 38 (Parker and King 1998) to ensure that data gathering techniques, documentation, and other efforts meet current professional standards.

Analysis

The Licensees will identify any continued Project O&M and Project-related recreation activities that have a potential to affect tribal resources documented during the *Tribal Resources Study* survey.

Reporting

Tribal Resources Study results, excluding any confidential information, will be summarized in the Licensees' ISR, USR, DLA, and FLA. The Licensees will also prepare a Privileged report at the conclusion of the *Tribal Resources Study* that includes the following sections: (1) *Tribal Resources Study* Goals and Objectives; (2) Methods; (3) Results (i.e., results of tribal resources identification efforts and descriptions of any tribal resources documented); (4) NRHP evaluations of identified resources following National Register Bulletin No. 38, *Guidelines for Evaluating and Documenting Identification of Traditional Cultural Properties* (Parker and King 1998); and (5) assessment of Project effects to NRHP eligible tribal resources and management recommendations[48]. The history of consultation regarding the study, and the associated correspondence, will be appended to the report.

The Privileged report will contain sensitive, confidential information. As such, the report will have restricted distribution and will only be distributed on a need to know basis. The draft Privileged report will be provided to the tribes for a 60-day review and comment period. The report will also be distributed to appropriate staff within the ANF, LPNF, and BLM for review and comment if any tribal resources are located on NFS and BLM lands. Following tribal and agency review of the document, the report will be submitted to SHPO for review and concurrence. The final report will be filed with FERC as Privileged. With the tribe's approval, a copy of the final report will be filed with the California State University, Fullerton, South Central Coastal Information Center.

4.1.13.5 NHPA Section 106 Consultation

The PAD and draft *Tribal Resources Study Plan* were provided to potentially affected Indian tribes, land managing agencies, and the SHPO for review and comment. Additionally, FERC has initiated consultation with the tribes and SHPO for purposes of the undertaking, and designated the Licensees as FERC's non-federal representative for purposes of day-to-day consultation. The Licensees will consult with the tribes, agencies, and SHPO throughout the study and relicensing process.

[48] 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 concludes its Section 106 responsibilities for the relicensing by issuing a Programmatic Agreement that requires Licensee develop and implement an HPMP that considers and manages effects on historic properties throughout the term of the license. While not a part of this study, it is anticipated that the information developed by this and other relicensing studies will be used to develop a HPMP in consultation with interested parties after the Cultural Resources Study has been completed.

4.1.13.6 Consistency of Methodology with Generally Accepted Scientific Practices

This *Tribal Resources Study* is consistent with the goals, objectives, and methods outlined for the most recent FERC hydropower relicensing efforts in California, including the Don Pedro Project (FERC No. 2299), the Yuba River Development Project (FERC No. 2246), and the Merced River Hydroelectric Project (FERC No. 2174) relicensing. The methods are consistent with the ACHP's guidelines.

4.1.13.7 Schedule

The *Tribal Resources Study* will begin after FERC issues its Study Plan Determination. The Licensees anticipate the schedule below will be followed to complete the *Tribal Resources Study*.

Fieldwork Preparation (Step 1)	July 2017 – August 2017
Fieldwork (Steps 2 and 3)	August 2017 – June 2018
Data QA/QC	June 2018 – July 2018
Data Analysis and Reporting	July 2018 – October 2018

4.1.13.8 Level of Effort and Cost

Based on the work effort described above, the Licensees estimate the current cost to complete this *Tribal Resources Study* will range between $141,000 and $188,000.

4.1.13.9 References

DWR. 2010. The Quagga and Zebra Mussel Rapid Response Plan for the State Water Project. 93 pp. CONFIDENTIAL/PRIVILEGED – Not for Public Distribution.

FERC. 2016. Tribal Consultation Contact with the Santa Ynez Band of Chumash Indians Regarding the Relicensing of the South SWP Hydropower Project. Telephone memo filed in FERC's electronic Public Files on August 22, 2016

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

4.1.14 Indicators of Hydrologic Alteration Study

4.1.14.1 Project Nexus

Continued Project O&M activities have the potential to affect flow in the Pyramid reach downstream of Pyramid Dam.

4.1.14.2 Existing Information and Need for Additional Information

Existing, relevant, and reasonably available information regarding flow control devices in Pyramid Dam are described in Section 3.2.2.2 of the Licensees' PAD. As a summary, water can flow out of Pyramid Lake into the Pyramid reach through one or more Project structures. These include: (1) a Pyramid Dam gate-controlled spillway; (2) a Pyramid Dam uncontrolled emergency spillway; (3) a Pyramid Dam low-level outlet; and (4) seepage through, under, or around Pyramid Dam. All of the structures deliver water to the Pyramid reach within the first few hundred feet of Piru Creek below Pyramid Dam.

Existing, relevant, and reasonably available information regarding flow in the Pyramid reach immediately downstream of Pyramid Dam is described in Section 3.2.3.5 of the Licensees' PAD. In general, daily average flows are highest in the winter and spring months, with median flows between approximately 10 and 100 cubic feet per second (cfs). Daily average flows are lowest in summer, with median average daily flows of approximately 5 cfs. Median average daily flows have been recorded as high as 8,000 cfs in spring and as high as approximately 80 cfs in summer (see Figure 3.2-17 in PAD).

This *IHA Study* will develop statistics comparing daily average flows in the Pyramid reach under With-Project conditions and Without-Project conditions.

4.1.14.3 Study Goals and Objectives

The goal of this *IHA Study* is to compare various metrics of hydrologic alteration to assess how the Project alters Without-Project flows. The objective of the *IHA Study* is to gather sufficient data necessary to fill recognized gaps in existing information including the development of flow metrics and statistics for analyzing With-Project and Without-Project flows.

4.1.14.4 Study Methods

Study Area

The study area for the *IHA Study* will consist of Pyramid reach shown in Figure 4.1-22. Specifically, flow statistics will be developed for a single location in the Pyramid reach immediately downstream of where the Pyramid Dam spillway enters Pyramid reach. In this way, flows from the Pyramid Dam spillway, low-level outlet, and dam seepage will be collectively accounted for in the study.

General Concepts and Procedures

- Personal safety is the most important consideration of each fieldwork team. Fieldwork will only occur in safely accessible areas and under conditions deemed safe by the field crews. Locations within the study area that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed; these areas will be identified in the data summary and an explanation for survey exclusion will be provided.

- The *IHA Study* will begin after FERC issues its Study Plan Determination.
- The *IHA Study* does not include the development of requirements for the new license, which will be addressed outside the *IHA Study*.
- The *IHA Study* focuses specifically on flow in the Pyramid reach below Pyramid Dam, and the study area *IHA Study* is specific to that resource.
- If required for the performance of the *IHA Study*, the Licensees will make a good faith effort to obtain permission to access private property well in advance of initiating the *IHA Study*. The Licensees will only enter private property if permission has been provided by the landowner.
- The Licensees will acquire all necessary agency permits and approvals prior to beginning fieldwork for the *IHA Study*.
- Field crews may make variances to the *IHA Study* in the field to accommodate actual field conditions and unforeseen problems. Any variances in the *IHA Study* will be noted in the data resulting from the *IHA Study*.
- To prevent the introduction and transmittal of amphibian chytrid fungus and invasive invertebrates (e.g., quagga mussels, zebra mussel, and Asian clams), field crews will be trained on, provided with, and use materials (e.g., Quat) for decontaminating their boots, waders, and other equipment when leaving or traveling between water-based study sites. Field crews will follow DWR's Quagga and Zebra Mussel Rapid Response Plan and CDFW's Aquatic Invasive Species Decontamination Protocol found at the following link: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=43333. All boats used during the study will follow clean protocols, including inspections before and after use. All decontamination requirements in place at Project reservoirs including those of DWR's *Quagga and Zebra Mussel Rapid Response Plan* for the SWP will be strictly followed (DWR 2010).

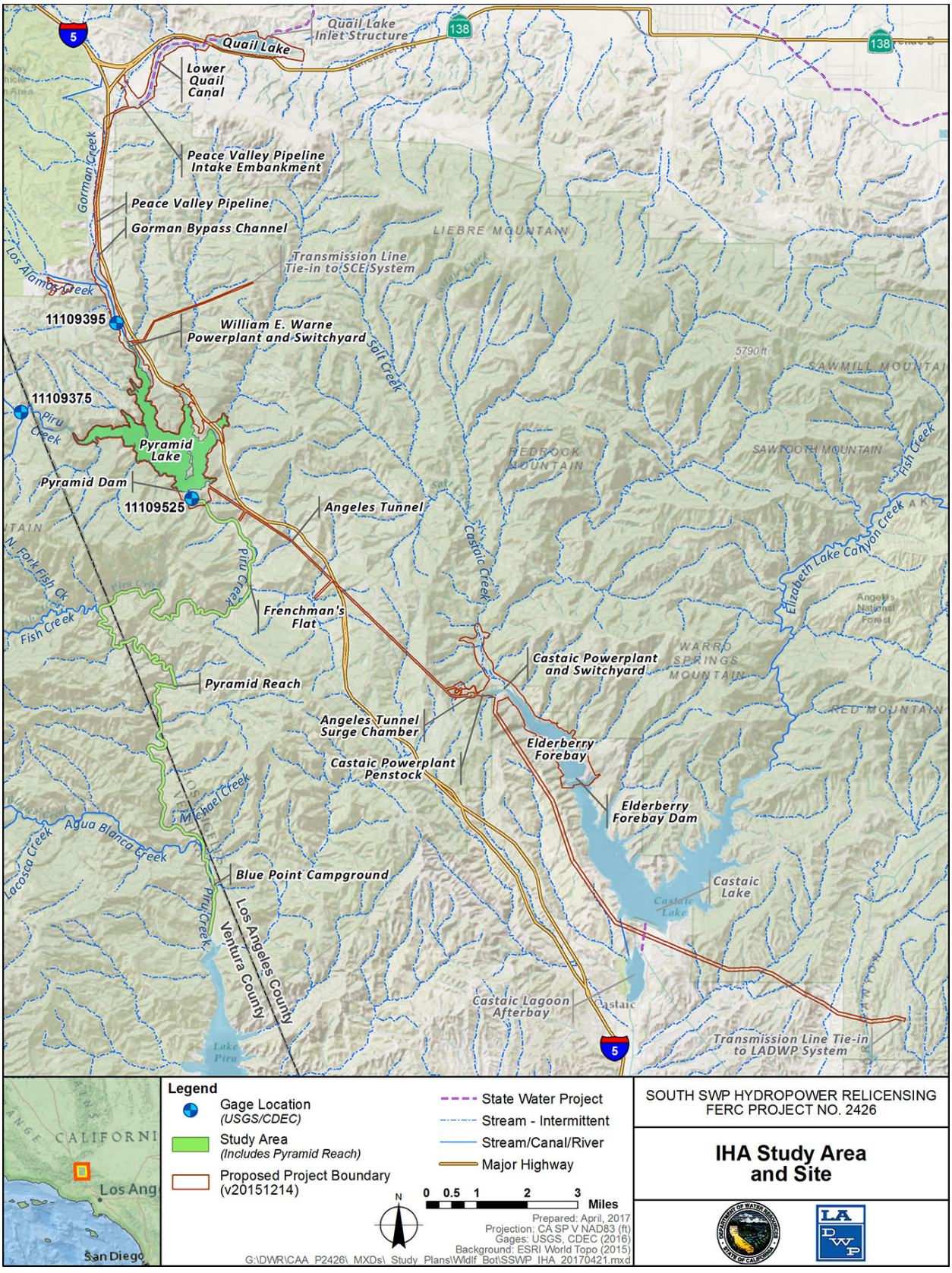

Figure 4.1-22. IHA Study Area and Site

Methods

This *IHA Study* will consist of three steps: (1) develop With-Project and Without-Project hydrology records; (2) conduct the ramping rate analysis; and (3) conduct the IHA analysis. These steps are described below.

Step 1 – Develop With-Project and Without-Project Hydrology Records. The Licensees will develop With-Project and Without-Project daily average flow hydrology from Water Year (WY) 2006 through WY 2017. The Licensees selected this period because the Licensees began operating to the Article 52 "natural hydrology" beginning in April of 2005 with the first full year of natural hydrology being 2006.

The With-Project hydrology record will be developed from USGS gage 11109525 (Piru Creek below Pyramid Lake, near Gorman, CA), which reports the releases from Pyramid Dam (Figure 4.1-22). The gage record of daily average flows extends from March 1972 through the present, and 15-minute and hourly flow data are available for the last seven years of the record. If any average daily flows are missing from the gaged record from the WYs 2006 through 2017, the Licensees will complete the record for those data using standard hydrology techniques, for example:

- Use historical flows for the same gage from another period that had similar conditions as the one with the missing data;
- Scale historical flows from a nearby gage for the same period of record by the ratio of contributing watershed sizes;
- Interpolate between available data for the gage with missing data.

The Without-Project hydrology record will be developed using the following gages:

- USGS gage 11109375 (Piru Creek below Buck Creek, near Pyramid Lake, CA), which is located in Piru Creek upstream of the NMWSE of Pyramid Lake (Figure 4.1-22). The gage record of daily average flows extends from October 1976 through the present, and 15-minute or hourly flow data are available for the last seven years of the record.
- USGS gage 11109395 (Cañada de Los Alamos above Pyramid Lake, CA), which is located on Gorman Creek upstream of the NMWSE of Pyramid Lake and the Warne Powerplant (Figure 4.1-22). The gage record of daily average flows extends from October 1976 through the present, and 15-minute or hourly flow data are available for the last seven years of the record.

If any daily average flow data are missing from the above record, the Licensees will complete the records for those data using the standard hydrology techniques described above.

Step 2 – Conduct Ramping Rate Analysis. The Licensees will select up to 10 events from the WYs 2006 through year 2017, when the Licensees were making releases into

Pyramid reach in an effort to reflect representative changes in flows into Pyramid reach. The selection of these 10 events will be contingent upon the Licensees having 15-minute or hourly flow data at USGS gage 11109525, USGS gage 11109375 and USGS gage 11109395 for the events selected. For each event, the Licensees will plot the 15-minute or hourly flow changes at both gages on one figure. For the 10 events, 24-hour hydrographs with any available descriptions of event conditions will be provided. A minimum of three of the examined events will occur when the Licensees released SWP water to be delivered to the UWCD.

Step 3 – Conduct the IHA Analysis. The Licensees will use IHA Version 7.1, a software package developed by Totten Software Design and Smythe Scientific Software (The Nature Conservancy, 2007) to calculate the above IHA statistics. The statistics will be computed for the entire WY 2006 through WY 2017 period for both Without-Project and With-Project conditions.

In order to compare the With-Project and Without-Project hydrologic records, using daily average flow data from WY 2006 through WY 2017 as described above, the flow characteristics identified by Richter et al. (1996) will be computed using the available software described below, for With-Project and Without-Project flows, and the Licensees will prepare comparison tables to show the differences between the With-Project and Without-Project flows for each statistical group. As recommended by Richter, all data will be presented as non-parametric (percentile) statistics due to the highly skewed nature of hydrologic data sets. In general, the median flow will be used as a measure of central tendency. The spread between the 25^{th} percentiles and the 75^{th} percentile divided by the median will be used to measure dispersion called the "coefficient of dispersion" (CD). The median and CD correspond to the mean and standard deviation in parametric statistics, which is typically used for data sets that are not so highly skewed. To express the difference between the Without-Project and With-Project statistics, Richter's deviation factors will be calculated for both medians and CDs. The deviation factor will be presented as an absolute value and calculated by the With-Project median or CD value minus the Without-Project median or CD value divided by the Without-Project median or CD value. The five groups recommended by Richter et al. (1996) will be:

- Group #1: Magnitude of monthly water conditions. This group includes 12 parameters, including monthly median flow values and associated statistics, and associated CDs and deviation factors.

- Group #2: Magnitude and duration of annual extreme water conditions. This group includes 11 parameters that measure the magnitude of extreme (minimum and maximum) annual water conditions or various duration periods ranging from one day to seasonal. The five duration periods for which statistics will be calculated include 1-day, 3-day, 7-day (week), 30-day (month), and 90-day (season) for each year. The number of zero-flow days will be computed. The median, CDs and deviation factors for each value will be shown. For any given year, the 1-day maximum (or minimum) value will be represented by the highest (or lowest) single median daily value occurring during that year. For any given

year, the multi-day maximum (or minimum) value will be represented by the highest (or lowest) average of median daily values over that multi-day period occurring in that year.

- Group #3: Timing of annual extreme water conditions. This group compares the timing of With-Project and Without-Project extreme flow conditions. The two parameters include the median of the Julian date when the 1-day minimum water condition occurred, and the median of the Julian date when the 1-day maximum water condition occurred. Associated CDs and deviation factors will be calculated.

- Group #4: Frequency and duration of high and low flow pulses. This group expresses the frequency of high and low flow pulses as well as the duration of each for the With-Project and Without-Project conditions. Four parameters will be measured in this group: two parameters measure the number of annual occurrences (frequency) during which the magnitude of the water condition exceeds an upper threshold or remain below a lower threshold, respectively, and; two parameters measure the number of days (duration) of such high and low pulses. Pulses will be defined as those periods within a year in which the daily median water condition rise above the 75th percentile (high pulse) or drops below the 25th percentile of all daily values for the Without-Project condition.

- Group #5: Rate and frequency of change in water conditions. This group is a comparison of rate and frequency of annual hydrograph changes for the Without-Project and With-Project conditions. Three parameters will be measured in this group: two parameters measure the median of positive and negative differences between consecutive daily values (rate), and one parameter measures the median number of hydrologic reversals (frequency) based on median daily flows. Associated CDs and deviation factors will be calculated.

Quality Assurance and Quality Control

All data, including both input data and output data, will be developed and analyzed in a manner that promotes high quality results and will be subject to appropriate QA/QC procedures. Data will be entered and organized in both Microsoft Excel and Hydrologic Engineering Center Data Storage System formats, where applicable. IHA data will be presented in its standard IHA output format.

Analysis

The Licensees will compare the changes in ramping rates and compare IHA statistics between the With-Project and Without-Project conditions. If any significant differences occur, the Licensees will review operations logs to determine the reason for the differences. If the reason is related to one of the qualifying conditions in Article 52 of the existing license, the Licensees will so indicate. For clarity, the qualifying conditions, as stated in Article 52, are as follows:

- Natural inflow to Pyramid Lake will be released into Piru Creek at a rate of up to about 18,000 cfs, which is the maximum safe, designed release from Pyramid Dam. The exact maximum safe release depends on the lake surface water elevation at the time of the release.

- Storm releases from Pyramid Dam into Piru Creek may be held back at less than 18,000 cfs if higher releases are deemed a threat to life, safety, or property at Pyramid Dam or downstream of the dam.

- The Licensees may elect to appropriate inflow to Pyramid Lake above the safe release flows under the provisions of its existing water rights.

- Up to 3,150 acre-feet of SWP water would be delivered to UWCD via the Pyramid reach (from Pyramid Dam) between November 1 and the end of February of each water year. During this period, water deliveries may be made over a period of a few days, ramping flows up and down to simulate the hydrograph of a typical storm event, or they may be released more gradually over a longer period.

- Releases from Pyramid Dam could be increased by up to 50 cfs for short periods to exercise the Pyramid Dam radial gate and stream release valves; test emergency power sources; conduct tests mandated by the Commission; or meet other short-term operational or maintenance requirements. No such testing would take place between March 15 and June 15. Testing would also be avoided to the extent possible between June 16 and July 31. Tests may be conducted at any time between August 1 and March 14, provided that flows do not increase by more than 50 cfs above current base flows during the event and that the event does not last longer than 15 minutes. Scheduled tests requiring larger releases or lasting longer than 15 minutes would require prior notification to the USFWS. Unscheduled releases due to equipment failure or emergency situations must be reported to the USFWS no later than three business days after the event.

- The gaging station on upper Piru Creek (located north of Pyramid Lake) provides 24-hour averages; therefore, instantaneous peak stream releases may be attenuated. Unlike the natural inflow hydrograph, which typically peaks sharply, the stream release hydrograph of Pyramid reach may be attenuated.

- A multiplier is used to account for those portions of Pyramid Lake watershed that are not tributaries of upper Piru Creek and Cañada de Los Alamos upstream of their respective gaging stations. This may result in some deviations for individual storm events due to localized variations in storm water intensity.

- Because of operational constraints, the stream release hydrograph of Pyramid reach would typically gage measured inflow. The valves at Pyramid Dam can be adjusted for release flows of less than 3 cfs; however, the precise measurement of released flows less than 3 cfs may not be possible due to operational constraints of the dam's gaging instrumentation.

Reporting

The *IHA Study* methods and results will be prepared and included, to the extent completed and ready for inclusion, in the Licensees' ISR, USR, DLA, and FLA.

4.1.14.5 Consistency of Methodology with Generally Accepted Scientific Practices

The *IHA Study* methods are generally consistent with the methods used for recent FERC hydropower relicensing efforts in California, including the Yuba River Development Project (FERC Project No. 2246). Further, IHA is a widely used hydrologic assessment tool and is endorsed by several State and federal agencies.

4.1.14.6 Schedule

The *IHA Study* will begin after FERC issues its Study Plan Determination. The Licensees anticipate the schedule below will be followed to complete the *IHA Study*:

Develop Hydrology	July 2017 – May 2018
Data QA/QC	June 2018
Conduct Analysis	July 2018 – September 2018
Data Analysis and Reporting	October 2018 – December 2018

4.1.14.7 Level of Effort and Cost

Based on the work effort described above, the Licensees estimate the current cost to complete this *IHA Study* will range between $20,000 and $35,000.

4.1.14.8 References

DWR. 2010. The Quagga and Zebra Mussel Rapid Response Plan for the State Water Project. 93 pp. CONFIDENTIAL/PRIVILEGED – Not for Public Distribution.

Richter, B.D., J.V. Baumgartner, J. Powell, and D.P. Braun. 1996. A method for assessing hydrologic alteration within ecosystems. Conservation Biology 10:1163-1174.

The Nature Conservancy (in collaboration with Totten Software Design and Smythe Scientific Software). 2007. Indicators of Hydrologic Alteration – Version 7 User's Manual. Online document.

4.1.15 Scenic Integrity Study

4.1.15.1 Project Nexus

Continued Project O&M and Project-related recreation activities have the potential to affect scenic integrity.

4.1.15.2 Existing Information and Need for Additional Information

Existing, relevant, and reasonably available information regarding the scenic integrity of the area within the proposed Project boundary is described in Section 4.10 of the Licensees' PAD. Approximately 49 percent of the land within the boundary is NFS lands managed by the USFS as part of the ANF. As a summary, the ANF's Scenic Integrity Objectives (SIO) are applicable for Project facilities and features on NFS lands (USFS 2005a, 2005b). Outside of NFS lands, the County of Los Angeles' Santa Clarita Valley Area Plan (2012) and Antelope Valley Area Plan (2015) provide general guidance regarding visual quality, though the plans do not apply to federal or State of California agencies. This *Scenic Integrity Study* will provide information to determine whether the existing visual conditions related to the Project meet ANF's scenic integrity direction, and generally comply with county visual direction.

4.1.15.3 Study Goals and Objectives

The goal of this *Scenic Integrity Study* is to identify any Project facilities or features on NFS lands that do not meet ANF's scenic integrity direction, and the visual quality of any Project facilities or features on non-NFS lands. The objective of this *Scenic Integrity Study* is to gather sufficient data necessary to fill recognized gaps in existing information in order to identify, map, and describe Project facilities and features, document the existing scenic integrity condition of these facilities and features, and determine whether their existing scenic integrity conditions meet ANF's scenic integrity direction if the facility or feature is on NFS lands. If the facility or feature is on non-NFS lands, this study will determine general conformity with the visual quality direction of applicable county plans.

4.1.15.4 Study Methods

Study Area

The study area for the *Scenic Integrity Study* will consist of all Project facilities and features within the proposed Project boundary within the Warne and Castaic Power Developments, and their associated viewsheds. The major Project facilities and features of the Warne Power Development include Quail Lake, Lower Quail Canal, Peace Valley Pipeline Intake Embankment, Peace Valley Pipeline, Gorman Bypass Channel, the William E. Warne Powerplant (Warne Powerplant) Switchyard, the transmission line that interconnects Warne Powerplant with the SCE Pastoria-Pardee Transmission Line, recreational facilities, 7.2 miles of primary Project roads, and appurtenant facilities. The major Project facilities and features of the Castaic Power Development include Pyramid Dam, Pyramid Lake, the Angeles Tunnel and seven penstocks, the Castaic Powerplant and Switchyard, the Elderberry Forebay and Dam, Storm Bypass Channel and Check Dams, Castaic Switchyard and the transmission lines that interconnect Castaic Switchyard with the Independent System Operator (ISO) power grid, and approximately 3.9 miles of access roads. The study area for the *Scenic Integrity Study* is shown in Figure 4.1-23.

General Concepts and Procedures

- Personal safety is the most important consideration of each fieldwork team. Fieldwork will only occur in safely accessible areas and under conditions deemed safe by the field crews. Locations within the study area that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed; these areas will be identified in the data summary and an explanation for survey exclusion will be provided.

- The *Scenic Integrity Study* will begin after FERC issues its Study Plan Determination.

- The *Scenic Integrity Study* does not include the development of requirements for the new license, which will be addressed outside the *Scenic Integrity Study*.

- The *Scenic Integrity Study* focuses specifically on scenic integrity on NFS lands within the proposed Project boundary and visual quality on non-NFS lands within the proposed Project boundary, and the study area for the *Scenic Integrity Study* is specific to those visual resources.

- If required for the performance of the *Scenic Integrity Study*, the Licensees will make a good faith effort to obtain permission to access private property well in advance of initiating the *Scenic Integrity Study*. The Licensees will only enter private property if permission has been provided by the landowner.

- The Licensees will acquire all necessary agency permits and approvals prior to beginning fieldwork for the *Scenic Integrity Study*.

- Field crews may make variances to the *Scenic Integrity Study* in the field to accommodate actual field conditions and unforeseen problems. Any variances in the *Scenic Integrity Study* will be noted in the data resulting from the *Scenic Integrity Study*.

- To prevent the introduction and transmittal of amphibian chytrid fungus and invasive invertebrates (e.g., quagga mussels, zebra mussel, and Asian clams), field crews will be trained on, provided with, and use materials (e.g., Quat) for decontaminating their boots, waders, and other equipment between water-based study sites. Field crews will follow DWR's Quagga and Zebra Mussel Rapid Response Plan and CDFW's Aquatic Invasive Species Decontamination Protocol found at the following link: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=43333. All boats used during the study will follow clean protocols, including inspections before and after use. All decontamination requirements in place at Project reservoirs including those of DWR's Quagga and Zebra Mussel Rapid Response Plan for the SWP will be strictly followed (DWR 2010).

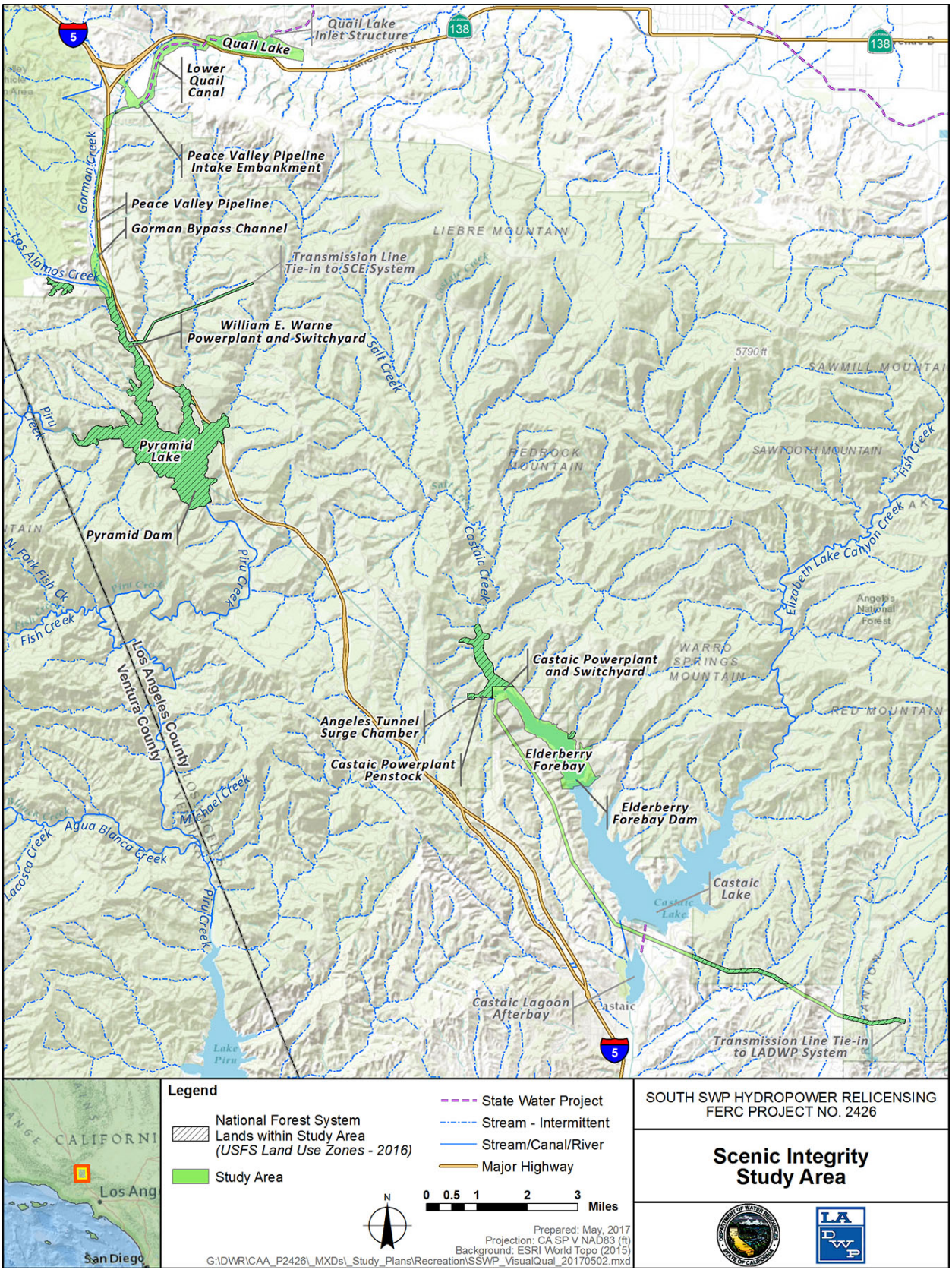

Figure 4.1-23. Scenic Integrity Study Area

Methods

The *Scenic Integrity Study* will consist of two steps: (1) identify Project facilities and features to evaluate; and (2) information gathering and mapping. These steps are described below.

Step 1 – Identify Project Facilities and Features to Evaluate. The Licensees will document all existing Project facilities and features within the proposed Project boundary on NFS lands (refer to Section 4.1.15.4 above).

Step 2 – Information Gathering and Mapping. The Licensees will perform the following:

- Identify and map all reasonable viewsheds associated with the Project facilities and features identified in Step 1.
- Map and summarize the ANF's SIOs (USFS 2005a, 2005b) potentially related to the Project facilities and features on NFS lands.
- Identify and summarize the ANF's Land Management Plan (USFS 2005a, 2005b) direction associated with the scenic inventories relative to the Project facilities and features on NFS lands, and the visual direction provided in applicable county plans for Project facilities and features on non-NFS lands.
- Map the location of the Project facilities and features with respect to their associated foreground, middleground, and background viewsheds and scenic inventories, including SIOs.
- Summarize variety classes, sensitivity levels, and distance zones in table format.
- Document the existing scenic integrity conditions of the Project facilities and features.
- Identify Key Observation Points (KOP) where photographs will be taken based on the list of Project facilities and features using agreed upon photographic protocols. The Licensees will map and describe the location of the KOPs, and take photographs from the KOPs of the Project facilities and features. The Licensees will consult with the USFS regarding the KOPs and photographic protocols to be used for Project facilities and features on NFS lands.

Quality Assurance and Quality Control

All data collected during this *Scenic Integrity Study* will be collected in a manner that promotes high quality results, and will be subject to appropriate QA/QC procedures including checking field data for accuracy and completeness.

Analysis

The Licensees will assess the existing scenic integrity conditions of the Project facilities and features identified in Step 1. For Project facilities and features on NFS lands, the Licensees will document whether those conditions meet ANF Land Management Plan scenic direction and are consistent with the 1969 MOU between the USFS and DWR regarding construction and operation of the California Aqueduct on NFS lands within the ANF and LPNF (USFS and DWR, 1969). The relevant portions of the MOU include Section III, Protection of Lands, which states: "The Department shall make every reasonable effort to preserve the scenic and aesthetic values of all National Forest System lands occupied or used by the Project as far as possible and consistent with Project development." Furthermore, MOU Section X, General Considerations, states: "All permanent structures will harmonize with the forest setting. Use of bright colors and reflective surfaces incompatible with the environment will not be authorized." For Project facilities and features on non-NFS lands, the Licensees will document if the Project facilities and features are generally consistent with the visual guidelines in applicable county plans.

Reporting

Scenic Integrity Study methods and results will be prepared and included, to the extent completed and ready for inclusion in the Licensees' ISR, USR, DLA, and FLA.

4.1.15.5 Consistency of Methodology with Generally Accepted Scientific Practices

The *Scenic Integrity Study* methods are generally consistent with the methods used for recent FERC hydroelectric relicensing efforts in California, including the Yuba River Development Project (FERC Project No. 2246).

4.1.15.6 Schedule

The *Scenic Integrity Study* will begin after FERC issues its Study Plan Determination. The Licensees anticipate the schedule below will be followed to complete the *Scenic Integrity Study*:

Fieldwork Preparation	July 2017 – August 2017
Fieldwork	September 2017
Data QA/QC	October 2017
Data Analysis and Reporting	November 2017

4.1.15.7 Level of Effort and Cost

Based on the work effort described above, the Licensees estimate the current cost to complete this *Scenic Integrity Study* will range between $25,000 and $35,000.

4.1.15.8 References

DWR. 2010. The Quagga and Zebra Mussel Rapid Response Plan for the State Water Project. 93 pp. CONFIDENTIAL/PRIVILEGED – Not for Public Distribution.

United States Department of Agriculture, Forest Service (USFS) and California Department of Water Resources (DWR). 1969. MOU Between the Forest Service, United States Department of Agriculture, and the Department of Water Resources, State of California, for Conduct of Work by the Department During Construction and Subsequent Operation of the California Aqueduct on the Los Padres and Angeles National Forests.

USFS. (1995). Landscape Aesthetics – A handbook for Scenery Management. Agricultural Handbook 701. Washington, DC.

USFS, Southwest Region. 2005a. Land Management Plan, Part 2, Angeles National Forest.

USFS. 2005b. Land Management Plan, Part 3, Design Criteria for Southern California National Forests.

4.1.16 Water Quality and Temperature Study

4.1.16.1 Project Nexus

Continued Project O&M activities have the potential to affect water quality and water temperature in Project reservoirs and stream reaches downstream of Project facilities.

4.1.16.2 Existing Information and Need for Additional Information

Existing, relevant, and reasonably available information regarding water quality and water temperature in Pyramid Lake and the Pyramid reach was presented in the Licensees' PAD in Section 4.4. As a summary, Project water quality monitoring has been conducted by the Licensees since 1968. The water quality program monitors eutrophication, salinity and other parameters of concern for drinking water, recreation, and fish and wildlife purposes. Additional data are collected by MWD. Extensive water quality sampling and analysis is ongoing by both DWR and MWD. Additionally, the USGS studies surface-water quality in cooperation with local and State governments, and with other federal agencies. The monitoring program consists of collection, analysis, data archiving, and dissemination of data and information describing the quality of surface water resources. These data are summarized in Section 4.4 of the PAD.

In addition, defined Beneficial Uses and Water Quality Objectives of Project waters are presented in Tables 4.4-6 and G-1, respectively, in the PAD.

Additional water quality and temperature data from this Study will be added to the existing data.

4.1.16.3 Study Goals and Objectives

The goal of this *Water Quality and Temperature Study* is to supplement existing information regarding water quality and temperature. The objective of the Study is to gather sufficient data necessary to fill recognized information gaps concerning water quality and temperature.

4.1.16.4 Study Methods

Study Area

The study area for the *Water Quality and Temperature Study* consists of Quail Lake, Pyramid Lake, Pyramid reach, and Piru Creek immediately upstream of Pyramid Lake (Figure 4.1-24).

General Concepts and Procedures

- Personal safety is the most important consideration of each fieldwork team. Fieldwork will only occur in safely accessible areas and under conditions deemed safe by the field crews. Locations within the study area that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed; these areas will be identified in the data summary and an explanation for survey exclusion will be provided.

- The *Water Quality and Temperature Study* will begin after FERC issues its Study Plan Determination.

- The *Water Quality and Temperature Study* does not include the development of requirements for the new license, which will be addressed outside the *Water Quality and Temperature Study*.

- The *Water Quality and Temperature Study* focus specifically on Quail Lake, Pyramid Lake, Pyramid reach, and Piru Creek immediately upstream of Pyramid Lake, and the study area for the *Water Quality and Temperature Study* is specific and limited to the locality of these resources.

- If required for the performance of the *Water Quality and Temperature Study*, the Licensees will make a good faith effort to obtain permission to access private property well in advance of initiating the *Water Quality and Temperature Study*. The Licensees will only enter private property if permission has been provided by the landowner.

- The Licensees will acquire all necessary agency permits and approvals prior to beginning fieldwork for the *Water Quality and Temperature Study*.

- Field crews may make variances to the *Water Quality and Temperature Study* in the field to accommodate actual field conditions and unforeseen problems. Any

variances in the *Water Quality and Temperature Study* will be noted in the data resulting from the *Water Quality and Temperature Study*.

- Field crews will record incidental observations of aquatic and terrestrial wildlife species observed during the performance of this study. The purpose of this effort is to opportunistically gather data during the performance of the study.

- To prevent the introduction and transmittal of amphibian chytrid fungus and invasive aquatic species (e.g., quagga mussels, zebra mussel, and Asian clams), field crews will be trained on, provided with, and use materials (e.g., Quat) for decontaminating their boots, waders, and other equipment when leaving or traveling between water-based study sites. Field crews will follow DWR's Quagga and Zebra Mussel Rapid Response Plan and CDFW's Aquatic Invasive Species Decontamination Protocol which can be found at the following link: (https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=43333). All boats used during the study will follow cleaning protocols, including inspections before and after use. All decontamination requirements in place at Project reservoirs including those of DWR's *Quagga and Zebra Mussel Rapid Response Plan* for the SWP will be strictly followed (DWR 2010).

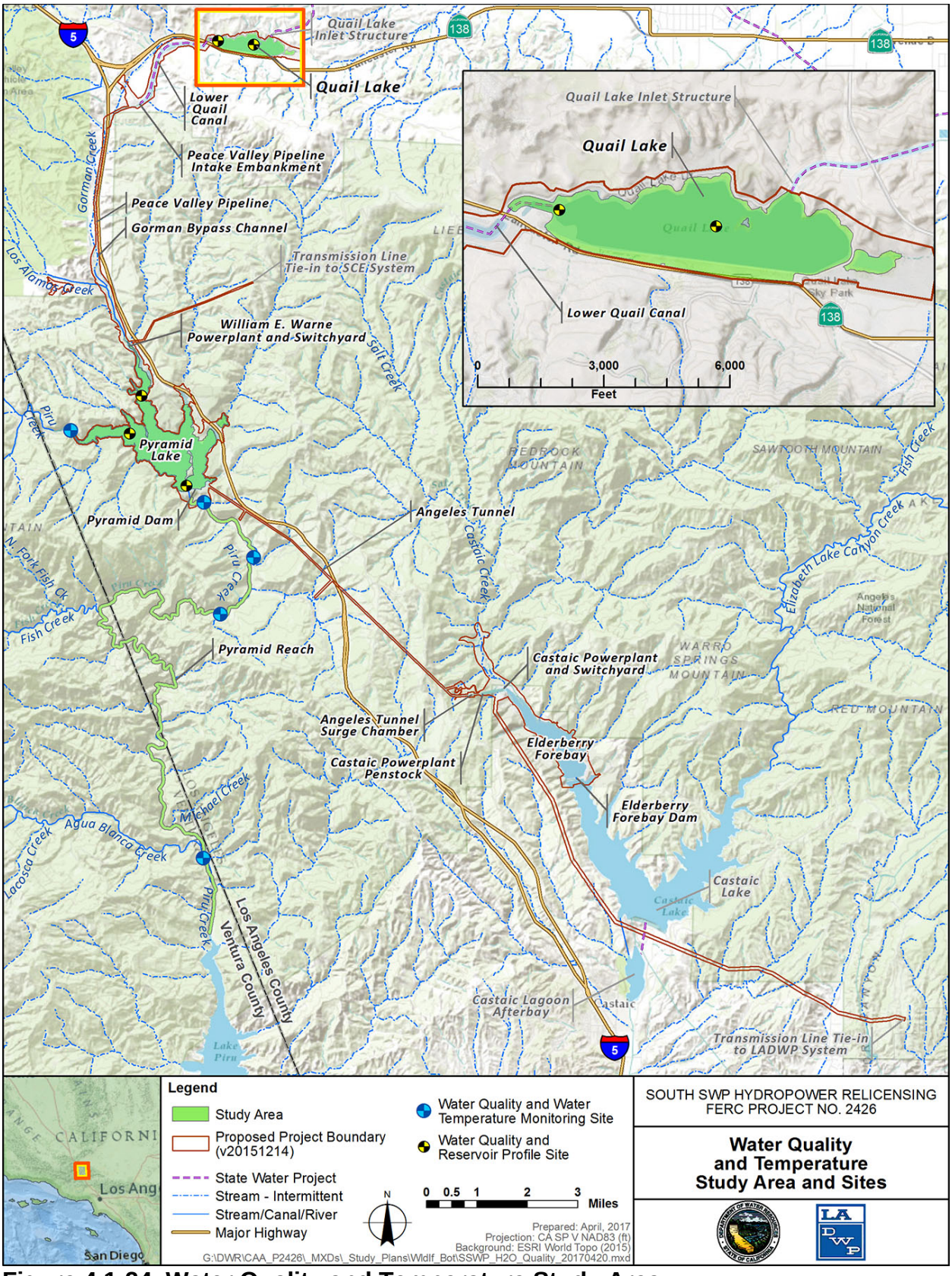

Figure 4.1-24. Water Quality and Temperature Study Area

Methods

This *Water Quality and Temperature Study* will consist of five steps: (1) select water quality parameters; (2) select sampling locations; (3) collect water quality samples; (4) collect reservoir profiles; and (5) install and maintain stream temperature loggers. These steps are described below.

Step 1 – Select Water Quality Parameters. For the purpose of this *Water Quality and Temperature Study*, the water quality parameters and constituents to be measured are divided into two categories: (1) basic water quality – in situ; and (2) basic water quality – laboratory, which includes inorganic ions, nutrients, and metals. The parameters included in each category and associated information is listed in Table 4.1-12. The basic water quality parameters described in Table 4.1-12 data will be collected through quarterly reservoir profiles. Water temperature will be collected in Pyramid reach and immediately upstream of Pyramid Lake by continuous monitoring.

Table 4.1-12. Water Quality Parameters, Analytes, Methods, Reporting Limits and Laboratory Holding Times

Parameter	Method	Target Reporting Limit[1] µg/L (or other)	Hold Time
BASIC WATER QUALITY – *IN SITU*			
Temperature	SM 2550 B	0.1 °C	Field (*in situ*)
Dissolved oxygen (DO)	SM 4500-O	0.1 mg/L	Field (*in situ*)
Specific conductance	SM 2510A	0.01 µmhos	Field (*in situ*)
pH	SM 4500-H	0.1 su	Field (*in situ*)
Turbidity	SM 2130 B	0.1 NTU	Field (*in situ*)
Secchi disc	--	--	Field (*in situ*)
BASIC WATER QUALITY – LABORATORY			
Total organic carbon (TOC)	SM 5310	0.5	28 d
Dissolved organic carbon (DOC)	EPA 415.1 D	0.5	28 d
Total dissolved solids (TDS)	EPA 2540 C SM 2340 C	1.0 mg/L	7d
Total suspended solids (TSS)	EPA 2520 D SM 2340 D	1.0 mg/L	7d

Table 4.1-12. Water Quality Parameters, Analytes, Methods, Reporting Limits and Laboratory Holding Times (continued)

Parameter	Method	Target Reporting Limit[1] µg/L (or other)	Hold Time
INORGANIC IONS			
Total alkalinity	SM 2340 B	2000	14 d
Calcium (Ca)	EPA 200.7	1.0 mg/L	180 d
Chloride (Cl)	EPA 300.0	1.0 mg/L	28 d
Hardness (measured value)	EPA 2340 B SM 2340 C	1.0 mg/L as $CaCO_3$	14 d
Magnesium (Mg)	EPA 200.7	1.0 mg/L	180 d
Potassium (K)	EPA 200.7	500	180 d
Sodium (Na)	EPA 200.7	1.0 mg/L	180 d
Sulfate (SO_4^{2-})	EPA 300.0	1.0 mg/L	28 d
Sulfide (S^{2-})	SM 4500 S2 – D	0.05 mg/L	28 d
NUTRIENTS			
Nitrate-nitrite	EPA 4500-NO3	2	28 d at 4 °C
Total ammonia as N	EPA 4500-NH3 SM 4500-NH3	10	28 d at 4 °C
Total Kjeldahl nitrogen as N (TKN)	SM 4500 N	100	28 d at 4 °C
Total phosphorus (TP)	SM 4500 P	100	28 d at 4 °C
Dissolved orthophosphate (PO_4)	EPA 365.1 EPA 300.0	10	48 h at 4 °C
METALS			
Aluminum (total and dissolved) (Al)	EPA 1638	0.1	180 d
Arsenic (total and dissolved) (As)	EPA 1638	0.1	180 d
Cadmium (total and dissolved) (Cd)	EPA 1638	0.1	180 d
Chromium, total (total and dissolved) (Cr)	EPA 1638	0.1	180 d
Copper (total and dissolved) (Cu)	EPA 1638	.05	180 d
Iron (total and dissolved) (Fe)	EPA 1638	0.2	180 d
Lead (total and dissolved) (Pb)	EPA 1638	.04	180 d
Mercury (total) (Hg)	EPA 1631	.0002	28 d
Methylmercury (total and dissolved) (CH_3Hg)	EPA 1630	.005	90 d
Nickel (total and dissolved) (Ni)	EPA 1638	0.1	180 d
Selenium (total) (Se)	EPA 1638	0.2	180 d

Table 4.1-12. Water Quality Parameters, Analytes, Methods, Reporting Limits and Laboratory Holding Times (continued)

Parameter	Method	Target Reporting Limit[1] µg/L (or other)	Hold Time
Silver (total and dissolved) (Ag)	EPA 1638	.04	180 d
Zinc (total and dissolved) (Zn)	EPA 1638	0.1	180 d
PESTICIDES			
Chlorpyrifos	EPA 8081A	0.005mg/L	7 d
Diazinon	EPA 8141A	0.005mg/L	7 d

[1]The Target Reporting Limit is the minimum accuracy at which the parameter will be reported in the Licensees' ISR, USR, DLA, and FLA based on the limit of detection identified by the laboratory.
Key:
EPA = United States Environmental Protection Agency
$CaCO_3$ = calcium carbonate
d = days
h = hours
µmhos = micro-mhos
µg/L = micrograms per liter (equals parts per billion)
mg/L = milligrams per liter (equals parts per million)
NTU = Nephelometric Turbidity Units
SM = Standard Method
su = standard unit

Step 2 – Select Sampling Locations. General water quality data will be collected in Quail Lake, Pyramid Lake, Pyramid reach and Piru Creek immediately upstream of Pyramid Lake. General water quality samples collected in Quail Lake and Pyramid Lake will correspond to reservoir profile locations. To the extent possible, the sampling locations will correspond with the sampling locations of recent or ongoing water quality monitoring by the Licensees. General water quality samples collected in Pyramid reach and upstream of Pyramid Lake will correspond to water temperature monitoring locations. To the extent possible, the sampling locations will correspond with the sampling locations described in the *Pyramid Reach Fish Populations Study*.

Water quality sampling and reservoir profiles in Quail Lake will occur at two locations: (1) near the center of the reservoir; and (2) near the Quail Lake outlet. Water quality sampling and reservoir profiles in Pyramid Lake will occur at three locations: (1) near the dam; (2) in the Piru Creek arm; and (3) in the William E. Warne Powerplant arm. Sampling in Quail Lake and Pyramid Lake will occur at two depths at each sampling location: 1) within the hypolimnion and 2) just below the surface of the epilimnion.

Water quality sampling and water temperature monitoring in Pyramid reach will occur at four locations: 1) near the base of Pyramid Dam, 2) approximately 1.5 miles downstream from Pyramid Dam, 3) approximately 3 miles downstream of the Pyramid Dam, and 4) upstream of Lake Piru near the Blue Point Campground. Water quality sampling and water temperature monitoring in Piru Creek will occur at one location: immediately upstream of Pyramid Lake.

The timing and methods of water quality sampling, reservoir profiles and water temperature monitoring are described in Steps three through five, respectively.

Step 3 – Collect Water Quality Samples. The *in situ* and grab samples listed in Table 4.1-12 will be collected once in Quail Lake and Pyramid Lake at the locations described in Step 2 when Pyramid Lake's elevation is anticipated to be at the lowest elevation for the year. The *in situ* water quality parameters listed in Table 4.1-12 will also be collected during quarterly reservoir profiles. The *in situ* and grab samples listed in table 4.1-12 will be collected once at the locations in Pyramid reach and Piru Creek, as listed in Step 2, in the fall.

This description provides a broad overview of the sample collection procedures that will be followed. Specific quality assurance and quality control protocols will be followed to prevent sample contamination and ensure the sample accuracy. These protocols will be included in the QAPP to be developed in collaboration with the laboratory. The QAPP will include instrument calibration, equipment decontamination, sample cross contamination prevention, labels and documentation, laboratory certification, chain of custody procedures, and sample collection, preservation, storage, transport, and analyses protocols.

In situ water quality measurements will be made with a Hydrolab DataSonde 5 (Hydrolab), or other instrument with similar precision and accuracy. Water temperature (±0.1°C), DO (±0.2 milligrams per liter [mg/L]), pH (±0.2 standard unit, or su), specific conductance (±0.001 micro-mhos per centimeter [µmhos/cm]), and turbidity (± 1 Nephelometric Turbidity Unit [NTU]) will be measured at each location. *In situ* samples in Pyramid reach and upstream of Pyramid Lake will be collected in an area of free flowing water, near the thalweg, to the extent flows allow for safe access. In the event of high flows, samples will be taken along the bank but still in an area of moving water. The datasonde will be suspended at approximately half the total depth as measured at each sampling location. Care will be taken to not submerge the datasonde in any sediments near the bottom in order to achieve accurate readings. The instrument will be calibrated daily using the manufacturer's recommended calibration methods. Any calibration variances will be noted on the field data sheet and in the Licensees' ISR and/or Updated Study Report (USR), and recalibration or repair done as necessary. Field crews will note relevant conditions during each sampling event on the field data sheet (e.g., air temperature, flow [if available at a nearby gage], description of the sampling location, floating material, evidence of oil and grease, and activities in the vicinity of the sampling site that could cause short- or long-term alterations to water quality).

The Licensees will follow USGS sampling protocol for water quality (Wilde, 2011). In summary, each sample will be collected in laboratory-supplied clean containers. Containers used during stream sampling and reservoir surface sampling will be filled directly from the water, submerged approximately six inches below the surface and facing downstream in order to prevent material from flowing into the container. Sampling from near the bottom of the reservoir will be done using a Kemmerer sampler (or equivalent) designed for trace metals sampling. Containers for the deep water samples

will be filled directly from the sampler. The sampler will be thoroughly cleaned with Alconox and distilled water between sample locations. While in the field, samples requiring refrigeration will be stored on ice, in an ice chest, until transferred to an appropriate laboratory refrigerator. Water samples to be analyzed for metals will be collected using "clean hands" methods consistent with the EPA's Method 1669 sampling protocol, Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria (EPA 1995). Samples requiring filtration before metals analysis will be filtered in accordance with standard protocols in the field. Certification of filter cleanliness will be obtained from the vendor and kept in the Project files.

All sample containers will be labeled with the date and time that the sample is collected, and a sampling site or unique sample identification number. A field sample log sheet will be maintained that includes a table of sample label information. The sampling site location will be recorded using a GPS unit. All containers will be handled in a manner consistent with appropriate chain-of-custody protocols. The sample containers will be preserved as appropriate, stored and delivered to a State of California-certified water quality laboratory for analyses of the parameters listed in Step 1, and in accordance with maximum holding periods for each parameter. A chain-of-custody record will be maintained with the samples at all times.

As part of the field QA/QC program, one field blank and one equipment rinsate will be collected and submitted to the laboratory, with a target of one for every 10 samples. A field blank is a sample of analyte-free water poured into the container in the field, preserved and shipped to the laboratory with samples. A field blank for filtered samples will be similarly created, but filtered using field techniques before pouring into the sample container. A field blank assesses the 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 and assesses the adequacy of the decontamination processes. Two duplicate samples will also be collected to confirm the laboratory's QA/QC process.

Step 4 – Collect Reservoir Profiles. Reservoir profiles will be taken once quarterly during the study at the locations in Quail Lake and Pyramid Lake described in Step 2. Sampling will occur in the third and fourth quarters of 2017 and the first and second quarters of 2018. Sampling will occur no sooner than two months after the previous event to capture maximum variation between events.

A GPS receiver will be used during each successive sampling occasion to locate the geographical coordinates of each sample site. Care will be taken to identify the same site for successive profiles where water conditions and GPS accuracy allow.

Field crews will use a Hydrolab® DataSonde 5® multi-parameter water quality monitoring system (or equivalent) to measure water temperature (±0.2°C) at each of the reservoir sampling sites. Generally, measurements will be taken at 10-foot vertical increments where the change in temperature with respect to depth is low. Where the temperature gradient is higher or where measuring water temperatures near the intake elevations, 5-foot or smaller vertical increments will be used. At each sample depth, the

parameter readings will be allowed to stabilize before water temperature will be recorded. Data will be collected throughout the entire water column.

Field crews will collect a Secchi disc depth reading as an indicator of water clarity and photic zone during each reservoir water temperature profile collection. Secchi depth readings will be taken by lowering a Secchi disc over the shaded side of the boat until the disc is no longer visible from the boat. The disc will then be raised until visible, at which location the depth of the disc will be recorded in tenths of a foot, and the average of the two readings will be used as the water clarity reading for that location.

Step 5 – Install and Maintain Stream Temperature Loggers. Stream temperature loggers will be installed at the stream locations described in Step 2 for at least one year (i.e., 365 days) from the date they are installed. Installation is planned to occur in August 2017.

The stream water temperature recorders in the active flow channel will have 12-bit resolution, with a minimum accuracy of plus or minus 0.2^{o}C (i.e., onset or equivalent). Each stream recorder will be contained in a durable protective housing that permits the active flow of water in and around the unit, and will be placed at an appropriate depth to allow continuous recording during the entire 365 days. Each stream recorder will be secured by a cable to a stable root mass, tree trunk or man-made structure, or secured using embedded rebar where necessary, such that the recorder will be secured in the channel during high flow periods without presenting a safety hazard to people or wildlife. The stream recorders will be installed in the channel thalweg, and the housing and cable will be disguised as much as possible while ensuring the ability to retrieve the unit for future downloads. A GPS coordinate will be taken and recorded at each installation point, along with any waypoints that may prove valuable for future retrieval, especially where there is not a defined trail leading to the access point. Photographs of the recorder site, including installation configuration, will be taken. Each recorder will be set to record water temperature at 15-minute intervals.

Prior to installation, each recorder will be numbered and calibrated to the manufacturer's recommended specifications. Field crews will install a redundant water temperature recorder at each site. Redundant recorders will be located as close as possible to the primary recorders. Where a redundant recorder occurs, the primary recorder will be labeled with the recorder number for the site (e.g., "PC1") with the suffix "a," and the redundant recorder with the number for the site with the suffix "b." Data from both recorders will be downloaded during each scheduled visit.

Loggers will be downloaded at least quarterly. During each visit, field crews will download data into an optic shuttle or directly to a personal computer. Immediately after the data are safely downloaded, back-ups will be recorded on portable memory devices (i.e., USB [Universal Serial Bus] "thumb drive"). Only after the raw water temperature data are safely backed-up will the optic shuttle be cleared or the data processed. In addition, during each site visit, crews will be prepared to replace or fix a recorder installation. Any recorder or optic shuttle that fails to download will be returned to the manufacturer for possible data recovery. Field crews will also check equipment

operation/calibration and remaining battery life, and will calibrate the instrument to manufacturer's specifications. After the recorder is removed from the water, it will be cleaned and visually inspected.

To prevent introduction and transmittal of amphibian chytrid fungus and invasive invertebrates (e.g., quagga mussels, zebra mussels and Asian clams) field crews will be trained on, provided with, and use materials (e.g., Quat) for decontaminating their boots, waders, and other equipment between water-based study sites. All boats used during the study will follow clean protocols, including inspections before and after use. All decontamination requirements in place at Project reservoirs will be strictly followed, including DWR's *SWP Rapid Response Plan for Zebra and Quagga Mussels* which includes a decontamination protocol using heat treatment and chemical solutions.

Quality Assurance and Quality Control

Field data will be collected in a manner that promotes high quality results, and will be subject to appropriate QA/QC procedures. The QAPP, developed in collaboration with the laboratory, will be followed during all field sampling. All water quality data will be verified and/or validated according to the laboratory's QA/QC procedures. The Licensees will subject all data to additional QA/QC procedures including, but not limited to: (1) spot-checks of transcription; (2) review of electronic data submissions for completeness; (3) graphical review of data to check for errors; (4) comparison of results to field blank and equipment rinsate results; and (5) identification of any data that seem inconsistent.

If any datum seems inconsistent during the QA/QC procedure, the Licensees will consult with the laboratory to identify any potential sources of error before concluding that the data is correct. Values that are determined to be anomalous will be removed from the analysis if the reason for the reading cannot be identified. If data are unavailable for brief periods of the record, the missing data will be synthesized into the record using a straight line interpolation method, and the data will be indicated as "synthesized" in the record and all subsequent summaries. The raw data files will be retained in their unaltered state for future QA/QC reference and data modified in the final record will be so indicated in the record.

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 contaminated, the Licensees will identify the data accordingly.

Analysis

The Licensees will analyze the raw data relative to Los Angeles or Lahontan Basin Plan water quality objectives, as appropriate (California Regional Water Quality Control Board [RWQCB] Lahontan Region 1995 and California RWQCB Los Angeles Region 1994). Data will also be compared to historical data collected by the Licensees in similar locations.

Data collected during the stream temperature monitoring study will be summarized to show mean, minimum, and maximum daily temperatures for each water temperature monitoring location. Reservoir profiles will be plotted as water temperature versus water surface elevation. Additional data will be summarized in tabular formats.

Reporting

Water Quality and Temperature Study methods and results will be prepared and included, to the extent they have been completed for inclusion in the Licensees' ISR, USR, DLA, and FLA.

4.1.16.5 Consistency of Methodology with Generally Accepted Scientific Practices

The *Water Quality and Temperature Study* methods are generally consistent with the methods used for collecting water quality and temperature data in recent relicensing efforts in California, including for the Don Pedro Project (FERC No. 2299), Yuba River Development Project (FERC No. 2246) and Merced River Hydroelectric Project (FERC No. 2179).

4.1.16.6 Schedule

The *Water Quality and Temperature Study* will begin after FERC issues its Study Plan Determination. The Licensees anticipate the schedule below will be followed to complete the *Water Quality and Temperature Study*:

Fieldwork Preparation	July 2017 – August 2017
General Water Quality Sampling	August 2017 – October 2017
Reservoir Profiles	August 2017 – June 2018
Stream Temperature Loggers	August 2017 – August 2018
Data QA/QC	August 2017 – September 2018
Data Analysis and Reporting	June 2018 – December 2018

4.1.16.7 Level of Effort and Cost

Based on the work effort described above, the Licensees estimate the current cost to complete this *Water Quality and Temperature Study* will range between $80,000 and $120,000.

4.1.16.8 References

California RWQCB Lahontan Region. 1995. Water quality control plan for the Lahontan Region, North and South Basins. Plan effective March 31, 1995, amended through August 16, 2011. Available: http://www.waterboards.ca.gov/lahontan/water_issues/programs/basin_plan/references.shtml

California RWQCB Los Angeles Region. 1994. Water Quality Control Plan Los Angeles Region. Basin Plan for the coastal watersheds of Los Angeles and Ventura counties. Adopted 1994. Amended through July 2015. Available: http://www.waterboards.ca.gov/losangeles/water_issues/programs/basin_plan/basin_plan_documentation.shtml

DWR. 2010. The Quagga and Zebra Mussel Rapid Response Plan for the State Water Project. 93 pp. CONFIDENTIAL/PRIVILEGED – Not for Public Distribution.

EPA. 1995. Method 1669: Sampling ambient water for trace metals at United States Environmental Protection Agency water quality criteria levels. EPA 821-R-95-034, United States Environmental Protection Agency, Washington, D.C.

Wilde, F.D., 2011, Water-quality sampling by the U.S. Geological Survey—Standard protocols and procedures: U.S. Geological Survey Fact Sheet 2010-3121, 2 p. Available at https://pubs.usgs.gov/fs/2010/3121.

4.1.17 Fish Entrainment Risk Assessment Study

4.1.17.1 Project Nexus

Continued Project O&M activities have the potential to affect fish in Pyramid Lake due to entrainment into the Angeles Tunnel intake and Pyramid Dam low level outlet to Pyramid reach.

4.1.17.2 Existing Information and Need for Additional Information

Existing, relevant, and reasonably available information regarding Pyramid Lake and its operations, fishes in Pyramid Lake, the Pyramid Dam low level outlet, and the Angeles Tunnel intake are described in the Licensees' PAD. As a summary, at its NMWSE, Pyramid Lake has a normal maximum capacity of 169,902 acre-feet and a maximum depth of 280 feet near Pyramid Dam.

Pyramid Dam low level outlet is a 15-foot-diameter, concrete-lined tunnel approximately 1,350 feet long and is located at the right abutment of Pyramid Dam. The tunnel can release up to 18,000 cfs into Pyramid reach. The lake outlet at the tunnel entrance is a submerged, 119-foot-high, 15-foot-diameter, reinforced concrete tower with an 18-foot-high trashrack. The tower lip is at elevation 2,340 feet, 238 feet below the NMWSE of Pyramid Lake.

The Angeles Tunnel intake structure, located at the north portal of the Angeles Tunnel, is a multiple-compartmented structure (four, 22-foot by 22-foot horizontal openings) with trashracks, which transitions to a 30-foot-diameter tunnel. The Angeles Tunnel intake draws water from Pyramid Lake down to elevation 2,335 feet, 243 feet below the NMWSE of Pyramid Lake. The Angeles Tunnel has a maximum capacity of 18,400 cfs. (Section 3.2 of the PAD.)

CDFW annually stocks 20,000 pounds of catchable size rainbow trout (*O. mykiss*) in the lake (Section 4.5.4.5 of the PAD), and based on sampling in 2013, CDFW considers the Pyramid Lake fish populations to be in good condition. CDFW found 12 fish species, and the catch was numerically dominated by largemouth bass (*Micropterus salmoides*). CDFW advised the Licensees that it intends to repeat its 2013 fish population sampling in Pyramid Lake in 2017. In addition, Environmental Science Associates, Inc. under contract with DWR conducts creel surveys in Pyramid Lake, with the most recent creel surveys in 2015 and 2016. (Section 4.5 of the PAD.)

4.1.17.3 Study Goals and Objectives

The goal of the *Fish Entrainment Risk Assessment Study* is to assess the potential for fish in Pyramid Lake to be entrained into the Pyramid Dam low level outlet or entrained into the Angeles Tunnel intake. The objective of this *Fish Entrainment Risk Assessment Study* is to gather sufficient information necessary to fill recognized information gaps regarding the potential for fish entrainment. The *Fish Entrainment Risk Assessment Study* will focus on two fish species: rainbow trout (adult) and largemouth bass (all life stages). Both fish species were selected for their recreational value and/or the Licensee's obligation to stock them for recreational purposes.

4.1.17.4 Study Methods

Study Area

The study area for the *Fish Entrainment Risk Assessment Study* will consist of Pyramid Lake (Figure 4.1-25).

General Concepts and Procedures

- Personal safety is the most important consideration of each fieldwork team. Fieldwork will only occur in safely accessible areas and under conditions deemed safe by the field crews. Locations within the study area that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed; these areas will be identified in the data summary and an explanation for survey exclusion will be provided.

- The *Fish Entrainment Risk Assessment Study* will begin after FERC issues its Study Plan Determination.

- The *Fish Entrainment Risk Assessment Study* does not include the development of requirements for the new license, which will be addressed outside the Fish Entrainment Risk Assessment Study.

- The *Fish Entrainment Risk Assessment Study* focuses specifically on Pyramid Lake, and the study area for the *Fish Entrainment Risk Assessment Study* is specific to that resource.

- If required for the performance of the *Fish Entrainment Risk Assessment Study*, the Licensees will make a good faith effort to obtain permission to access private property well in advance of initiating the Study. The Licensees will only enter private property if permission has been provided by the landowner.

- The Licensees will acquire all necessary agency permits and approvals prior to beginning fieldwork for the *Fish Entrainment Risk Assessment Study*.

- Field crews may make variances to the *Fish Entrainment Risk Assessment Study* in the field to accommodate actual field conditions and unforeseen problems. Any variances in the study will be noted in the data resulting from the *Fish Entrainment Risk Assessment Study.*

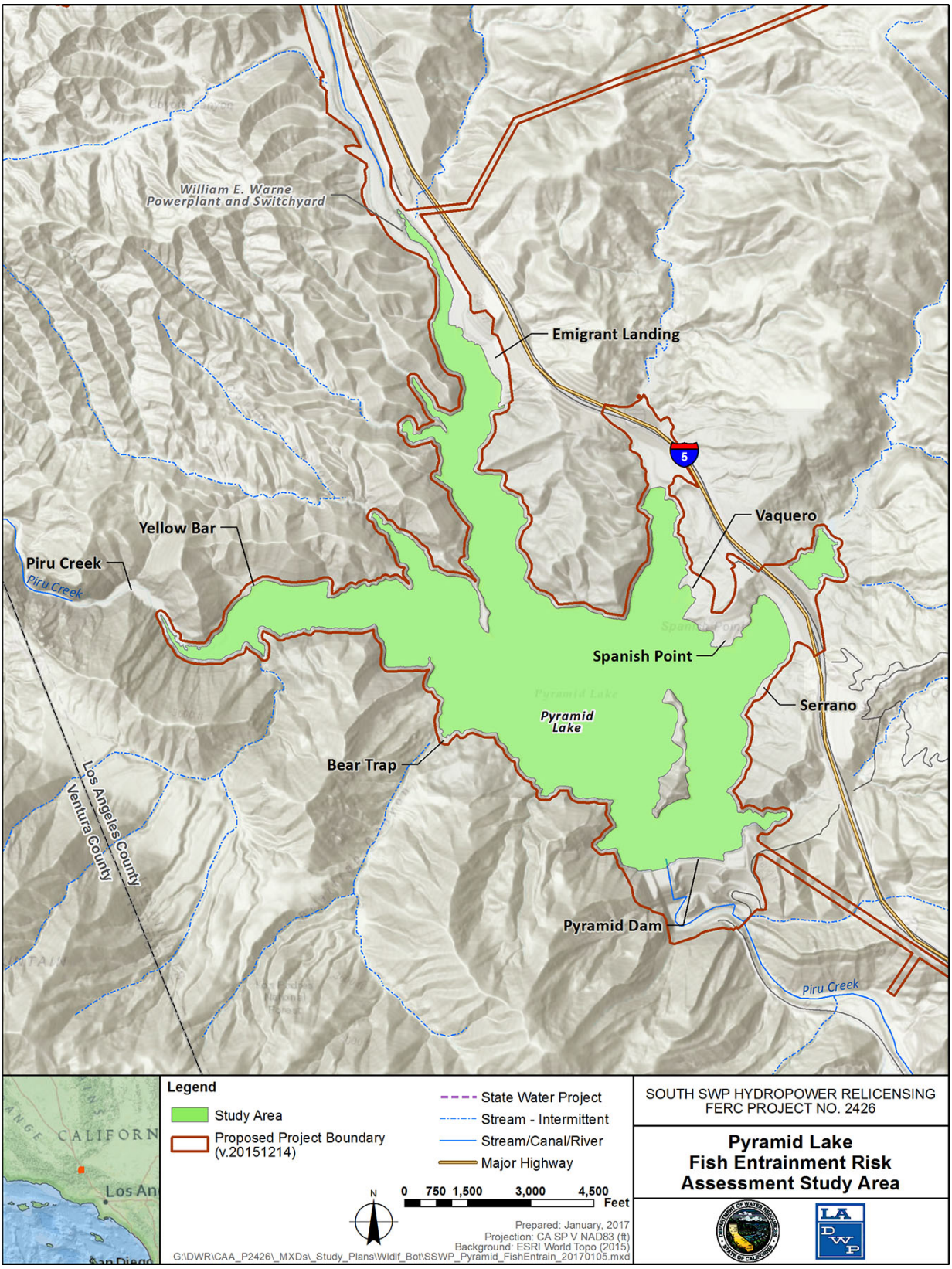

Figure 4.1-25. Pyramid Lake Fish Entrainment Risk Assessment Study Area and Site

Methods

This *Fish Entrainment Risk Assessment Study* will consist of four steps: (1) characterize each outlet through which Pyramid Lake water is released (i.e., the Angeles Tunnel intake and Pyramid Dam Low Level Outlet); (2) determine the likelihood that reservoir fish would be near the outlets; (3) determine swim speeds for fish life stages likely to be near the outlets; and (4) compare swim speeds and outlet water velocities. These steps are described below:

Step 1 – Characterize Each Outlet. The Licensees will examine existing Exhibit F and L Design Drawings and operations of Pyramid Lake and the two outlets to characterize for each outlet the typical outlet depth, dimensions, and flows. Using this information, the Licensees will calculate typical approach velocities near and at each outlet, and at various distances from the outlet. Approach velocities will be calculated by examining the cross sectional area of the tunnel intake structures and the median, 10 percent, and 90 percent exceedance discharges. These values will be compared with the annual inflow/outflow hydrographs to evaluate the temporal risk of entrainment to fish. Seasonal water quality and physical habitat characteristics will be described using all available information and included in the final report.

Step 2 – Determine Likelihood That Reservoir Fish Would be Near the Outlets. Using the information developed in Step 1, existing information regarding the fish species in Pyramid Lake and existing information in existing literature regarding the fish species' life history, the Licensees will determine which of the species' life stages has a reasonable potential to be near the outlets and when.

As stated above, two fish species and life stages will be evaluated: rainbow trout (adult) and largemouth bass (all life stages). Both species will be assessed for potential risk of entrainment for under both stratified and non-stratified lake conditions. The seasonality of stratification and its effect on species presence near the intakes will be described from available information.

Rainbow trout are native to California and have adapted to a broad variety of habitats throughout their California range. A review of the literature indicates that when water temperatures are suitable, rainbow trout are normally found near the surface of large reservoirs due to preferences for temperature, DO, food, and cover. Fast (1973), May (1973), and Hess (1974) state that adult rainbow trout normally are found at depths less than or equal to the 18ºC isotherm in reservoirs where DO levels are greater than 3 mg/l. Moyle (2002) reports that optimal temperatures for growth of rainbow trout are 15–18ºC, but they can tolerate temperatures between 0ºC and 27ºC. They can also tolerate DO levels as low as 1.5–2.0 mg/l at low temperatures.

Largemouth bass is a recreationally important species throughout California. Largemouth bass are an opportunistic piscivorous species. Warm, shallow (<6 m) waters of moderate clarity and beds of aquatic plants are the usual habitat of largemouth bass (Moyle 2002). Optimal water temperatures for largemouth bass are 25-30ºC, although, largemouth bass may persist in a much wider temperature range.

Largemouth bass begin to spawn when water temperatures warm to 15-16ºC, usually occurring from April through June (Moyle 2002). Nests are generally shallow depressions up to 1 m in diameter created by males in sand, gravel, or debris-littered bottoms at depths of 0.5-2 m (Moyle 2002). Nests are often built next to submerged objects, such as logs or boulders. Young of the year and yearling bass tend to stay close to shore and congregate in schools as they swim near or above beds of aquatic plants (Moyle 2002). Juvenile largemouth bass prefer warm shallow waters (30-32ºC) where forage is prevalent to ensure rapid growth (Moyle 2002).

Step 3 – Determine Swim Speeds for Fish Life Stages Likely to be Near the Outlets. A literature review will be conducted to evaluate the existing understanding of fish swimming capabilities of both adult rainbow trout and largemouth bass. Using this information, the Licensees will determine the swim speeds of fish and their respective life stages that have the potential to be proximal to the tunnel intakes as determined in Step 2. A fish's ability to avoid entrainment is related to its swimming ability, which is a function of its size. Researchers have developed a general fish length-swim speed relationship, which states that a fish is able to maintain a cruising speed equal to about four fish-lengths per second for long periods, and speeds of about ten fish-lengths per second for short bursts (Alexander 1967, Clay 1961).

Step 4 – Compare Swim Speeds and Outlet Velocities. The Licensees will compare the outlet velocities calculated in Step 1 with the swim speeds calculated in Step 3, and assess the potential for fish entrainment at the two outlets.

Quality Assurance and Quality Control

All data collected during this *Fish Entrainment Risk Assessment Study* will be collected in a manner that promotes high quality results, and will be subject to appropriate QA/QC procedures including checking all data for accuracy and completeness.

Analysis

The Licensees will compare the outlet velocities calculated in Step 1 with the swim speeds calculated in Step 3 to determine the risk for fish entrainment.

Reporting

The *Fish Entrainment Risk Assessment Study* methods and results will be prepared and included, to the extent completed and ready for inclusion, in the Licensees' ISR, USR, DLA, and FLA.

4.1.17.5 Consistency of Methodology with Generally Accepted Scientific Practices

The *Fish Entrainment Risk Assessment Study* methods are generally consistent with the methods used for assessing the potential for entrainment at deep water outlets in reservoirs in recent relicensing efforts in California, including the Yuba-Bear Hydroelectric Project (FERC Project No. 2266).

4.1.17.6 Schedule

The *Fish Entrainment Risk Assessment Study* will begin after FERC issues its Study Plan Determination. The Licensees anticipate the schedule below will be followed to complete the *Fish Entrainment Risk Assessment Study*:

Characterize Each Outlet	July 2017 – October 2017
Determine Fishes Near Outlets	July 2017 – October 2017
Determine Swim Speeds	November 2017 – December 2017
Data QA/QC	January 2018
Data Analysis and Reporting	February 2018 – May 2018

4.1.17.7 Level of Effort and Cost

Based on the work effort described above, the Licensees estimate the current cost to complete this *Fish Entrainment Risk Assessment Study* will range between $20,000 and $30,000.

4.1.17.8 References

Alexander, R.M. 1967. Functional Design of Fishes. Hutchinson and Company, London.

Clay, C.H. 1961. Design of Fishways and Other Fish Facilities. Department of Fisheries of Canada, Ottawa. Cat. No. FS 31-1961/1.

DWR. 2010. The Quagga and Zebra Mussel Rapid Response Plan for the State Water Project. 93 pp. CONFIDENTIAL/PRIVILEGED – Not for Public Distribution.

Moyle, P.B. 2002. Inland Fish of California, Second Edition. Berkeley, California: University of California Press.

Fast, A. W. 1973. Effects of artificial hypolimnion aeration of rainbow trout (*Salmo gairdneri Richardson*) depth distribution. Trans. Am. Fish. Soc. 102:715-722.

Hess, L. 1974. The summer catch, vertical distributions and feeding habits of trout in Spruce Knob Lake. Proc. W. V. Acad. Sci., 49th Session 46:255-264.

May, B. E. 1973. Seasonal depth distribution of rainbow trout (Salmo gairdneri) in Lake Powell. Proc. Utah Acad. Sci., Arts, and Letters 50:64-72.

4.1.18 ESA-Listed Terrestrial Wildlife Species – California Wildlife Habitat Relationships Study

4.1.18.1 Project Nexus

Continued Project O&M and Project-related recreation activities have the potential to affect federal ESA-listed terrestrial wildlife species. For the purpose of this *ESA-listed Terrestrial Wildlife Species – CWHR Study*, an ESA-listed terrestrial wildlife species is

defined as a terrestrial species that is listed under ESA as threatened or endangered, or is a candidate for listing. There are no species proposed for listing identified by USFWS.

Three ESA-listed terrestrial wildlife species are considered under a separate study for the Project and will not be included in this Study. These species are the least Bell's vireo, southwestern willow flycatcher, and yellow-billed cuckoo western DPS. However, information from this study may be used to help inform that study.

4.1.18.2 Existing Information and Need for Additional Information

Existing, relevant, and reasonably available information regarding ESA-listed terrestrial wildlife species and their habitat within the proposed Project boundary is provided in Section 4.8 of the Licensees' PAD. The PAD identified three species potentially affected by the Project that will be included as part of this study: vernal pool fairy shrimp (*Branchinecta lynchi*), California condor (*Gymnogyps californianus*), and the coastal California gnatcatcher (*Polioptila californica californica*). Additionally, this study addresses two other species not included in the PAD as potentially affected by the Project because the Project is outside of each species' known range: the Mojave desert tortoise (*Gopherus agassizii*) and blunt-nosed leopard lizard (*Gambelia sila*). However, because of the proximity of each species range, more information is needed to validate this conclusion.

As a summary, the Licensees found no records of vernal pool fairy shrimp, coastal California gnatcatcher, Mojave Desert tortoise, or blunt-nosed leopard lizard within the proposed Project boundary. There are records of California condor in the CNDDB from the Sespe-Piru Condor Area, which is less than one mile from Pyramid Lake (CDFW 2015). Aspen Environmental Group (2007) indicates California condors are "commonly observed" in flight around Pyramid Lake.

To meet the goals of the study (described in 3.1.3 below), the Licensees have identified the following additional information needs: (1) collection of further CWHR habitat data for each potential special-species; and (2) a list of Project O&M activities that includes location and duration of the activity.

4.1.18.3 Study Goals and Objectives

The goal of this *ESA-listed Terrestrial Wildlife Species – CWHR Study* is to determine the quality and suitability of potential habitat for ESA-listed terrestrial wildlife species within the proposed Project boundary.

The objective of this *ESA-listed Terrestrial Wildlife Species – CWHR Study* is to gather sufficient data necessary to fill recognized gaps in existing information regarding the potential for ESA-listed terrestrial wildlife species to occur within the proposed Project boundary.

4.1.18.4 Study Methods

Study Area

The study area for the *ESA-listed Terrestrial Wildlife Species – CWHR Study* consists of the area within the proposed Project boundary, excluding lands overlying the Angeles Tunnel on which the Licensees do not perform any Project-related activities. The study area for the *ESA-listed Terrestrial Wildlife Species – CWHR Study* is shown below in Figure 4.1-26.

General Concepts and Procedures

- Personal safety is the most important consideration of each fieldwork team. Fieldwork will only occur in safely accessible areas and under conditions deemed safe by the field crews. Locations within the study area that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed; these areas will be identified in the data summary and an explanation for survey exclusion will be provided.

- The *ESA-listed Terrestrial Wildlife Species – CWHR Study* will begin after FERC issues its Study Plan Determination.

- The *ESA-listed Terrestrial Wildlife Species – CWHR Study* does not plan to include the development of requirements for the new license, which will be addressed outside of the study.

- The *ESA-listed Terrestrial Wildlife Species – CWHR Study* focuses specifically on special-status terrestrial wildlife within the proposed Project boundary, but the study area for the *ESA-listed Terrestrial Wildlife Species – CWHR Study* is specific to locations that can support those resources.

- If required for the performance of the *ESA-listed Terrestrial Wildlife Species – CWHR Study*, the Licensees will make a good faith effort to obtain permission to access private property well in advance of initiating the study. The Licensees will only enter private property if permission has been provided by the landowner.

- The Licensees will acquire all necessary agency permits and approvals prior to beginning fieldwork for the *ESA-listed Terrestrial Wildlife Species – CWHR Study*.

- Field crews may make variances to the *ESA-listed Terrestrial Wildlife Species – CWHR Study* in the field to accommodate actual field conditions and unforeseen problems. Any variances from the study will be noted in the data resulting from the *ESA-listed Terrestrial Wildlife Species – CWHR Study*.

- To prevent the introduction and transmittal of amphibian chytrid fungus and invasive aquatic species (e.g., quagga mussels, zebra mussel, and Asian clams), field crews will be trained on, provided with, and use materials (e.g., Quat) for decontaminating their boots, waders, and other equipment when leaving or traveling between water-based study sites. Field crews will follow DWR's Quagga and Zebra Mussel Rapid Response Plan and CDFW's Aquatic Invasive Species Decontamination Protocol which can be found at the following link: (https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=43333). All boats used during the study will follow cleaning protocols, including inspections before and after use. All decontamination requirements in place at Project reservoirs including those of DWR's *Quagga and Zebra Mussel Rapid Response Plan* for the SWP will be strictly followed (DWR 2010).

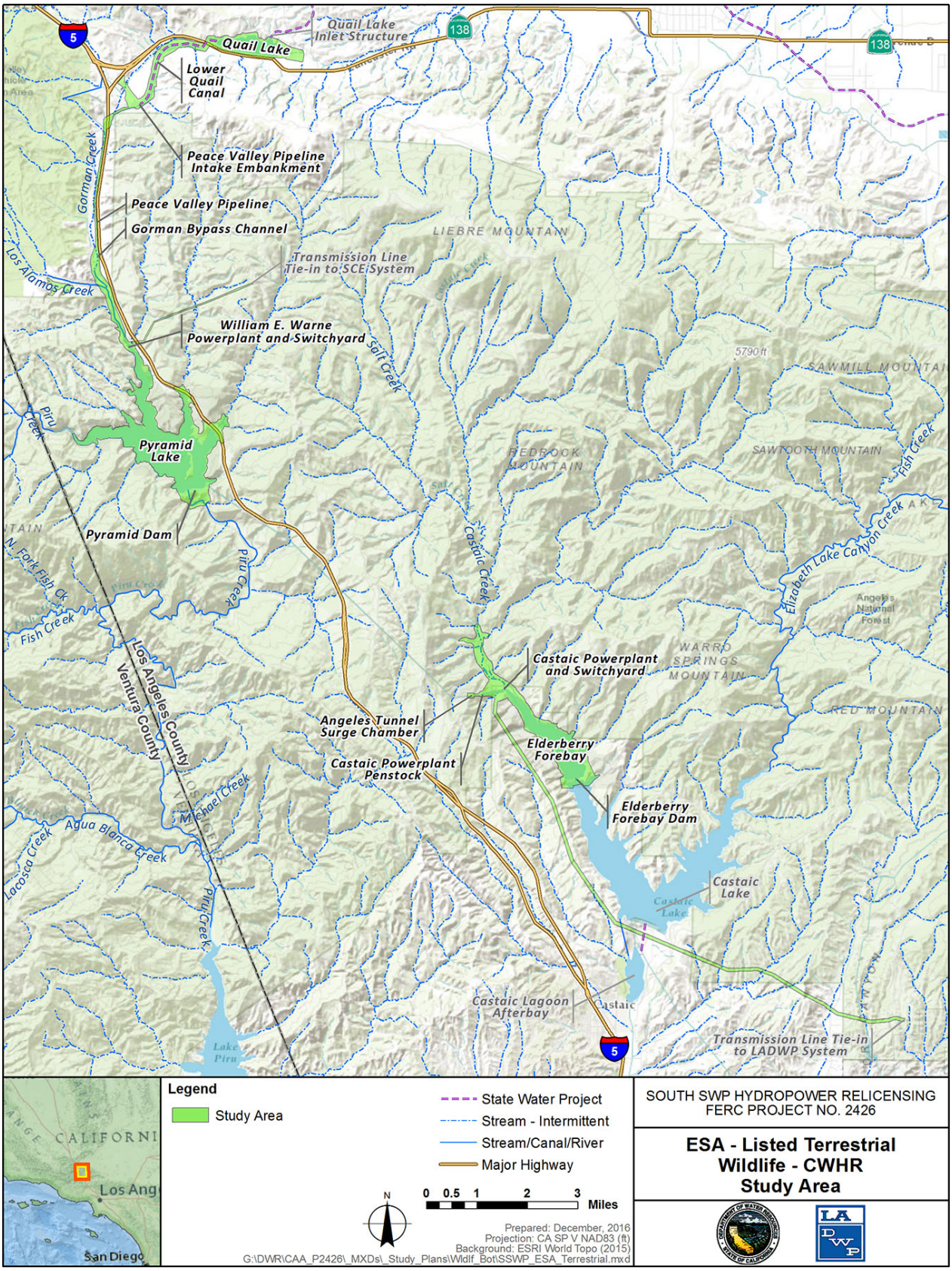

Figure 4.1-26. ESA-listed Terrestrial Wildlife Species – CWHR Study Area

Methods

This *ESA-listed Terrestrial Wildlife Species – CWHR Study* will consist of two steps: (1) create field study maps; and (2) conduct field habitat assessments at sampling points. These steps are described below. The Licensees' relicensing *Botanical Resources Study* will also be a source of information for habitat features, including vernal pools, which may be too small to be represented on existing habitat maps.

Step 1 – Create Field Study Maps. There were 15 terrestrial CWHR vegetation types identified within the proposed Project boundary, as shown in Table 4.1-13 below. Of these, the most common are Mixed Chaparral (563 acres), Coastal Scrub (545 acres), and Sagebrush (286 acres). There are also four riparian and wetland vegetation types identified within the proposed Project boundary: Montane Riparian (39 acres), Valley Foothill Riparian (54 acres), Wet Meadow (53 acres), and Freshwater Emergent Wetland (39 acres) (USFS 2014). Using GIS, the Licensees will select sampling points in representative habitats, with more points in areas with higher potential for ESA-listed species and considered to be sensitive natural communities (e.g., Wet Meadow and Montane Riparian) and larger acreage inside the proposed Project boundary. Table 4.1-13 shows the 15 terrestrial vegetation types and the number of sampling points for each.

Table 4.1-13. California Wildlife Habitat Relationship Acreages Within the Proposed Project Boundary and Sampling Points

California Wildlife Habitat Relationship Type	Acreage[1]	Percentage of Study Area	Number of Sampling Points[2]
Tree-Dominated Habitats			
Pinyon-Juniper (PJN)	5	<1	2
Montane Hardwood (MHW)	<1	<1	1
Coastal Oak Woodland (COW)	3	<1	1
Montane Riparian (MRI)	39	2	2
Valley Foothill Riparian (VRI)	54	2	2
Shrub-Dominated Habitats			
Sagebrush (SGB)	286	11	4
Mixed Chaparral (MCH)	563	22	5
Chamise-Redshank Chaparral (CRC)	130	5	3
Coastal Scrub (CSC)	545	22	5
Desert Wash (DSW)	63	2	2
Herbaceous-Dominated Habitats			
Annual Grassland (AGS)	208	8	3
Wet Meadow (WTM)	53	2	2
Freshwater Emergent Wetland (FEW)	39	2	2
Developed Habitats			
Urban (URB)	293	12	3
Non-vegetated Habitats			
Barren (BAR)	226	9	3
	2,507	100	40

Notes:
[1]Acreages include underground features.
[2]Sampling points are the same as those in the Special-Status Terrestrial Wildlife Species – CWHR Study and information collected will be used for both studies.

The Licensees will produce field maps that will include CWHR habitat types, sampling points, CNDDB occurrences, other known locations of ESA-listed species, and Project facilities.

Step 2 – Conduct Field Habitat Assessments at Sampling Points and Incidentally Document ESA-listed Terrestrial Wildlife. Field habitat assessments and characterizations will be conducted at representative sampling points (Table 4.1-13), using CDFW's CWHR System data forms (CDFW 2016). Information collected on these forms will include species composition, stages, structure, percent cover, and habitat elements, as well as diameter at breast height for wooded habitats. Evidence of Project O&M activities and Project-related recreation activities in the vicinity of the sampling points will also be documented. Photographs of all sampling points will be taken in each cardinal direction from the center point of the plot.

If an ESA-listed terrestrial wildlife species is incidentally identified, the survey team will prepare a California Native Species Field Survey Form, which records data required to be submitted to CDFW for addition to the CNDDB and reported to the CDFW and USFWS. The information will also be provided to the USFS if the occurrence is located on NFS lands.

Quality Assurance and Quality Control

Field data will be collected in a manner that promotes high quality results, and will be subject to appropriate QA/QC procedures, including spot-checks of transcription and comparison of GIS maps with field notes.

Analysis

Field data will be used in conjunction with CWHR to correct and update the map created in Step 1 and refine the list and habitats of ESA-listed terrestrial wildlife potentially occurring in the study area for the *ESA-listed Terrestrial Wildlife Species – CWHR Study*. The Licensees will then use the maps created in Step 1 to identify areas within the study area for the *ESA-listed Terrestrial Wildlife Species – CWHR Study* in which ESA-listed wildlife habitat, Project facilities, and O&M activities overlap.

Reporting

The Licensees will compile and summarize results of this *ESA-listed Terrestrial Wildlife Species – CWHR Study*, as well as other existing and relevant information, to the extent completed and ready for incorporation, in the Licensees' ISR, USR, DLA, and FLA.

4.1.18.5 Consistency of Methodology with Generally Accepted Scientific Practices

This *ESA-listed Terrestrial Wildlife Species – CWHR Study* is consistent with the goals, objectives, and methods outlined for the most recent FERC hydroelectric relicensing efforts in California, including the Yuba River Development Project (FERC Project No. 2246), French Meadows Transmission Line Project (FERC Project No. 2479), Camp Far

West Transmission Line Project (FERC Project No. 10821), Drum-Spaulding Project (FERC Project No. 2310), and Yuba-Bear Hydroelectric Project (FERC Project No. 2266).

4.1.18.6 Schedule

The *ESA-listed Terrestrial Wildlife Species – CWHR Study* will begin after FERC issues its Study Plan Determination. The Licensees anticipate the schedule below will be followed to complete the *ESA-listed Terrestrial Wildlife Species – CWHR Study*.

Fieldwork Preparation	January 2018 – March 2018
Fieldwork	April 2018 – Sept 2018
Data QA/QC	October 2018
Data Analysis & Reporting	October 2018 – December 2018

4.1.18.7 Level of Effort and Cost

Based on the work effort described above, the Licensees estimate the current cost to complete this *ESA-listed Terrestrial Wildlife Species – CWHR Study* will range between $5,000 and $10,000.

4.1.18.8 References

Aspen Environmental Group. 2007. Biological Assessment and Report of Sensitive Resource Surveys for Castaic Power Plant and Vicinity. Report prepared for LADWP. September 2007.

CDFW. 2016. California Wildlife Habitat Relationships. Available online: <https://www.wildlife.ca.gov/Data/CWHR> Accessed December 16, 2016. Last updated 2016. Sacramento, CA.

DWR. 2010. The Quagga and Zebra Mussel Rapid Response Plan for the State Water Project. 93 pp. CONFIDENTIAL/PRIVILEGED – Not for Public Distribution.

USFS. 2014. Classification and Assessment with Landsat of Visible Ecological Groupings (CalVeg) data. Updated in 2014. Available online: <http://www.fs.usda.gov/detail/r5/landmanagement/resourcemanagement/?cid=stelprdb5347192>.

4.1.19 Whitewater Boating Study

4.1.19.1 Existing Information and Need for Additional Information

This study plan focuses on evaluating and characterizing the whitewater boating resource downstream from Pyramid dam on Pyramid reach. The primary purpose of the proposed study is to identify the characteristics of the whitewater boating resource, particularly with regard to access in the upper reaches and understand what ranges of flow conditions are suitable and preferable for whitewater boaters. Study requests and

comments received from USFS, American Whitewater, and NPS centered on a whitewater boating study for Pyramid reach below Pyramid Lake. This proposed study plan considers those requests and comments.

4.1.19.2 Study Goals and Objectives

The main objective of the *Whitewater Boating Study* is to gather additional information on river-based recreational activities and opportunities in Pyramid reach. This will include information about the hydrology of upper Piru Creek, Pyramid Lake releases, how project operations might affect existing and potential whitewater boating opportunities, and how and where boaters access and typically use Pyramid reach. Analysis of information gathered about the whitewater opportunities on Pyramid reach will help determine the relationship between Project operations and the whitewater boating resource on Pyramid reach.

This *Whitewater Boating Study* will comprise the following elements:

- Hydrology assessment
- Conduct structured interviews
- Field reconnaissance and site visit (if deemed necessary after Level 1 Assessment)
- Recommend findings and analysis

4.1.19.3 Study Methods

Study Area

The *Whitewater Boating Study* area includes Pyramid reach from Pyramid Dam to the NMWSE of Lake Piru. Figure 4.1-27 shows the *Whitewater Boating Study* area. American Whitewater has documented Pyramid reach as a navigable 18.5-mile stretch of Class IV waterway. Of this 18.5 mile stretch 4.3 miles are designated Wild and Scenic and 3.0 miles are designated Recreational. This 7.3 miles includes the portion of Pyramid reach starting 0.5 miles downstream of Pyramid Dam to the boundary between Los Angeles and Ventura counties.

General Concepts and Procedures

- Personal safety is the most important consideration of each fieldwork team. Fieldwork will only occur in safely accessible areas and under conditions deemed safe by the field crews. Locations within the study area that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed; these areas will be identified in the data summary and an explanation for survey exclusion will be provided.

- The *Whitewater Boating Study* will begin after FERC issues its Study Plan Determination.

- The *Whitewater Boating Study* does not include the development of requirements for the new license, which will be addressed outside the *Whitewater Boating Study*.

- The *Whitewater Boating Study* focuses specifically on river-based recreational activities and opportunities within Pyramid reach, but the study area is specific to locations that can support that resource.

- If required for the performance of the *Whitewater Boating Study*, the Licensees will make a good faith effort to obtain permission to access private property well in advance of initiating the *Whitewater Boating Study*. The Licensees will only enter private property if permission has been provided by the landowner.

- The Licensees will acquire all necessary agency permits and approvals prior to beginning fieldwork for the *Whitewater Boating Study*.

- Field crews may make variances to the *Whitewater Boating Study* in the field to accommodate actual field conditions and unforeseen problems. Any variances in the *Whitewater Boating Study* will be noted in the data resulting from the *Whitewater Boating Study*.

- To prevent the introduction and transmittal of amphibian chytrid fungus and invasive aquatic species (e.g., quagga mussels, zebra mussel, and Asian clams), field crews will be trained on, provided with, and use materials (e.g., Quat) for decontaminating their boots, waders, and other equipment when leaving or traveling between water-based study sites. Field crews will follow DWR's Quagga and Zebra Mussel Rapid Response Plan and CDFW's Aquatic Invasive Species Decontamination Protocol which can be found at the following link: (https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=43333). All boats used during the study will follow cleaning protocols, including inspections before and after use. All decontamination requirements in place at Project reservoirs including those of DWR's *Quagga and Zebra Mussel Rapid Response Plan* for the SWP will be strictly followed (DWR 2010).

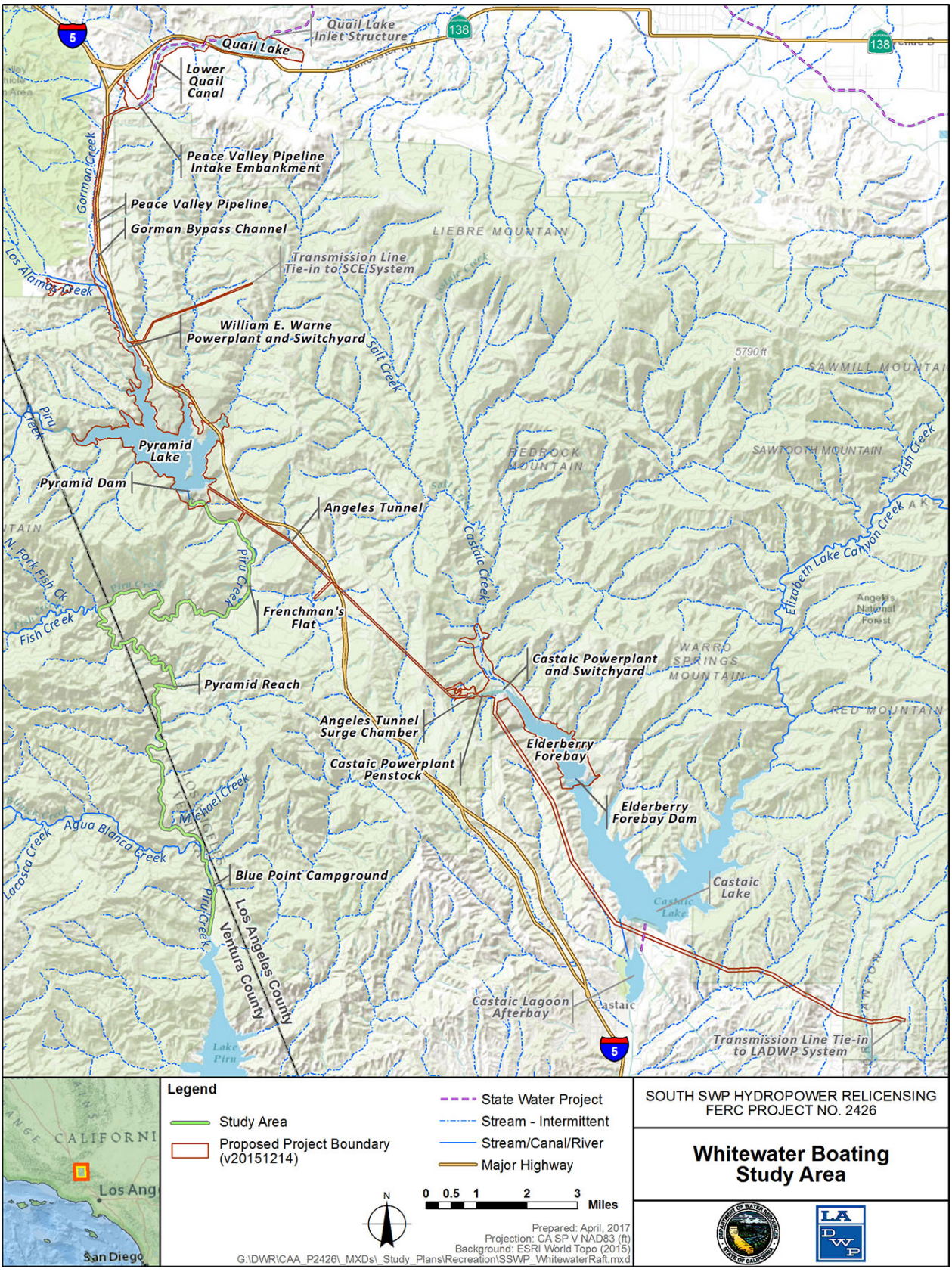

Figure 4.1-27. Whitewater Boating Study Area

Methods

The *Whitewater Boating Study* will consist of the following steps: (1) literature search and mapping; (2) hydrology assessment; (3) conduct structured interviews and; (4) field reconnaissance and site visit. These steps closely follow Level 1 and Level 2 assessments based on American Whitewater's recommended methodology outlined in the 2005 report by Whittaker, Shelby and Gamgemi: Flows and Recreation, A Guide to Studies for River Professionals. Steps 1 through 3 fall under the Level 1 Assessment and Step 4 falls under the Level 2 Assessment based on the methodology outlined in the 2005 report.

The Level 1 Assessment aims to characterize the Pyramid reach as a whitewater recreation resource and to assess the whitewater boating conditions and opportunities based on a hydrology assessment and structured interviews. The results of the two study components will be summarized in a report that describes the hydrology, optimum recreation boating flows, and Project effects on recreation flows.

Step 1 – Literature Search and Mapping. A literature and internet review will be undertaken to document existing and past recreation activities and opportunities in Pyramid reach. Information about recreation opportunities that make the reach attractive for whitewater boaters (frequency of boating opportunities are available, in what season, etc.), any information on current use of the reach for whitewater boating as well as potential physical inhibitors to whitewater boating on the reach will be identified and documented. Included in the literature review will be guidebooks, blogs, historical information on recreation boating on Pyramid reach, and a review of USFS land management plans. Wild and Scenic management goals will be evaluated to determine Project effects on Pyramid reach. GIS maps using existing data sets will be prepared to help identify and characterize the river reaches and land management allocations as well as known access points and trails.

Step 2 – Hydrology Assessment. The *Whitewater Boating Study* will utilize information from the *IHA Study* to analyze flows out of Pyramid Lake into Pyramid reach. The hydrology record will be developed from USGS gage 11109525 (Piru Creek below Pyramid Lake, near Gorman, CA), which is located in the Pyramid reach immediately downstream of Pyramid Dam as well as California Data Exchange Center (CDEC) gauges above and below Pyramid Lake as well as Project records on inflow and outflow. The current hydrologic record includes sub-daily flow information that will be used with USGS average daily flow information for analysis in this study. Boaters and other river users currently can also access hourly flow data from CDEC gauges, in Piru Creek just above Pyramid Lake and at the Pyramid Dam. The licensee's sub-daily flow data and data from the USGS gauges as part of the Licensees' *IHA Study* will be used to characterize the recreation opportunities throughout the year for whitewater boating in Pyramid reach. This summary of information may also include interviews with people knowledgeable about Pyramid reach, boating opportunities in the reach, and the gauges on the reach.

Project outflow into Pyramid reach is generally equal to natural inflow into Pyramid Lake. It is understood that current flows into Pyramid reach are consistent with Article 52 of the existing Project license to avoid adverse effects on the federally endangered arroyo toad (*Anaxyrus californicus*) as described in the Licensees' PAD and the PSP for South SWP Hydropower. The study results of the Licensees' *IHA Study* will describe the relationship between Project inflow into Pyramid Lake and Project outflow into Pyramid reach. This *Whitewater Boating Study* will evaluate the information from the *IHA Study* to determine whitewater boating opportunities in Pyramid reach.

Step 3 – Conduct Structured Interviews. Information will be sought from whitewater boating enthusiasts and stakeholders to obtain local knowledge of Pyramid reach regarding current recreation opportunities (including popular put-in and take-out areas), user preferences, and any known flow effects on whitewater boating for Pyramid reach. This information will be used to identify existing recreational use and demand in the study area and estimate future demand for whitewater boating activity on Pyramid reach.

Interview candidates from the whitewater boating community will include guides, user groups and others to determine the types and locations of whitewater boating activity occurring within Pyramid reach and a range of conditions (including flows) generally acceptable to whitewater boaters at various skill levels. The survey will include interviews with whitewater boaters and experts familiar with whitewater resources in the Project area. The interview methods will be consistent with Flows and Recreation: A Guide to Studies for River Professionals, by Whittaker, Shelby, and Gangemi (2005).

Based on Licensees' interviews with whitewater boating enthusiasts, a range of flows that are acceptable or optimal for whitewater boating in the *Whitewater Boating Study* area will be identified. The level of challenge these flows offer based on the International Scale of River Difficulty (Class 1 - Class VI) will also be evaluated to determine consistency with generally accepted conditions (or perceptions of difficulty) within Pyramid reach. American Whitewater's Safety Code may also be reviewed for information applicable to this *Whitewater Boating Study*.

Interviews and meetings with stakeholders will include questions about (1) how people use the river, with the goal to describe the character of recreation opportunities and identify flow-depended attributes; (2) the effects of flows on those attributes and whether participants can identify specific flows that affect the quality of opportunities; and (3) how to prioritize opportunities and identify recreation users' need for improved access and flow information. Attempts will be made to conduct the interviews around the same time as a site visit to the upper and lower reaches of Pyramid reach will be undertaken.

To the extent practical, current and future use that might be expected for Pyramid reach, during the whitewater boating season, will be estimated. Other whitewater boating use in nearby waterways will be identified and described to evaluate overall whitewater boating needs in the southern California area.

Step 4 – Field Reconnaissance and Site Visit. As an extension of the Level 1 evaluations, a group of whitewater boaters participating in the interviews will be invited concurrently to a site visit to evaluate the upper and lower Pyramid reach corridor for recreation facilities and opportunities affecting whitewater boating. Experienced whitewater boaters will participate in the site visit to assist with examination of the quality and characteristics of access, the boating opportunities, possibly estimate potential flow ranges, and identify obvious hazards. The site visit will be important for gathering GPS location data of likely put-in and take-out areas, parking, and general access to Pyramid reach.

Prior to the site visit, a desktop GIS constraints analysis will be performed to evaluate Pyramid reach and identify, map, and describe any existing and potential sites for access (put-in and takeout sites) along the study area. This will be done by analyzing topography, local roads, vegetation cover, existing trails, land ownership, etc. In addition, the U.S. Fish and Wildlife Service would be contacted prior to performing the field reconnaissance and site visit to identify any measures or precautions that might be necessary to ensure protection of FE, FT, FC or other protected species.

Quality Assurance and Quality Control

Field data gathered during this *Whitewater Boating Study* will be collected in a manner that promotes high quality results, and will be subject to appropriate QA/QC for sample collection equipment, procedures, and cross-checking of data. As part of the QA/QC procedures, extreme care will be taken to ensure the data collected is accurate and maintained in a safe environment.

Analysis

The results of the *Whitewater Boating Study* will be considered in relation to Project operations. The analysis will include an assessment of the study participant's evaluations of the potential quality and characteristics of the boating opportunities, access opportunities and constraints and summarize what is known or estimated about difficulty, type of run, and the type of craft suitable for the run. The analysis will also describe potential flow ranges, and obvious hazards that were observed during the site visit.

Reporting

Whitewater Boating Study results will be included, to the extent completed and ready for inclusion, in the Licensees' ISR, USR, DLA, and FLA.

4.1.19.4 Consistency of Methodology with Generally Accepted Scientific Practices

The inventory and assessment of whitewater boating opportunities is following procedures outlined by Whittaker, Shelby, and Gangemi (2005) are generally accepted procedures for many relicensing efforts.

4.1.19.5 Schedule

The *Whitewater Boating Study* will begin after FERC issues its Study Plan Determination. The Licensees anticipate the schedule below will be followed to complete the *Whitewater Boating Study*.

Fieldwork Preparation	August 2017 – February 2018
Fieldwork	February 2018 – December 2018
Data QA/QC Review	March 2018 – February 2019
Data Analysis and Reporting	February 2018 – June 2019

4.1.19.6 Level of Effort and Cost

Based on the work effort described above, the Licensees estimate the current cost to complete this *Whitewater Boating Study* will range between $125,000 and $200,000.

4.1.19.7 References

Whittaker, D., Shelby, B., & Gangemi, J. (2005). Flows and Recreation: A Guide to Studies for River Professionals.

4.1.20 Special-Status Raptors Study

4.1.20.1 Project Nexus

Continued Project O&M and Project-related recreation activities have the potential to affect special-status raptor species and their nesting habitat. For the purpose of this *Special-Status Raptors Study*, a special-status raptor species is a raptor that meets one or more of the following criteria: (1) listed under CESA as threatened (CT), endangered (CE), or candidate (C); (2) CDFW Fully Protected (FP); (3) CDFW SSC; (4) USFS Sensitive Species (FSS) and found on NFS lands; (5) BLM Sensitive and found on BLM lands; (6) formerly listed by USFWS as a Bird of Conservation Concern (BCC) or (7) protected under the Bald and Golden Eagle Protection Act.

4.1.20.2 Existing Information and Need for Additional Information

Existing, relevant, and reasonably available information regarding special-status raptors within, or with the potential to occur within, the proposed Project boundary is provided in Section 4.6.5 of the Licensees' PAD. As a summary, the Licensees found that no comprehensive special-status raptor surveys have been performed recently within the proposed Project boundary, but 11 special-status raptor species have the potential to occur (Table G-4 in the PAD [Appendix G]). Existing, relevant, and reasonably available information regarding special-status raptors and habitats within the proposed Project boundary is provided in PAD Section 4.6.5. This *Special-Status Raptors Study* will augment existing, relevant, and reasonably available information by conducting raptor studies in the proposed Project boundary.

Special-status raptor species with the potential to occur and their habitat descriptions are included in Table 4.1-14.

4.1.20.3 Study Goals and Objectives

The goal of this *Special-Status Raptors Study* is to document the presence and distribution of special-status raptor species within the proposed Project boundary or that may be impacted by activities associated with Project O&M or Project-related recreation.

4.1.20.4 Study Methods

Study Area

The *Special-Status Raptors Study* area will include specific locations within the proposed Project boundary including Pyramid Lake, Quail Lake, and a general 0.25 mile buffer around the lakes, Lower Quail Canal, and the area surrounding Castaic Powerplant. The *Special-Status Raptors Study* area is shown in Figure 4.1-28.

General Concepts and Procedures

- Personal safety is the most important consideration of each fieldwork team. Fieldwork will only occur in safely accessible areas and under conditions deemed safe by the field crews. Locations within the study area that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed; these areas will be identified in the data summary and an explanation for survey exclusion will be provided.

- The *Special-Status Raptors Study* will begin after FERC issues its Study Plan Determination.

- The *Special-Status Raptors Study* does not include the development of requirements for the new license, which will be addressed outside the study.

- The *Special-Status Raptors Study* focuses specifically on the resource addressed by the Study within the proposed Project boundary, but the study area is specific to the areas within the proposed Project boundary containing ecological conditions suitable for that resource.

- If required for the performance of the *Special-Status Raptors Study*, the Licensees will make a good faith effort to obtain permission to access private property well in advance of initiating the study. The Licensees will only enter private property if permission has been provided by the landowner.

- The Licensees will acquire all necessary agency permits and approvals prior to beginning fieldwork for the *Special-Status Raptors Study*.

- Field crews may make variances to the *Special-Status Raptors Study* in the field to accommodate actual field conditions and unforeseen problems. Any variances to the *Special-Status Raptors Study* will be noted in the data resulting from the *Special-Status Raptors Study*.

- To prevent the introduction and transmittal of amphibian chytrid fungus and invasive aquatic species (e.g., quagga mussels, zebra mussel, and Asian clams), field crews will be trained on, provided with, and use materials (e.g., Quat) for decontaminating their boots, waders, and other equipment when leaving or traveling between water-based study sites. Field crews will follow DWR's Quagga and Zebra Mussel Rapid Response Plan and CDFW's Aquatic Invasive Species Decontamination Protocol which can be found at the following link: (https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=43333). All boats used during the study will follow cleaning protocols, including inspections before and after use. All decontamination requirements in place at Project reservoirs including those of DWR's *Quagga and Zebra Mussel Rapid Response Plan* for the SWP will be strictly followed (DWR 2010).

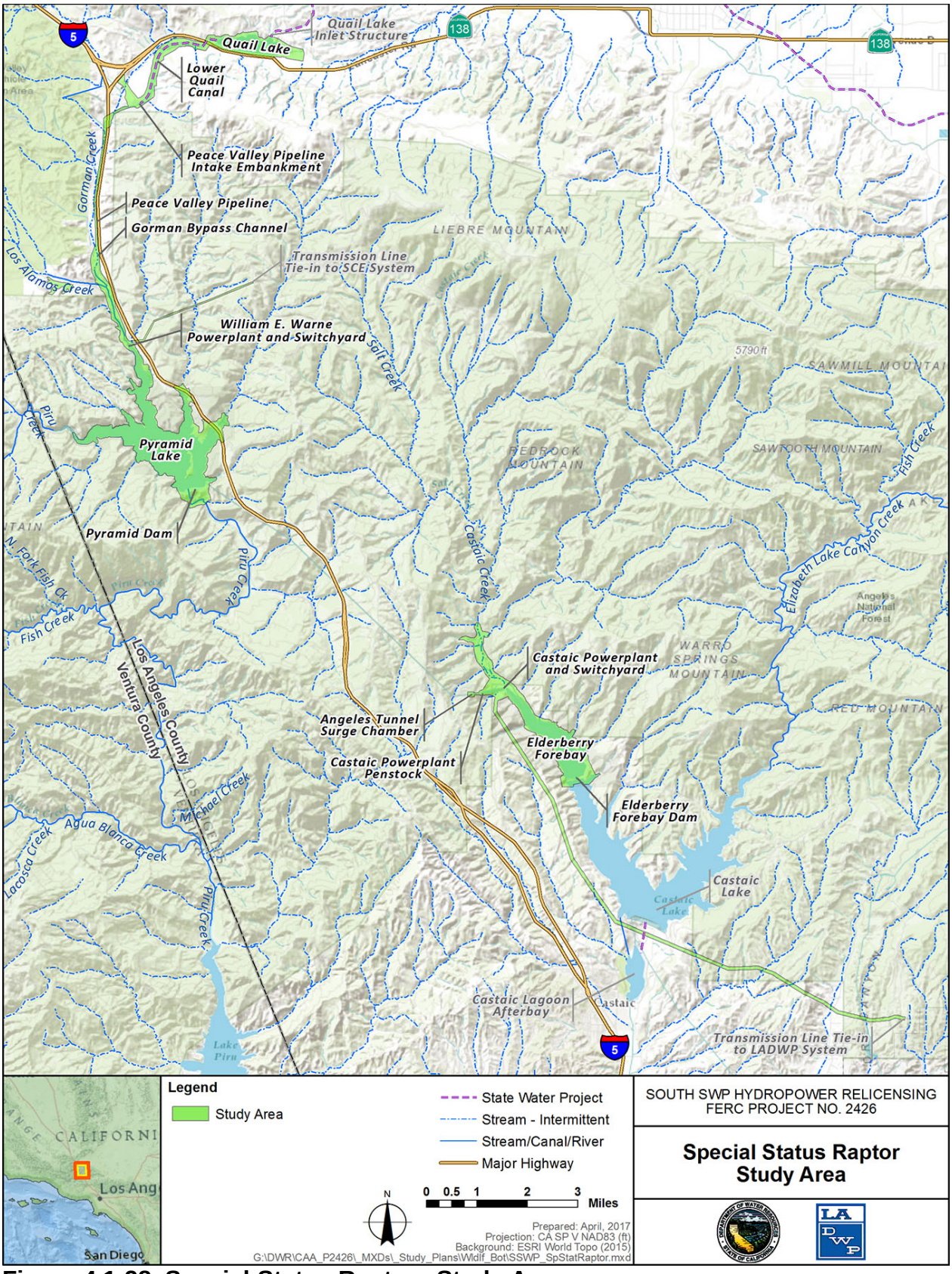

Figure 4.1-28. Special-Status Raptors Study Area

Methods

Special-status raptor surveys require that all species encountered are identified to the extent necessary to determine listing status. The *Special-Status Raptors Study* will consist of two steps: (1) gather data and prepare for field efforts, and (2) conduct special-status raptor surveys. These steps are described below.

Step 1 – Gather Data and Prepare for Field Efforts. Licensees will identify and map known occurrences of special-status raptor species within one mile of Pyramid Lake and Quail Lake, and prepare field maps for use by survey teams. This effort includes a 0.75 mile radius outside the study area to provide context for the surveyors when they perform the fieldwork associated with the study (i.e., the study area does not include this additional 0.75 mile radius outside the study area). The maps will include aerial imagery, Project features, and known special-status raptor species in the area. Survey timing will be planned based on established survey protocol periods for the target special-status raptors.

Step 2 – Conduct Special-Status Raptor Surveys. Licensees will conduct established protocol surveys for bald eagles, golden eagles, and burrowing owls. All other special-status raptors will be recorded as incidental observations only.

For all special-status raptor observations, the following will be collected: (1) digital photographs, if needed, to describe the occurrence, its habitat, and any potential threats; (2) estimated location of a bird or nest as derived from a handheld GPS unit, with a target accuracy of 50 feet. GPS data will be used to plot the sites on a GIS map; (3) estimated distance to nearest Project facility or feature, or Project-related activity, if in evidence; and (4) activities (e.g. recreational trails, maintenance, and uses) observed in the vicinity of the observation that have a potential to adversely affect the bird.

Special-status raptor species with the potential to occur and their habitat descriptions are included in Table 4.1-14.

Table 4.1-14. Special-Status Raptors with the Potential to Occur Within the Project Vicinity

Common Name	Scientific Name	Status	Habitat Requirements	Occurrence in Project Vicinity
Northern goshawk	*Accipiter gentilis*	FP, SSC, FSS, BCC, BLMs	Year-round resident of forested habitats, particularly mature coniferous and mixed forests. Few recent records in the mountains of Southern California.	No records. Considered unlikely to occur (LADWP 2012).
Golden eagle	*Aquila chrysaetos*	FP, BCC, BLMS	Generally open country, in prairies, arctic and alpine tundra, open wooded country, and barren areas, especially in hilly or mountainous regions. Nests on cliff ledges and in large trees.	One record in CNDDB from Project vicinity (LEB quadrangle). Observed in flight near Elderberry Forebay (Aspen Environmental Group 2007).
Long-eared owl	*Asio otus*	SSC	Riparian bottomland forest with over story of willows and cottonwoods; riparian forest along stream corridors (often dominated by live oak trees). Wooded areas with dense vegetation needed for roosting and nesting, adjacent open areas needed for hunting.	No records.
Burrowing owl	*Athene cunicularia*	SSC, BCC, BLMS	Open grasslands, especially prairie, plains, and savanna, sometimes in open areas such as vacant lots near human habitation or airports.	Eight records in CNDDB from the Project vicinity (LEB, MTC, NEW, PIR, and WTP quadrangles). No records in Project area.
Ferruginous hawk	*Buteo regalis*	BCC	Occurs in grasslands, desert scrub, agricultural areas or other areas of sparse shrubs, where there are poles, trees, cliffs, or other elevated features for nesting.	One record in CNDDB from Project vicinity (LEB quadrangle).
Northern harrier	*Circus cyaneus*	SSC	Marshes, meadows, grasslands, open rangelands, emergent wetlands, and cultivated fields. Nests on the ground, often in brushy cover near water, but also in grassland, fields, and sagebrush flats.	No records.

Table 4.1-14. Special-Status Raptors with the Potential to Occur Within the Project Vicinity (continued)

Common Name	Scientific Name	Status	Habitat Requirements	Occurrence in Project Vicinity
White-tailed kite	*Elanus leucurus*	FP, BLM	Savanna, open woodland, marshes, partially cleared lands and cultivated fields, mostly in lowland situations. Often near agricultural areas. Nests in groves of deciduous trees.	One record in CNDDB from Project vicinity (NEW quadrangle).
Prairie falcon	*Falco mexicanus*	BCC	Savanna, perennial grasslands, rangeland, and desert scrub. Nests on cliff ledges.	Three records in CNDDB from Project vicinity (BMT, LEB, and LIM quadrangles).
American peregrine falcon	*Falco peregrinus anatum*	FP, BCC	Breeds in open landscapes with cliffs. Winters in any open habitat, mudflats, coastlines, lake edges and mountain chains, especially in areas where potential prey (other birds) are numerous.	No records.
Bald eagle	*Haliaeetus leucocephalus*	CE, FP, FSS, BCC, BLMS	Breeding habitat usually includes areas close to coastal areas, bays, rivers, lakes, or other bodies of water that reflect the general availability of primary food sources. Preferentially roosts in conifers or other sheltered sites in winter in some areas.	No records in CNDDB. Observed in flight in the Project area (Aspen Environmental Group 2007).
California spotted owl	*Strix occidentalis occidentalis*	SSC, FSS, BCC, BLM	Mixed forests dominated by black oak, lodgepole pine, red fir from 1200 to 5500 feet elevation.	No records.
Osprey	*Pandion haliaetus*	WL	Ospreys occur primarily along rivers, lakes, reservoirs, and seacoasts. They often cross land between bodies of water. They typically build large stick nests on living or dead trees and also use numerous man-made structures such as utility poles, wharf pilings, windmills, microwave towers, chimneys, and channel. Nests are usually near or above water.	No records.

Source: Aspen Environmental Group 2007, Bolster 1998, Zeiner et al. 1988-1990, Shuford and Gardali 2008, IUCN Red List of threatened Species 2015, LADWP 2012
Key:
BCC = USFWS Bird of Conservation Concern
BLMS = BLM Sensitive
CE = CESA Endangered
FP = CDFW Fully Protected
FSS = Forest Service Sensitive
WL = Watch List species

Bald Eagle Surveys

Bald eagle surveys will be conducted by boat on Pyramid Lake and on foot from the shore at Quail Lake. It is assumed that the surveyor in the boat at Pyramid Lake and on foot at Quail Lake will be able to visually observe an area of approximately 0.25 miles from the water's edge.

Licensees will conduct bald eagle wintering and night roost surveys according to the *Protocol for Evaluating Bald Eagle Habitat and Populations in California* (Jackman and Jenkins 2004). The survey forms derived by Jackman and Jenkins (2004) will be used for both the wintering and night roost surveys. Survey methods include:

- Wintering Bird Surveys. A one-day survey will be conducted monthly from December through February (three surveys, at least two weeks apart) to capture peak wintering activity. The January survey will be conducted during the two-week nationwide, Mid-Winter Bald Eagle Surveys, coordinated by the U.S. Army Corps of Engineers (Steenhof et al. 2008), unless inclement weather prohibits safe surveys. Bald eagle activities and their exact locations will be recorded by GPS during these surveys.

- Winter Night Roost Surveys. One winter night roost survey will be conducted monthly from December through February (three surveys) if wintering bald eagles are observed in the Wintering Bird Surveys. Surveys will be conducted in the afternoon/early evening in areas where eagles were observed wintering in an effort to identify any night roosts. If roosts are located, the number of eagles will be recorded as they move from foraging to roosting habitat. These locations will be revisited the following morning, one-half hour before sunrise for at least two hours to count the number of eagles leaving the roost. If a stand is identified as a probable night roost, the area will be revisited during the day to search for any evidence of bald eagle use (e.g., feathers or castings) and the exact location will be recorded by GPS.

Licensees will conduct nesting surveys according to the *Bald Eagle Breeding Survey Instructions* (CDFG 1999) and *Protocol for Evaluating Bald Eagle Habitat and Populations in California* (Jackman and Jenkins 2004). Nesting territories will be checked at least three times during the nesting season (February through July). Survey methods include:

- Determine Occupancy of Territories and Early Incubation. Territories will be checked in early March, as weather conditions allow, in areas where bald eagles were observed during the Wintering Bird Surveys. Data collected at each site will consist of: (1) presence of adults, (2) courtship behavior, (3) evidence of nest repair or construction, (4) incubation, (5) observation of old nests, and (5) identification of any new nests. Surveys will be performed by boat, GPS coordinates will be recorded, and photographs will be taken for all nests observed.

- Confirm Occupancy of Territories and Presence of Eggs/Nestlings. Surveys will be conducted in late April or early May to determine whether the breeding pair surveyed in March is still tending the nest (e.g., incubating eggs or tending nestlings). The number of eggs/nestlings, bird behavior, and any other relevant observations will be recorded. These surveys will be conducted in the same manner as the initial surveys.

- Determine Nest Success. Surveys will be conducted in mid-June to determine how many nestlings are approaching fledgling age. These surveys will be conducted in the same manner as the other nesting surveys. The CDFW California Bald Eagle Nesting Territory Survey Form will be utilized during all nesting surveys.

Golden Eagle

Golden eagle surveys will be conducted by boat on Pyramid Lake and on foot from the dam at Quail Lake. It is assumed that the surveyor in the boat at Pyramid Lake and on foot at Quail Lake will be able to visually observe an area of approximately 0.25 mile from the water edge.

Licensees will conduct nesting golden eagle surveys according to the *Interim Golden Eagle Inventory and Monitoring; and Other Recommendations* (USFWS 2010) and *Protocol For Golden Eagle Occupancy, Reproduction, and Prey Population Assessment* (Driscoll 2010). Nesting territories will be checked four times during the nesting season (i.e., primarily February through July), with each survey spaced at least 30 days apart. Survey methods include:

- Occupancy Survey. Between January 1 and February 28, one 4-hour survey will be conducted to document courting behavior and nest building. Data collected will include: (1) description and GPS location of any nests or partial nests, (2) description and GPS location of any perches, (3) number of adults observed and behavior, (4) number of sub-adults observed and behavior, (5) GPS location of all golden eagles observed, and (6) weather.

- Incubation Survey. During March, one 4-hour survey will be conducted to document nests and egg incubation. Data collected will include: (1) description and GPS location of any nests or partial nests, (2) description and GPS location of any perches, (3) number of adults observed and behavior, (4) number of sub-adults observed and behavior, (5) number of eggs observed, (6) GPS location of all golden eagles observed, and (7) weather.

- Nesting Survey. Between April 1 and May 15, one 4-hour survey will be conducted to document nestlings. Data collected should include: (1) description and GPS location of any nests or partial nests, (2) description and GPS location of any perches, (3) number of adults observed and behavior, (4) number of sub-adults observed and behavior, (5) number of nestlings observed, description of

plumage, and behavior, (6) GPS location of all golden eagles observed, and (7) weather.

- Fledgling Survey. Between May 15 and June 30, one 4-hour survey will be conducted to document fledglings. Data collected should include: (1) description and GPS location of any nests or partial nests, (2) description and GPS location of any perches, (3) number of adults observed and behavior, (4) number of sub-adults observed and behavior, (5) number of fledglings observed, description of plumage, and behavior, (6) GPS location of all golden eagles observed, and (7) weather.

Burrowing Owl

Per CWHR maps in the PAD, the following areas will be surveyed for burrowing owl: Quail Lake, Lower Quail Canal, the arms of Pyramid Lake near Highway I-5, and the area surrounding Castaic Powerplant, where accessible. Licensees will conduct surveys by generally following the *Burrowing Owl Survey Protocol and Mitigation Guidelines* (The California Burrowing Owl Consortium, 1993).

First, Licensees will conduct a pedestrian survey of the study area, plus a 500-foot buffer, for 100 percent visual coverage of any signs of burrowing owl or burrows during the period September 1 through January 31. A 150-foot minimum distance from any owls or occupied burrows will be maintained. All burrows and/or burrowing owls found will be recorded, including GPS location and photographs.

If burrows are located, nesting bird surveys will be conducted between April 15 and July 15. Four surveys on four separate days will be conducted at all located burrowing sites. These will take place either two hours before sunset and one hour after, or an hour before sunrise and two hours after. Owl sightings, occupied burrows, and territorial and breeding behavior will be recorded, along with GPS location.

Incidental Raptors Sightings

For all other special-status raptors (i.e., northern goshawk, northern harrier, ferruginous hawk, white-tailed kite, prairie falcon, American peregrine falcon, long-eared owl, and California spotted owl), Licensees will record any sightings and nests observed, photograph the bird and/or nest, and record the location using GPS. If reasonably possible, Licensees will make a determination as to whether a raptor nest is active or inactive.

A list of all observed and identified bird species will be collected throughout the surveys and included in the final reporting.

4.1.20.5 Quality Assurance and Quality Control

Field data will be collected in a manner that promotes high quality results, and will be subject to appropriate quality assurance/quality control procedures, including spot-

checks of transcription and comparison of GIS maps with field notes to verify locations of sensitive habitats and species.

4.1.20.6 Analysis

Once the location of a special-status raptor species 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 occurrence that have a potential to affect the species.

4.1.20.7 Reporting

Special-status Raptors Study results will be incorporated, to the extent they have been completed for inclusion in the Licensees' ISR, USR, DLA, and FLA.

4.1.20.8 Consistency of Methodology with Generally Accepted Scientific Practices

Elements of this *Special-Status Raptors Study* are consistent with the goals, objectives, and methods outlined for most recent FERC hydropower relicensing efforts in California, including the Don Pedro Project (FERC No. 2299), the Yuba River Development Project (FERC No. 2246), the Merced River Hydroelectric Project (FERC No. 2174), and the Camp Far West Hydroelectric Project (FERC No. 2997), and will use established survey protocols for each species.

4.1.20.9 Schedule

The *Special-Status Raptors Study* will begin after FERC issues its Study Plan Determination. Licensees anticipate the schedule below will be followed to complete the *Special Status Raptors Study*.

Fieldwork Preparation	March 2018 – July 2018
Fieldwork	March 2018 – November 2018
Data QA/QC	December 2018 – January 2019
Data Analysis and Reporting	January 2019 – February 2019

4.1.20.10 Level of Effort and Cost

Based on the work effort described above, Licensees estimate the current cost to complete this *Special-Status Raptors Study* will range between $50,000 and $75,000.

4.1.20.11 References

Aspen Environmental Group. 2007. Biological Assessment and Report of Sensitive Resource Surveys for Castaic Power Plant and Vicinity. Report prepared for LADWP. September 2007.

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4.1.21 Pyramid Reach Benthic Macroinvertebrates Study

4.1.21.1 Project Nexus

Continued Project O&M have the potential to affect benthic macroinvertebrates (BMI) in Pyramid reach.

4.1.21.2 Existing Information and Need for Additional Information

Existing, relevant, and reasonably available information regarding BMIs in Pyramid reach is provided in Section 4.5.7 of the Licensees' PAD. As a summary, historical sampling identified 19 orders and 50 families of BMIs over five sampling sites in Pyramid reach.

Additional information, which will be provided by this *Pyramid Reach Benthic Macroinvertebrate Study*, is needed to determine the presence and locations of BMIs that occur in Pyramid reach that could be affected by the Project.

4.1.21.3 Study Goals and Objectives

The goal of this *Pyramid Reach Benthic Macroinvertebrate Study* is to characterize BMI assemblages within the Pyramid reach using the SWAMP protocol for BMI and physical habitat sampling (Ode et al. 2016). The objective of this *Pyramid Reach Benthic Macroinvertebrate Study* is to fill recognized gaps in existing information on BMIs in the Pyramid reach.

4.1.21.4 Study Methods

Study Area

The *Pyramid Reach Benthic Macroinvertebrate Study* area includes Pyramid reach as shown in Figure 4.1-29 below. Three representative sample sites will be selected in coordination with the *Pyramid Reach Fish Population Study* site selection process including one in the 2-mile-long section of Pyramid reach between Pyramid Dam and the concrete structure upstream of Frenchman's Flat (stream segment 1); one within a mile downstream of Frenchman's Flat, within the stream segment from the concrete structure upstream of Frenchman's Flat to the confluence of Fish Creek (stream segment 2); and one just upstream of the confluence with Agua Blanca Creek within the stream segment from Fish Creek to the NMWSE of Lake Piru (stream segment 3). The sites will be selected at locations accessible to field crews and will represent the overall habitat ratios found in the reach using the mesohabitat mapping data created for the reach.

Prior to site selection in the field, preliminary sites will be selected using existing aerial imagery and habitat mapping data. Final sampling sites will be selected in consultation with USFS, USFWS, SWRCB, and CDFW. The Licensees will make a good faith effort to schedule the consultation on a day or days convenient to the Licensees and

interested relicensing stakeholders, and will provide an email notice at least 30 days in advance of the meeting or site visit.

General Concepts and Procedures

- Personal safety is the most important consideration of each fieldwork team. Fieldwork will only occur in safely accessible areas and under conditions deemed safe by the field crews. Locations within the study area that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed; these areas will be identified in the data summary and an explanation for survey exclusion will be provided.

- The *Pyramid Reach Benthic Macroinvertebrate Study* will begin after FERC issues its Study Plan Determination.

- The *Pyramid Reach Benthic Macroinvertebrate Study* does not include the development of requirements for the new license, which will be addressed outside the study.

- The *Pyramid Reach Benthic Macroinvertebrate Study* focuses specifically on BMI communities within Pyramid reach, but the study area is specific to locations that can support that resource.

- If required for the performance of the *Pyramid Reach Benthic Macroinvertebrate Study*, the Licensees will make a good faith effort to obtain permission to access private property well in advance of initiating the study. The Licensees will only enter private property if permission has been provided by the landowner.

- The Licensees will acquire all necessary agency permits and approvals prior to beginning fieldwork for the *Pyramid Reach Benthic Macroinvertebrate Study*.

- Field crews may make variances to the *Pyramid Reach Benthic Macroinvertebrate Study* in the field to accommodate actual field conditions and unforeseen problems. Any variances in the *Pyramid Reach Benthic Macroinvertebrate Study* will be noted in the data resulting from the *Pyramid Reach Benthic Macroinvertebrate Study*.

- Licensee's field crews will record incidental observations of aquatic and terrestrial wildlife species observed during the performance of this study. The purpose of this effort is to gather incidental data during the performance of the study.

- To prevent the introduction and transmittal of amphibian chytrid fungus and invasive aquatic species (e.g., quagga mussels, zebra mussel, and Asian clams), field crews will be trained on, provided with, and use materials (e.g., Quat) for decontaminating their boots, waders, and other equipment when leaving or traveling between water-based study sites. Field crews will follow DWR's Quagga

and Zebra Mussel Rapid Response Plan and CDFW's Aquatic Invasive Species Decontamination Protocol which can be found at the following link: (https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=43333). All boats used during the study will follow cleaning protocols, including inspections before and after use. All decontamination requirements in place at Project reservoirs including those of DWR's Quagga and Zebra Mussel Rapid Response Plan for the SWP will be strictly followed (DWR 2010).

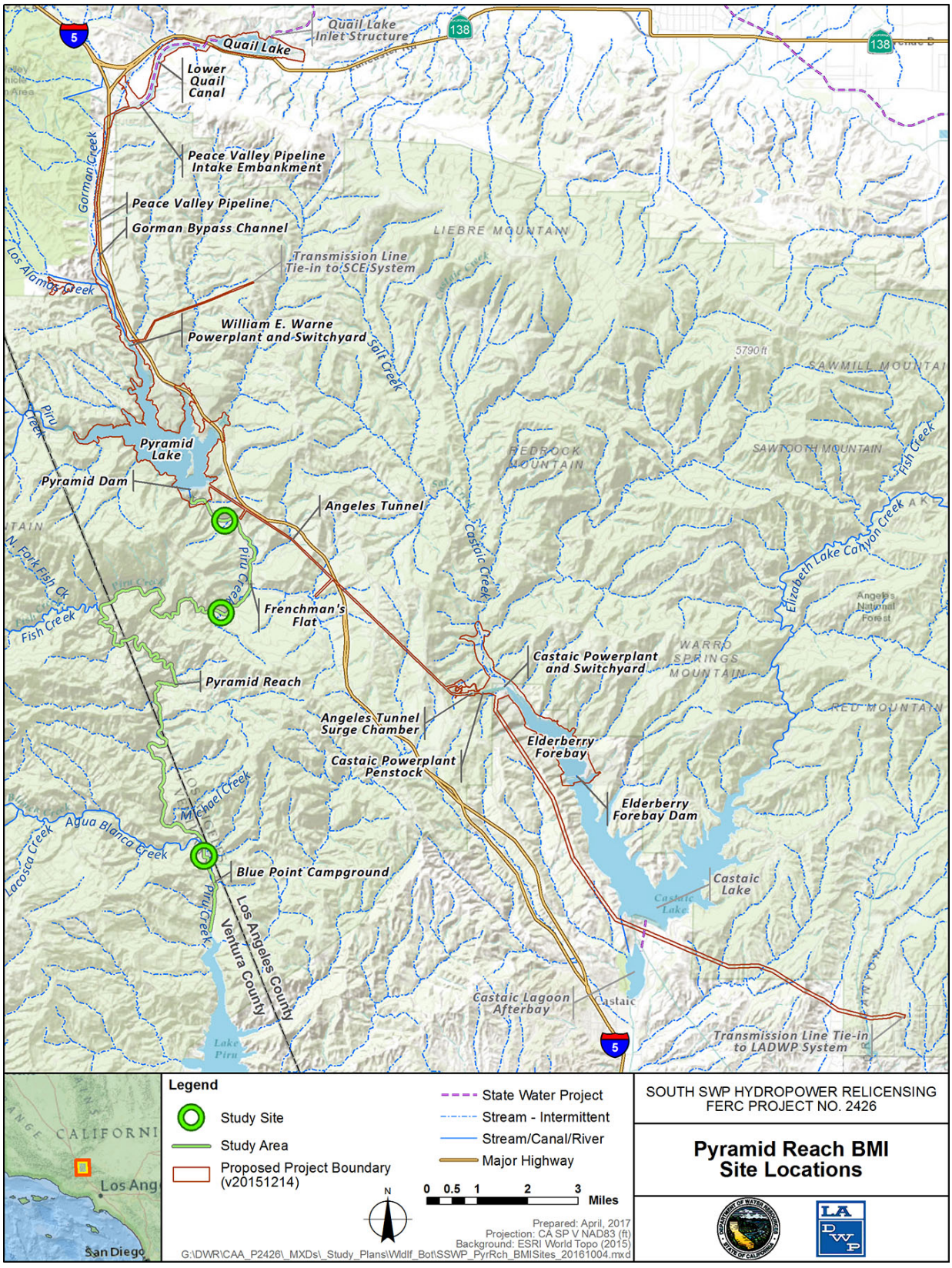

Figure 4.1-29. Pyramid Reach Benthic Macroinvertebrate Study Area and Sampling Locations

Methods

Data collection for the *Pyramid Reach Benthic Macroinvertebrate Study* will consist of three steps: (1) identify sampling locations, (2) collect SWAMP data, and (3) laboratory processing, as described below.

BMI sampling will be predicated on the Licensees obtaining necessary federal and State permits for sampling. Required permits may include a CDFW scientific collecting permit for streams that do not contain ESA-listed species and an ESA section 10(a)(1)(A) authorization from the USFWS for arroyo toad. Licensees will adhere to the permit terms and conditions during the study.

Steps 1 and 2 – Identify Sampling Segment Locations and Collect SWAMP Data.
Sampling methods will conform to the standard reach wide benthos (RWB) methods for documenting and describing BMI assemblages and physical habitat described in the SWAMP protocol (Ode et al. 2016). A summary of these methods is provided below. Data will be collected at each sampling site once in the May to July period per SWAMP protocol (Ode et al. 2016).

Reach Set Up: If the site's average wetted width is equal to or less than 10 meters (m), the site sampled will be 150 m in length; if the site's average wetted width is greater than 10 m, the site sampled will be 250 m. The standard sampling layout consists of 11 "main" transects (A-K) interspersed with 10 "inter-transects", all of which are arranged perpendicularly to the primary direction of stream flow (usually the thalweg), and placed at equal distances from one to the next. A flag will be installed at water's edge on one bank at the downstream limit of the sampling reach to indicate the first main transect ("A"). The positions of the remaining transects and inter-transects will then be established by heading upstream along the bank and using the transect tape or a segment of rope of appropriate length to measure off successive segments of 7.5 m (if sampling reach is 150 m), or 12.5 m (if it is 250 m).

Physical Habitat and Water Chemistry: Physical habitat and water chemistry will be characterized at each site. The habitat scoring criteria outlined by the SWAMP provides an effective measure of the physical integrity of a stream. The following list summarizes the quantitative measures of chemical, physical, and habitat characteristics that will be collected at each site. Refer to Ode et al. (2016) for a complete list of BMI and physical habitat data to be collected and SWAMP data sheets.

Reach-wide Parameters:

- GPS coordinates will be recorded at the top and bottom of the site.
- Water temperature, specific conductance, pH, and DO will be measured using approved standardized procedures and instruments.
- Total reach length and gradient (percent slope) as well as average width and depth will be recorded.

- Photographs will be taken at the top, middle, and bottom of the reach.
- A flow measurement will be taken within the reach.

Transect-specific Parameters:

- The wetted and bankfull widths of each transect will be taken.
- Substrate size, depth, and coarse particulate matter will be recorded at five locations along each transect.
- Cobble embeddedness for each cobble identified along the transect will be recorded. If the area contains fewer than 25 cobbles, the data will be supplemented by collecting "random" cobbles within the reach.
- Algal and macrophyte cover will be recorded at each of the sampling points.
- Bank stability, riparian vegetation, human influences, and instream habitat complexity will be recorded.
- Stream shading using a densitometer will be recorded.

BMI Field Collection: At each delineated sampling segment, samples will be collected at the 11 "main" transects by rubbing cobble and boulder substrates and disturbing finer substrate upstream of a D-frame kicknet fitted with a 0.02-inch (in.) diameter mesh net. For the RWB method, the sub-sampling position alternates between left, center, and right portions of the main transects, as one proceeds upstream from one transect to the next. These sampling locations are defined as the points at 25 percent ("left"), 50 percent ("center") and 75 percent ("right") across the wetted width in most systems.

At each sample location the net will be held in position on the substrate and field personnel will visually define a square area on the stream bottom upstream of the net opening, approximately one net-width wide and one net-width long. Because standard D-nets are 12 inches wide, the area within the plot will be 1 square foot (0.09 m2).

Working backward from the upstream edge of the sampling plot, field personnel will check the sampling plot for heavy organisms such as mussels, caddis cases, and snails. Field personnel will remove these organisms from the substrate by hand and place them into the net. Next, samplers will carefully pick up and rub stones directly in front of the net to remove attached benthic invertebrates. Rocks larger than a golf ball within the sampling plot will be cleaned such that all the organisms attached to them are washed downstream into the net. These rocks will be placed outside the sampling plot after they have been cleaned. Large rocks that protrude less than halfway into the sampling area will be pushed aside. If the substrate is consolidated, bedrock, or comprised of large, heavy rocks, field personnel will kick and dislodge the substrate (with the feet) to displace BMIs into the net. If a rock cannot be removed from the stream bottom, it will be rubbed with hands or feet (concentrating on cracks or

indentations), thereby loosening any attached insects. As the plot is disturbed, water current will carry all loosened material into the net. A brush will not be used to dislodge organisms from substrates.

Once the coarser substrates have been removed from the sampling plot, field personnel will dig through the remaining underlying material with hands to a depth of about 10 cm, where gravels and finer particles are often dominant. Field personnel will thoroughly manipulate the substrates in the plot to encourage flow to dislodge any resistant organisms. To the extent practical, field personnel will reduce the amount of sand particles in the net, as they damage organisms and degrade taxonomic data quality.

The subsamples will be combined in a jar, preserved with 95 percent ethanol, and labeled to form a single composite sample for that study site.

Step 3 – Laboratory Processing. Each composite sample will be rinsed in a standard no. 35 sieve (0.5 mm) and transferred to a tray with twenty, 4-inch square grids for sub-sampling. Sub-sampling will be performed using a stereomicroscope with magnifications of 10 to 20 times magnification.

Subsamples will be transferred from randomly selected grids to Petri dishes where the BMIs will be removed indiscriminately with the aid of a stereomicroscope and placed in vials containing 70 percent ethanol and 2 percent glycerol. In cases where BMI abundance exceeds 100 organisms per grid, half grids will be delineated to assure that a minimum of three discreet areas within the tray of benthic material will be subsampled. At least 600 BMIs will be subsampled from a minimum of five grids, or five half grids.

The debris from the processed grids will be placed in a remnant jar and preserved in 70 percent ethanol for later quality control testing. Subsampled BMIs will be identified by a taxonomist approved by the CDFW for EPA evaluations using standard aquatic macroinvertebrate identification keys (e.g., Kathman and Brinkhurst 1998, Merritt and Cummins 1996, Stewart and Stark 1993, Thorp and Covich 2001, Wiggins 1996) and other appropriate references.

All BMIs retained on a 0.5-mm screen will be removed from the subsample and a standard level 2a taxonomic effort will be used as specified in the Southwestern Association of Freshwater Invertebrate Taxonomists (SAFIT) in 2015 (Richards and Rogers 2011).

Quality Assurance and Quality Control

Field data gathered during this *Pyramid Reach Benthic Macroinvertebrate Study* will be collected in a manner that promotes high quality results, and will be subject to appropriate QA/QC for sample collection equipment, procedures, and cross-checking of data. As part of the QA/QC procedures, extreme care will be taken to ensure the data collected is accurate and maintained in a safe environment.

The CDFW Aquatic Bioassessment Laboratory (ABL) will be contracted to perform an external quality control review of the sample identification. Fifteen to 20 percent of the samples collected will be randomly selected for quality control by the taxonomist and sent to the CDFW ABL.

Analysis

Analytical methods will conform to the standard methods describing BMI assemblages and physical habitat outlined by SWAMP. Standard biological metrics, plus additional relevant metrics, will be calculated for each site (Table 4.1-15) and presented in graphical or tabular form.

Table 4.1-15. Biological Metrics Calculated to Assess BMI Assemblages

BMI Metrics	Description
RICHNESS MEASURES	
Taxonomic Richness	Total number of individual taxa
No. EPT Taxa	Number of taxa in the insect orders Ephemeroptera, Plecoptera, and Trichoptera
Ephemeroptera Taxa	Number of mayfly taxa
Plecoptera Taxa	Number of stonefly taxa
Trichoptera Taxa	Number of caddisfly taxa
Coleoptera Taxa	Number of beetle taxa
COMPOSITION MEASURES	
percent EPT	Percent of the composite of mayfly, stonefly, and caddisfly larvae
percent Ephemeroptera	Percent of mayfly nymphs
Shannon Diversity Index	General measure of sample diversity that incorporates richness and evenness
TOLERANCE/INTOLERANCE MEASURES	
California Tolerance Value (CTV)	CTVs between 0 and 10 weighed for abundance of individuals designated as pollution tolerant (higher values) and intolerant (lower values)
No. of Intolerant taxa	Taxa richness of those organisms considered to be sensitive to perturbation
percent Tolerant Organisms	Percent of macrobenthos considered to be tolerant of various types of perturbation
percent Dominant Taxon	Measures the dominance of the single most abundant taxon. Can be calculated as dominant 2, 3, 4, or 5 taxa
FEEDING MEASURES	
percent CF+CG Individuals	Percentage of BMIs within the collector-filterer and collector gatherer functional feeding groups
percent Scrapers	Percent of macroinvertebrates that graze upon periphyton
percent Non-gastropoda Scrapers	Percentage of BMIs within the scraper functional feeding group excluding gastropod scrapers
percent Predators	Percent of macroinvertebrates that prey on living organisms
percent Shredders	Percent of macroinvertebrates that shred leaf litter

Aquatic macroinvertebrates will be identified to Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT) level 2 (Richards and Rogers 2011), and metrics outlined in Rehn et al. (2007) will be calculated. Metrics will be used to formulate the Hydropower Index of Biotic Integrity described by Rehn (2009). The results from each site will also be scored utilizing the California Stream Condition Index (CSCI) to translate BMI metrics into a measure of overall stream health (Rehn et al. 2015).

Reporting

Pyramid Reach Benthic Macroinvertebrate Study results will be included, to the extent completed and ready for inclusion, in the Licensees' ISR, USR, DLA, and FLA.

4.1.21.5 Consistency of Methodology with Generally Accepted Scientific Practices

The methods are consistent with the methods used for recent FERC hydroelectric relicensing efforts in California, including the Drum-Spaulding Project (FERC Project No. 2310), the Yuba-Bear Hydroelectric Project (FERC Project No. 2266), and the Yuba River Development Project (FERC Project No. 2246).

4.1.21.6 Schedule

The *Pyramid Reach Benthic Macroinvertebrate Study* will begin after FERC issues its Study Plan Determination. Licensees anticipate the schedule below will be followed to complete the *Pyramid Reach Benthic Macroinvertebrate Study*.

Fieldwork Preparation	March 2018 – May 2018
Site Selection	May 2018 – June 2018
Fieldwork	May 2018 – July 2018
Data QA/QC	August – October 2018
Data Analysis and Reporting	November 2017 – December 2018

4.1.21.7 Level of Effort and Cost

Based on the work effort described above, the Licensees estimate the current cost to complete this *Pyramid Reach Benthic Macroinvertebrate Study* is between $35,000 and $50,000.

4.1.21.8 References

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4.1.22 Pyramid Lake Tributaries Fish Passage Barriers Study

4.1.22.1 Project Nexus

Continued Project O&M and Project-related recreation have the potential to affect access to tributaries of Pyramid Lake by local fish populations.

4.1.22.2 Existing Information and Need for Additional Information

Existing, relevant, and reasonably available information regarding fish communities and operations of Pyramid Lake is provided in Sections 4.5.4 and 3.2, respectively, of the Licensees' PAD. As summary, 19 species of fish have been documented in Pyramid Lake including rainbow trout (Oncorhynchus mykiss). Rainbow trout have also been

documented in Piru Creek upstream of Pyramid Lake but not in any other tributaries to Pyramid Lake. Current operating agreements limit fluctuation of the lake to only the upper 19 feet under normal operating conditions.

Additional information, which will be provided by this *Pyramid Lake Tributaries Fish Passage Barriers Study*, is needed to determine upstream passage barriers in Pyramid Lake.

4.1.22.3 Study Goals and Objectives

The goal of this *Pyramid Lake Tributaries Fish Passage Barriers Study* is to identify any upstream fish passage barriers on identified tributaries to Pyramid Lake below the NMWSE of Pyramid Lake. The objective of this *Pyramid Lake Tributaries Fish Passage Barriers Study* is to fill recognized gaps in existing information regarding fish passage on tributaries to Pyramid Lake.

4.1.22.4 Study Methods

Study Area

The *Pyramid Lake Tributaries Fish Passage Barriers Study* area includes Pyramid Lake between its NMWSE of 2,578 feet to the area of normal drawdown during the time when fish in the lake would access the tributaries. The portion of the tributaries to be assessed lie within the lake fluctuation zone. Tributaries to be studied include: Piru Creek, Gorman Creek, and Carlos Canyon. The *Pyramid Lake Tributaries Fish Passage Barriers Study* area is shown in Figure 4.1-30.

General Concepts and Procedures

- Personal safety is the most important consideration of each fieldwork team. Fieldwork will only occur in safely accessible areas and under conditions deemed safe by the field crews. Locations within the study area that cannot be accessed in a safe manner (e.g., locations containing dense vegetation or unsafe slopes) and areas inundated when the surveys are performed, will not be surveyed; these areas will be identified in the data summary and an explanation for survey exclusion will be provided.

- The *Pyramid Lake Tributaries Fish Passage Barriers Study* will begin after FERC issues its Study Plan Determination.

- The *Pyramid Lake Tributaries Fish Passage Barriers Study* does not include the development of requirements for the new license, which will be addressed outside the study.

- The *Pyramid Lake Tributaries Fish Passage Barriers Study* focuses specifically on fish passage barriers within Pyramid Lake and the portions of the tributaries that are located within the lake elevation fluctuation zone (the area between the

Pyramid Lake NMWSE of 2,578 feet to normal drawdown elevation during the time when fish in the lake would access the tributaries).

- If required for the performance of the *Pyramid Lake Tributaries Fish Passage Barriers Study*, the Licensees will make a good faith effort to obtain permission to access private property well in advance of initiating the study. The Licensees will only enter private property if permission has been provided by the landowner.

- The Licensees will acquire all necessary agency permits and approvals prior to beginning fieldwork for the *Pyramid Lake Tributaries Fish Passage Barriers Study*.

- Field crews may make variances to the *Pyramid Lake Tributaries Fish Passage Barriers Study* in the field to accommodate actual field conditions and unforeseen problems. Any variances in the *Pyramid Lake Tributaries Fish Passage Barriers Study* will be noted in the data resulting from the *Pyramid Lake Tributaries Fish Passage Barriers Study*.

- To prevent the introduction and transmittal of amphibian chytrid fungus and invasive aquatic species (e.g., quagga mussels, zebra mussel, and Asian clams), field crews will be trained on, provided with, and use materials (e.g., Quat) for decontaminating their boots, waders, and other equipment when leaving or traveling between water-based study sites. Field crews will follow DWR's Quagga and Zebra Mussel Rapid Response Plan and CDFW's Aquatic Invasive Species Decontamination Protocol which can be found at the following link: (https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=43333). All boats used during the study will follow cleaning protocols, including inspections before and after use. All decontamination requirements in place at Project reservoirs including those of DWR's Quagga and Zebra Mussel Rapid Response Plan for the SWP will be strictly followed (DWR 2010).

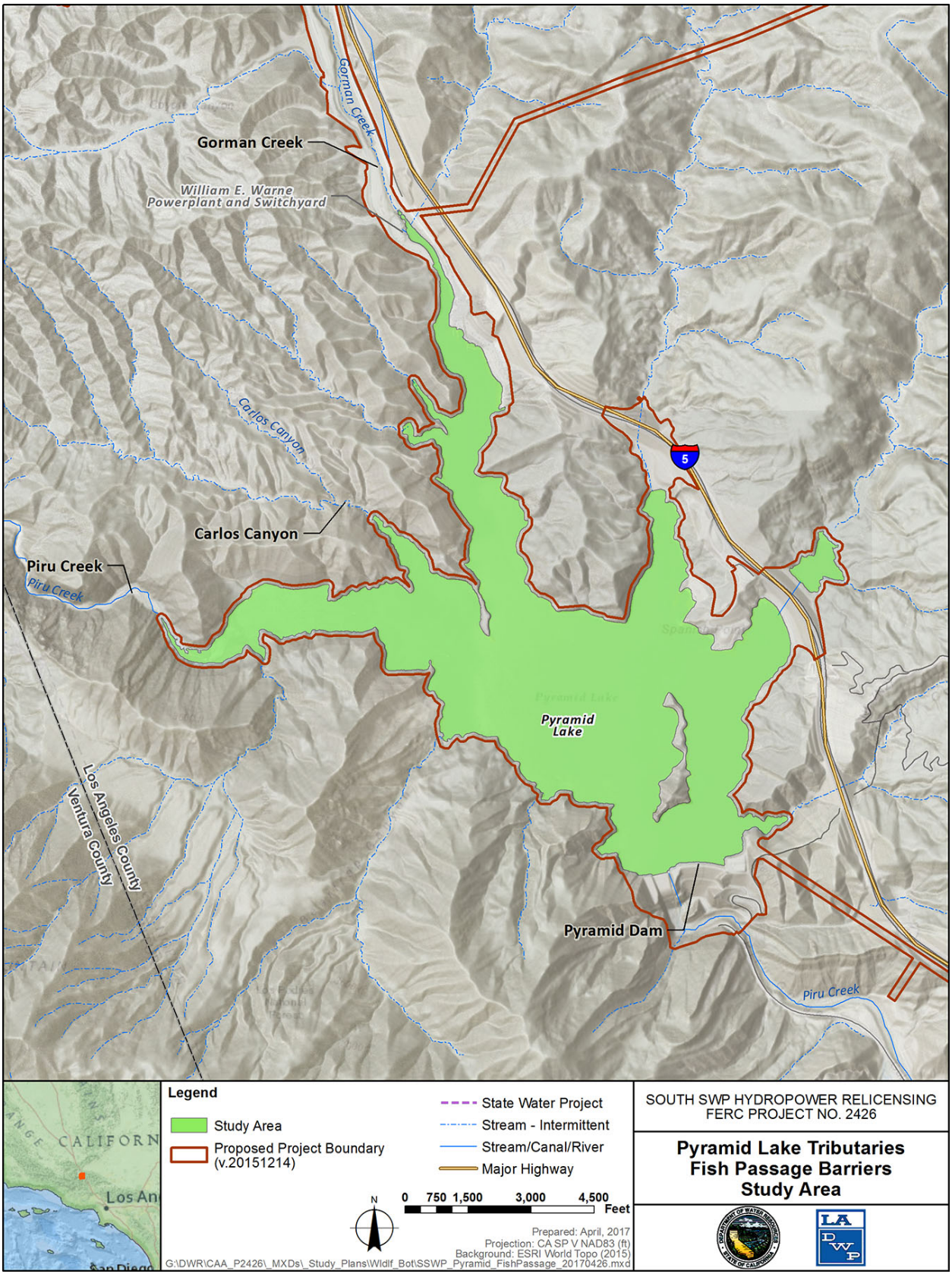

Figure 4.1-30. Pyramid Lake Tributaries Fish Passage Barriers Study Area

Methods

Data collection for the *Pyramid Lake Tributaries Fish Passage Barriers Study* will consist of one step: complete fish passage barriers assessment, as described below.

Step 1 – Complete Fish Passage Assessment. This assessment will focus on potential barriers to rainbow trout movement out of Pyramid Lake into the tributaries when the reservoir is drawn down – that is, the assessment will identify barriers within the reservoir 19 feet below the NMWSE of 2,578 feet and above the elevation of normal drawdown. As discussed under Section 3.2 of the Licensees' PAD, current operating agreements limit fluctuation of the lake to only the upper 19 feet under normal operating conditions.

At each tributary, a surveyor will map the channel topography moving in an upstream direction from the Pyramid Lake water surface elevation to the reservoir's NMWSE using Real Time Kinetic (RTK) GPS survey equipment. At each data collection location the surveyor will collect a data point for the bed elevation in the thalweg and a water surface elevation over the bed in the North American Vertical Datum of 1988. The resulting data set will produce a detailed longitudinal profile of the channel bed and water surface elevations. Dominate/sub-dominate substrate in each tributary will be mapped along the survey path. Potential barriers will be identified for each rainbow trout lifestage and classified as either a leaping barrier, a shallow water barrier, or a velocity barrier. Photos will be taken to document the tributary survey generally, and for each identified barrier specifically. The location of each barrier will be identified with the RTK GPS. The stream profile will be compared with the leaping ability of rainbow trout identified from the Pyramid Lake creel census data, to determine if the stream profile represents a barrier to fish that might want to move upstream.

Fieldwork will occur at a time when Pyramid Lake is at its normal lowest elevation, which is typically about 19 feet below NMWSE and occurs in the August to September period. The reservoir will not be drawn down for the study; Licensees will make a good faith effort to perform the fieldwork when the lake is at its lowest point in the August-September period.

Reservoir operations data will be acquired and described to relate project operations to the annual time period for which potential barriers may be exposed. This will be done by calculating the percentage of the year in which each barrier was exposed and therefore presented a potential impediment to fish movement.

Quality Assurance and Quality Control

Field data gathered during this *Pyramid Lake Tributaries Fish Passage Barriers Study* will be collected in a manner that promotes high quality results, and will be subject to QA/QC for sample collection equipment, procedures, and cross-checking of data. As part of the QA/QC procedures, extreme care will be taken to ensure the data collected is accurate and maintained in a safe environment.

Analysis

As described above, a longitudinal profile presenting the results of the RTK GPS survey will be produced for each tributary. Each profile will describe the channel elevation and water surface elevation at the time of each survey. Photos for each tributary will be presented and organized from downstream to upstream. The results of the *Pyramid Lake Tributaries Fish Passage Barriers Study* will be considered in relation to typical Project operations, particularly during rainbow trout spawning periods.

Reporting

Pyramid Lake Tributaries Fish Passage Barriers Study results will be included, to the extent completed and ready for inclusion, in the Licensees' ISR, USR, DLA, and FLA.

4.1.22.5 Consistency of Methodology with Generally Accepted Scientific Practices

The methods are consistent with the methods used for recent FERC hydroelectric relicensing efforts in California, including the Merced River Hydroelectric Project (FERC Project No. 2179) and the Yuba River Development Project (FERC Project No. 2246).

4.1.22.6 Schedule

The *Pyramid Lake Tributaries Fish Passage Barriers Study* will begin after FERC issues its Study Plan Determination. Licensees anticipate the schedule below will be followed to complete the *Pyramid Lake Tributaries Fish Passage Barriers Study*.

Fieldwork Preparation	June 2017 – July 2017
Fieldwork	August 2017 – September 2017
Data QA/QC	October 2017
Data Analysis and Reporting	November 2017

4.1.22.7 Level of Effort and Cost

Based on the work effort described above, the Licensees estimate the current cost to complete this *Pyramid Lake Tributaries Fish Passage Barriers Study* is between $15,000 and $25,000.

4.1.22.8 References

DWR. 2010. The Quagga and Zebra Mussel Rapid Response Plan for the State Water Project. 93 pp. CONFIDENTIAL/PRIVILEGED – Not for Public Distribution.

5.0 COMMUNICATION AND REPORTING

Section 5.11(b)(3) of FERC's ILP regulations requires that the RSP include provisions for periodic progress reports, including the manner and extent to which information will be shared.

For each study, the Licensees will create a folder on the South SWP Relicensing website and place in the folder the FERC-approved study plan for that study. When study data are available and have undergone appropriate quality assurance and control review, the Licensees will place in the folder: study data in usable formats (e.g., Microsoft™ Excel or Word, .DSS and GIS shapefiles, as appropriate); data summaries (e.g., plots of mean, minimum and maximum water temperature and flow over time for location where continuous water temperature recordings occur); and a listing of any known study variances at that time. In addition, the Licensees will periodically post to the website progress of ongoing studies.

As required by FERC regulations, the Licensees will file with FERC an ISR and an USR within 1 year and 2 years, respectively, of commencing studies. The study reports will describe for each of the study plans, which work occurred in the preceding year, the Licensees overall progress in implementing the study plan, and schedule and the data collected, including an explanation of any variance from the study plan and schedule. The study reports will also include any modifications to ongoing studies or new studies proposed by the Licensees.

With regard to communications, the Licensees will follow the Relicensing Communication Guidelines included in Section 2.4 of the August 2016 South SWP Hydropower Relicensing PAD.

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Appendix A

Summary of the Arroyo Toad and Sensitive Species Monitoring in Pyramid Reach

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Summary of the Arroyo Toad and Sensitive Species Monitoring in Pyramid Reach

Executive Summary

- The Department of Water Resources (DWR) and Los Angeles Department of Water and Power (LADWP) have been operating the South SWP Hydropower facilities under a license issued by the Federal Energy Regulatory Commission (FERC) in 1978.

- Prior to a 2009 FERC order[1] requiring DWR to implement an operational plan that schedules flow releases to mimic the natural hydrograph of Piru Creek in the Pyramid reach, DWR operated flow releases under a regime that was developed in consultation with multiple agencies including the California Department of Fish and Wildlife (CDFW) and the U.S. Forest Service (USFS) to support a year round rainbow trout fishery in the Pyramid reach.

- Throughout the years DWR has continuously consulted with those agencies as well as the U.S. Fish and Wildlife Service (USFWS), the State Water Resources Control Board (SWRCB), and the United Water Conservation District (UWCD) to appropriately manage the flow releases from Pyramid Dam to the Pyramid reach. The operational plan for flow releases into the Pyramid reach that is the subject of the 2009 FERC Order was developed through consensus of the resource agencies after a thorough review that included an environmental assessment prepared by FERC, preparation of a biological assessment by DWR and issuance of concurrence by the U.S. Fish and Wildlife Service, and issuance of a Clean Water Act Section 401 certification (401 WQC) by the State Water Quality Control Board.

- Currently, DWR continues to implement the operational plan for releases into the Pyramid reach consistent with the 2009 FERC order and the 401 WQC. To comply with the FERC order and the 401 WQC, DWR conducts annual monitoring of arroyo toad (*Anaxyrus californicus*), California red-legged frog (*Rana draytonii*), and other sensitive species. DWR also implements two programs for the monitoring of erosion damage and flood warning signage in the Pyramid reach consistent with the approved Prevention of Erosion Damage to Infrastructure Plan and the approved Flood Warning System and Signage Plan. Annual monitoring reports on those activities have been provided each year to FERC, SWRCB, USFWS, USFS, CDFW and UWCD. Detailed discussion is provided below.

History of the Origin of the Flow Release and Arroyo Toad Monitoring Requirements in the Pyramid Reach

- The pre-2005 flow regime was consistent with the FERC approved 1982 Exhibit S (as amended in 1999) in effect at that time under Articles 51 and 52. During the comment period for the Exhibit S filing in 1980, the USFS recommended releases to the Pyramid reach be based on predicted air temperatures as follows:

  > "From May 1 to November 15, a minimum of 10 [cubic feet per second] cfs should be released from Pyramid Dam, except that increased flows are necessary on days when the air temperature reaches or exceeds 85 degrees F. To minimize the amount of water released from Pyramid Dam, a graduated flow schedule based on the local weather reports predicted maximum temperature for the day should be used. On a day when the predicted maximum air temperature is expected to exceed 85 degrees F, increased

[1] FERC Order Amending Article 52 and Exhibit S (129 FERC ¶ 62,073) issued on October 28, 2009.

flows should begin at 1000 in the morning and continue until 1800. Ideally, these adjustments in flows should be based on actual temperatures rather than predicted temperatures and should be made in increments to correspond with the rises in temperature."

USFS derived this recommendation from a 1976 CDFW report that assessed the fishery potential in Piru Creek and evaluated the minimum flows necessary to sustain a year-round trout fishery in the two mile reach of Piru Creek from Pyramid Dam to Piru Gorge. The report was prepared under a Federal Power Act Section 4(e) condition issued by the USFS in 1975.

The FERC-approved 1982 Exhibit S[2] required among other things a fishery enhancement plan that would establish and maintain a year-round trout fishery between Pyramid Dam and Frenchman's Flat. The USFS's recommendation for minimum flows in the Pyramid reach based on predicted daily maximum daytime temperatures was incorporated into the FERC-approved 1982 Exhibit S specifying the following release schedule under Article 52 of the license:

"Licensees shall discharge from Pyramid Reservoir into Piru Creek a continuous minimum flow of 5 cubic feet per second (cfs) from November 16 – April 30, and 10 cfs from May 1 – November 15, for the purpose of protecting and enhancing aquatic resources. When the predicted maximum air temperature in the project are during the May 1 – November 15 period is between 86° to 90° F the continuous minimum flow shall be increased to 15 cfs; 91° to 95° F – 20 cfs; and 96° F or above – 25 cfs. On days when the predicted maximum air temperature exceeds 85° F, the increase in the minimum flow shall begin at 10:00 a.m., and continue until 6:00 p.m. These flows may be temporarily modified if required by operating emergencies beyond the control of the Licensees, and for short periods for fishery management purposes upon mutual agreement between the Licensees and the California Department of Fish and Game."

- The federally endangered arroyo toad was listed under the Endangered Species Act (ESA) on December 16, 1994 (59 FR 64859). The USFWS expressed concern for the potential effects of the then-current flow regime on the arroyo toad. As a result, DWR consulted with multiple agencies in the mid-1990s to develop an operational plan that would involve releasing flows to mimic the natural hydrograph of Pyramid reach, support the rainbow trout fishery, and protect the arroyo toad and California red-legged frog[3] while complying with existing water rights and providing water supply to UWCD.

- DWR implemented the 1982 Exhibit S (Article 52) stream release requirements up until April 1, 1996, when DWR received approval from FERC to begin implementing an interim minimum flow schedule developed by CDFW that had the consent of CDFW, USFWS, UWCD and USFS (Los Padres and Angles National Forests). The agreed-upon interim minimum flow schedule consisted of releasing 25 cfs from April 1 to August 31, and then ramping down by 1 cfs per day until reaching 5 cfs from September 1 to March 31. DWR was required to report annually to FERC on the agency consultations regarding the interim minimum flow schedule. On October 25, 1999, FERC approved the interim minimum flow

[2] FERC Order Approving Revised Exhibit S and Amending License, issued on November 9, 1982.
[3] The federally threatened California red-legged frog was listed under the ESA on June 24, 1996 (61 FR 25813) and its life history and habitat requirements were taken into consideration during the development of the flow releases when DWR consulted with the resource agencies.

schedule (Article 52) as part of an amended Exhibit S to allow DWR time to complete its consultation with the resource agencies and develop a permanent solution to the flow releases into the Pyramid reach. A revised temporary flow guideline was implemented in 2004 per discussions with USFWS to avoid take of the arroyo toad resulting from higher than natural perennial stream flows in the Pyramid reach under the interim minimum flow schedule.

- DWR continued to consult with CDFW, USFWS, USFS and UWCD in the subsequent years including 2005 to discuss elements of a new operational plan that was being developed through consensus of the resource agencies. On February 10, 2005, DWR filed a request with FERC to temporarily waive the minimum flow requirements of Article 52 and the trout fishery requirements specified in the amended Exhibit S (October 25, 1999) under Article 51, and to begin implementing the new operational plan by March 15, 2005 to avoid incidental take of the arroyo toad. As a result of implementing the operational plan, DWR would not be able to comply with the then-current license requirements for providing minimum flows to support the year-round rainbow trout fishery, and thus, a temporary waiver of those requirements was needed. The temporary waiver would also permit DWR to implement the new operational plan to avoid take of the arroyo toad, while allowing FERC time to review DWR's license amendment application seeking FERC approval of the new operational plan.

- Several agencies and individuals supported the temporary waiver of the minimum flows and the operational plan to mimic the natural hydrograph of Piru Creek. Supporters of the waiver included the USFS (Los Padres National Forest), USFWS, CDFW and UWCD, as well as experts in arroyo toad ecology such as Nancy Sandburg and Dr. Samuel Sweet of the University of California Santa Barbara, who have studied the arroyo toad population in Piru Creek since the late 1980s and 1990s and into the early 2000s. FERC approved the temporary waiver of the minimum flow requirements (Article 52) on April 12, 2005.

- On February 14, 2005, the USFWS issued a proposed rule for designating portions of the Pyramid reach from just downstream of Frenchman's Flat to Lake Piru and the segment of Piru Creek above Pyramid Lake as critical habitat for the arroyo toad. DWR coordinated with the USFWS, who stated that the segment of the Pyramid reach from Pyramid Dam to Frenchman's Flat would be excluded from the critical habitat designation because USFWS considered arroyo toads to be extirpated in this area. USFWS reassured DWR that approval of the designation of critical habitat in those segments would not affect implementation of the new operational plan.

- On March 17, 2005, DWR filed a license amendment application with FERC to amend the flow requirements in the Pyramid reach to be consistent with the new operational plan under Article 52 that would mimic the natural hydrograph. The amendment also sought to modify the Exhibit S trout stocking requirements (Article 51) to include only a seasonal rainbow trout fishery at Frenchman's Flat and between Pyramid Dam and Frenchman's Flat. The new operational plan would provide greater volumes of water through the Pyramid reach during a storm event during the months of November through April. During the months of May through October, the volume and rate of flows into the Pyramid reach would be reduced to match the natural inflows and thus summer flows would typically be small due to smaller volumes of natural inflows into Pyramid Lake.

- As part of the license amendment application process, DWR prepared a draft and final Environmental Impact Report[4] (EIR; 2004, 2005 respectively) under the California Environmental Quality Act (CEQA), and FERC prepared a draft and final Environmental Assessment[5] (EA; 2007, 2008 respectively) under the National Environmental Policy Act (NEPA) to analyze the environmental impacts of the proposed amendments.

- A discussion of sediment transport resulting from the operational plan in the Pyramid reach was analyzed in the EIR using the Meyer-Peter, Muller bed load function (p. 3-61) and in FERC's EA (p.58). Both the EIR and EA analyses concluded that the releases under the operational plan would result in increased sediment transport downstream of Pyramid Dam. Although the operational plan releases would have the potential to increase sediment loss in the uppermost portion of the Pyramid reach due to more frequent higher flows transporting sediment downstream, arroyo toads are not known to occur in this area, and it is expected that sediment from adjoining tributaries and along the banks due to scouring and erosional forces could support suitable habitat further downstream.

- Several entities commented on the FERC EA including CDFW and USFWS whose comments are referenced in the 2009 FERC Order (at 34). Among the comments received from CDFW was a recommendation for a long-term arroyo toad and sensitive species monitoring program and a more detailed discussion on mechanisms to facilitate sediment supply into the Pyramid reach if the natural flow regime was degrading habitat. USFWS recommended a 10-year or more long-term monitoring program to document the variation in climatic fluctuations in the Pyramid reach. This monitoring would allow early detection of potential adverse effects on arroyo toad from the loss of sediment in portions of the system[6]. In its EA, FERC agreed that monitoring of arroyo toads and other sensitive species in the Pyramid reach was needed to determine if populations of arroyo toad were being established in the upstream portion of the Pyramid reach and if the loss of sediment extends further downstream than anticipated.

- In the draft EA, FERC acknowledged that a 7.3 mile segment of the Pyramid reach was being proposed for designation as wild (a 4.3-mile-long portion) and for recreation (a 3-mile-long portion) under the Wild and Scenic Rivers Act. FERC recommended an assessment of the geological values in certain areas of the Pyramid reach that meet eligibility criteria for listing under the Wild and Scenic Rivers Act. As discussed in the 2009 FERC Order, this 7.3 segment was listed under the Wild and Scenic Rivers Act on March 30, 2009, and FERC concluded that because the current releases (which were consistent with the operational plan) have been implemented since 2005, monitoring of the geologic values is no longer warranted.

FERC's EA was used in support of the Section 7 ESA consultation with USFWS. Following the ESA consultation, FERC determined that the amendments were not likely to adversely affect the arroyo toad and FERC concluded by granting approval of DWR's license amendment application thereby approving the proposed change in the operating flow regime during high flow periods with a maximum discharge of 18,000 cfs and daily adjustments in flow releases from Pyramid Dam. FERC determined that the changes will improve habitat for federally

[4] DWR. Environmental Impact Report for the Simulation of Natural Flows in Middle Piru Creek. State Clearinghouse No. 2004051123. Prepared by Aspen Environmental Group. November 2004.
[5] FERC, Environmental Assessment Amendment to License. California Aqueduct Project, FERC Project No. 2426-197, California. Washington, DC. February 2007.
[6] Id. at 34.

endangered species and improve trout habitat by providing more dynamic geomorphic stream processes and by creating deeper pools with cooler water temperatures. FERC also stated that the changes were expected to benefit the arroyo toad by increasing geomorphic processes, providing scouring needed to reduce riparian and emergent vegetation, increasing stream terraces and sand bars, and providing natural fluvial process to redistribute sediments. FERC recommended that the CDFW cease stocking in the catch-and-release area between Pyramid Dam and Frenchman's Flat until NMFS and CDFW make a determination on the potential effects of fish stocking on arroyo toad and determine appropriate future stocking practices in the area[7]. This evaluation and determination is ongoing and has not yet been completed.

- On December 9, 2008, the SWRCB issued a 401 WQC with requirements to develop a monitoring plan for arroyo toad and other sensitive species in the lower portion of Pyramid reach between Lake Piru and Ruby Canyon, with a requirement to submit an annual monitoring report to SWRCB by October 1. In the 1990s and early 2000s, it was documented that arroyo toad and its habitat was present above Lake Piru at Blue Point Campground and upstream about 3.5 miles to Ruby Canyon. Studies conducted as part of UWCD's relicensing of FERC Project 2153 in 2004 from Lake Piru to Blue Point Campground did not detect any life stages of arroyo toad, but arroyo toad egg clutches were found above Blue Point Campground. Condition 2 of the SWRCB 401 WQC states the following:

  > "Within one year of issuance of the license amendment, DWR shall file with FERC a plan approved by the Deputy Director for Water Rights for annual breeding surveys of the arroyo toad in middle Piru Creek. Monitoring shall occur, at a minimum, in the lower portion of middle Piru Creek between Lake Piru and Ruby Canyon (a distance of approximately 2 to 3 miles) and shall be conducted by a qualified biologist with experience in identifying arroyo toad larvae and tadpoles. An annual monitoring report shall be submitted to the Deputy Director by October 1 of each year that includes the results of the breeding surveys as well as flow data to document daily releases at Pyramid Dam. If three years of monitoring indicate that the arroyo toad population has shown improvement under the flow modifications identified in this certification, DWR, upon consultation with the State Water Board and FWS, may modify the monitoring frequency required to demonstrate the presence of arroyo toad."

- The 401 WQC includes conditions for mitigating potential erosion and damage to downstream infrastructure in the Pyramid reach, and requirements for a warning system and signage program. In response to a petition from CalTrout and Friends of the River, the SWRCB[8] issued a revised 401 WQC on August 4, 2009 that included additional environmental findings required under CEQA in the areas of water and recreational resources. The SWRCB adopted mitigation measures that were incorporated into the revised 401 WQC. Those measures required DWR to: a) complete an engineering analysis on infrastructure adjacent to Piru Creek in the Pyramid reach; b) develop procedures and guidelines to monitor erosion based on the engineering analysis as well as implement any needed engineered erosion protection measures; and c) develop and implement a warning system and signage program. DWR complies with those measures annually, and submits annual reports to the SWRCB and FERC. See discussion below.

[7] See *Pacific Rivers Council, et al., v. CDFG (2006)*

[8] Order Partially Granting Petition for Reconsideration and Authorizing Issuance of Revised Water Quality Certification for Re-Operation of Pyramid Dam for the California Aqueduct Hydroelectric Project Federal Energy Regulatory Commission Project No. 2426 (Order WQ 2009-2007).

- FERC approved DWR's license amendment application in 2009 and incorporated SWRCB's 401 WQC conditions by reference[9]. FERC's 2009 Order required DWR to prepare a plan within one year for monitoring arroyo toad, California red-legged frog, southwestern pond turtle, and other sensitive species in consultation with CDFW, USFS, SWRCB, and USFWS. Paragraph E of the 2009 FERC Order states the following:

  > "Within one year of the issuance date of this order, the licensee shall file with the Commission, for approval, arroyo toad and sensitive species monitoring plan. This plan shall address arroyo toads, California red-legged frogs, and the southwestern pond turtle. The plan shall include measures for annual breeding surveys for the arroyo toad and the California red-legged frogs and shall be conducted by a qualified biologist for at least three years. The plan shall include a schedule for filing the results of the annual surveys with the Commission and the resource agencies. The plan shall also comply with the requirements of mitigation measure 2 of the Water Quality Certification included in Appendix A of this order."

- A copy of the draft monitoring plan was transmitted to CDFW, SWRCB, USFWS, USFS and UWCD for review and comment. Only the USFWS and SWRCB provided comments on the methodology and process requirements, which were incorporated into the plan. The SWRCB specifically stated that the "Monitoring Plan, together with the requested attachments [USFWS arroyo toad survey protocol and evidence that the consultant possesses the requisite expertise], adequately fulfills the requirements of Condition 2, and is approved by the State Water Board."

- DWR submitted the monitoring plan to FERC for its approval. FERC determined that the monitoring plan with the incorporation of additional conditions (providing copies of annual reports to CDFW, USFWS, SWRCB and USFS, and consulting with the resource agencies if requesting to modify the monitoring plan or revise the survey frequency after three years of monitoring) satisfied the requirements of paragraph E of the 2009 FERC Order. FERC approved the plan[10] in August 2010. FERC ordered DWR to file an annual monitoring report with USFWS, SWRCB, CDFW, USFS, and FERC within 45 days of completing the final survey of the season. DWR consulted with SWRCB, USFWS, USFS and CDFW to request a deadline extension to 90 days after completion of the field surveys, and received approval from all those agencies in 2013. As a result, FERC modified the deadline for reporting survey results to be within 90 days of completing the final survey of the season.

Current Compliance Requirements for Arroyo Toad and Sensitive Species Monitoring in Pyramid Reach

- The 2009 FERC Order requires DWR to conduct annual arroyo toad and sensitive species surveys in Pyramid reach. Condition 2 of SWRCB 401 WQC states that "if three years of monitoring indicate that the arroyo toad population has shown improvement under the flow modifications identified in this certification, DWR, upon consultation with the State Water Board and FWS, may modify the monitoring frequency required to demonstrate the presence of arroyo toads." This condition was incorporated into the 2009 FERC under ordering paragraph (E) which states that the monitoring plan "shall include measures for annual breeding surveys for arroyo toad and California red-legged frog, and shall be

[9] *Id.*

[10] *Order Modifying and Approving Arroyo Toad and Sensitive Species Monitoring Plan for Piru Creek* (132 FERC ¶ 62,136) issued on August 26, 2010.

conducted by a qualified biologist for at least three years." However, DWR has chosen to continue this monitoring each year without modification to obtain more data and to satisfy ongoing requirements of the 401 WQC. DWR has implemented this license requirement since 2010, resulting in 6 consecutive studies. DWR plans to continue the monitoring into the 2017 year.

- Consistent with the approved 2010 monitoring plan[11], the surveys are conducted in the approximately 4.6 mile segment of Pyramid reach between Ruby Canyon and Blue Point Campground just above Lake Piru, as well as up to about a one mile segment of Agua Blanca Creek (a reference site that is a tributary to Pyramid reach) for a total survey area of about 6 miles. The surveys follow the 1999 USFWS survey protocols for arroyo toad, and incidental sightings of other sensitive species and removal of American bullfrogs are conducted concurrently with the arroyo toad surveys. To date, DWR has been contracting with Environmental Science Associates, Inc. to conduct the surveys and complete the annual reports.

- After the last survey of the season, which typically occurs in late June or early July, a report is filed within 90 days with FERC and the following agencies:

    a. CDFW, San Diego office (Ed Pert, Region V Regional Manager)
    b. Angeles National Forest (Jeffrey Vail, Forest Supervisor)
    c. USFWS, Ventura Office (Steve Henry, Field Supervisor)
    d. SWRCB, Division of Water Rights (Les Grober, Deputy Director)
    e. UWCD (Mike Booth, Senior Biologist)

- Natural inflow to Pyramid Lake is released into the Pyramid reach at a rate of up to 18,000 cfs, which is the maximum safe, designed release from Pyramid Dam. DWR's releases to the Pyramid reach are consistent with requirements of the 2009 FERC Order and 401 WQC.

- DWR also conducts monitoring consistent with a Prevention of Erosion Damage to Infrastructure Plan and Flood Warning System and Signage Plan required under the SWRCB's 401 WQC that was incorporated into the FERC 2009 Order. Those plans were developed in consultation with USFWS, USFS, CDFW, and SWRCB prior to filing them for approval with FERC and SWRCB. Those two plans have been approved by FERC and SWRCB and annual reports are routinely provided to them consistent with the 401 Water Quality Certification and the 2009 FERC Order. The annual reports are also provided to CDFW, USFS, USFWS and UWCD addressed to the individuals listed above.

- The Prevention of Erosion Damage to Infrastructure Plan requires an annual assessment of erosion damage to downstream infrastructure including bridges, roads, culverts, utilities and other State Water Project facilities located in or adjacent to the Pyramid reach that may have resulted from peak releases, and subsequent implementation of any erosion control measures that might be needed. The frequency of monitoring is dependent on the daily releases such that monitoring is implemented daily for releases of between 4,000 cfs to 10,000 cfs, and is conducted multiple times a day for releases exceeding 10,000 cfs. Monitoring is not conducted for flows less than 4,000 cfs. DWR implements a Flood Warning System and Signage Plan in the Pyramid reach that provides public warning and alerts in advance of high stream releases. Monitoring and any measures conducted under those two plans are discussed in the annual reports. Monitoring is currently being conducted at 11

[11] *Id.*

flood warning signage locations and 8 erosion monitoring sites located between Pyramid Dam and Frenchman's Flat.

- Water deliveries to UWCD are made from November 1 to February 28 usually in association with a natural runoff event or in a ramping pattern similar to a natural hydrological event. Radial gate and stream release valves testing and other testing requirements requiring an increase of 50 cubic feet per second (cfs) for a short duration (15 minutes or less) are conducted from August 15 to January 31, dates that are outside of the arroyo toad breeding period. Any testing that requires increasing releases above 50 cfs, or requiring a longer duration, or requiring testing releases outside of the August 15 through January 31 period is coordinated with the USFWS within 72 hours.