



## **WRPI: Water Resources Institute Final Report**

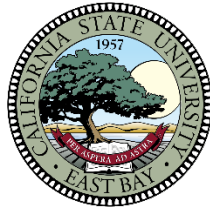
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# **Potter Valley Hydroelectric Project Relicensing of Pacific Gas and Electric (PG&E)**

Mendocino and Lake Counties, California

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## Acknowledgements

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I like to thank the guidance of my internship supervisor, Dawn Alvarez, the Pacific Southwest Region Fish Biologist, Hydropower Assistance Team. I would also like to acknowledge the genuine support of Forest Service Regional Program Specialist, Lily Nieves and WRPI Internship Manager, Christina Rodriguez.

## **Executive Summary**

The Potter Valley is comprised of two dams, a powerhouse, and a diversion tunnel that artificially connects the Eel River to the East Branch Russian River. The project is located in the Eel River headwaters and diverts water out of the watershed through a tunnel in a mountain into the Russian River. Since the location of this plant is between two, Eel River watershed and Russian River watershed, considering the effect of climate change and overall condition of Eel River with its salmonid and steelhead, it puts demands and imposes tougher environmental laws and regulation for PG&E PAD. Yoshiyama and Moyle (2010) estimated that from 500,000 up to 1 million salmonids historically spawned in the Eel River watershed annually; Flow regime alteration by dams and water diversions is one of the most serious and continuous threats to river ecosystem sustainability (Poff et al. 1997; Bunn 2002). Project relicensing started on April 15, 2017, 5 years prior to expiration on April 14, 2022. In 2004, FERC issued an Order Amending License for the Project which included a complex set of conditions to govern streamflow in both the Eel River and East Branch Russian River, as well as storage levels in Lake Pillsbury. This PAD is a requirement of the ILP. PG&E is filing the PAD with FERC simultaneously with the notice of intent and distributing the PAD to federal and state resource agencies, local governments, Native American tribes, members of the public, and others interested in the relicensing proceeding. FERC staff prepares a scoping document that includes a preliminary list of issues, and solicits comments on the scope of analysis of issues, which staff holds scoping meetings, conducts a site visit, and issues a revised scoping document based on public and agency input. Stakeholders (tribes, resource agencies, non-governmental organizations, interested public, and FERC) submit study requests.

## **Project Objectives**

Potter Valley is in Mendocino County, north-northeast of the town of Ukiah and at the headwaters of the East Fork on the Russian River. The Ukiah Valley has major wine production industry. Potter Valley also is a producer of wines; its rich agricultural soils planted mostly in irrigated pasture, wine grapes, and pears and supports a wide verity of farms and ranches. Most

of the Project is located on lands owned by Pacific Gas and Electric (PG&E and National Forest System Lands (NFSL)) administered by the United States Forest Service (USFS), Mendocino National Forest (MNF). The Potter Valley Project began in the year 1905 when the town of Ukiah and nearby areas around it needed more water, for the small coal-burning plant and natural flow of the Russian River was no longer providing enough water for the fast-growing agricultural and urban demands. Mr. W.W. Van Arsdale of San Francisco envisioned an electrical power plant, powered by water, that could replace a small coal-burning plant at the north end of Potter Valley on the Eel River and the East Branch Russian River. Mr. Van Arsdale inspired by the Eel River being in 475 feet higher elevation than the valley so he builds the Cape Horn Dam, which backed up the Eel River and formed a reservoir called Van Arsdale as well as a one-mile (1.6 km) and 8-foot (2.4 m)-diameter tunnel under the drainage divide to Potter Valley and over 450 feet vertical into the Potter Valley powerhouse, at the headwaters of the East Branch of the Russian River. However, this project could only operate during the wet winter months, when there was enough water in the Eel River to divert without drying up the riverbed downstream. The Scott Dam, cyclopean concrete ogee gravity structure 12 miles (19 km) upstream from Cape Horn Dam formed Lake Pillsbury, was built in 1922 with much greater storage capacity that provides water for the diversion during the summer months.

On April 15, 1922, the Federal Power Commission (precursor to the Federal Energy Regulatory Commission (FERC) which now licenses the Project) granted a 50-year license, which expired in 1972, for the project owned by the Snow Mountain Water and Power Company. In 1930 PG&E bought the Project from Snow Mountain Water and Power and assumed the license. In 1983, the Hydropower Project was relicensed for 50 years (from the original expiration date of 1972) and was signed by PG&E, California Department of Fish and Game (CDFG) and three counties of Mendocino, Sonoma, and Humboldt. Based on Article 39 10-year study undertaken to determine the project water flows impact on the Eel River's salmon and steelhead and establish the new modified flow recommended by FERC. After a year or two other organizations like the Round Valley Indian Tribes (RVIT) and Sonoma County Water Agency (SCWA) or Upper Russian River Water Agency submitted proposals for minimum flow releases to FERC. A public scoping meeting was held by FERC in February of 1998 for many organizations and water districts, governmental agencies and environmental groups joined as interveners in the process resulting in the completion of EIS Draft. In November of 2002 after a long Section 7 Consultation between

PF&E, FERC and National Marine Fisheries Service (NMFS), according to Endangered Species Act, NMFS formed a Biological View and Reasonable and Prudent Alternative (RPA) for the Project water flows that was submitted to FERC. As a result, FERC issued the License for the Project on January 28, 2004, that expires on April 14, 2022.

To renew project license PG&E is filing with the (FERC or Commission) a Notice of Intent (NOI) to begin official relicensing for the current 9.2-megawatt (MW) Potter Valley Project, FERC Project No. 77. To initiate relicensing of the project PG&E uses FERC's Integrated Licensing Process (ILP). The ILP is a step by step process made up of pre-application activity and post-filing activity. Figure 1&2 demonstrate the flow path process of pre-filing activity and post-filing activity. In the preparation of this PAD, PG&E exercised due diligence by communicating to governmental agencies, Native American tribes, and other organizations with potentially having relevant information. The PAD provides participants the information necessary to recognize issues and develop study requests and to familiarize those who plan to participate in the relicensing. Information from the PAD will be used to support the development of FERC's Scoping Documents, the License Application (to be filed by April 14, 2020), and FERC's Environmental Impact Statement or Environmental Assessment under the National Environmental Policy Act (NEPA). PAD is organized into 7 sections:

- Section 1.0. Introduction to the Project and relicensing process.
- Section 2.0. Process Plan and Schedule for all relicensing activities through the filing of the License Application; Proposed Communication Protocols; and ILP Flow Chart.
- Section 3.0. General Description of the Eel and Russian River Watersheds.
- Section 4.0. Description of Project Location, Facilities, and Operation.
- Section 5.0. Description of the Existing Environment by Resource Area.
- Section 6.0. Potential Resource Issues; Potential Studies and Analyses; existing and Proposed Measures; and Relevant Comprehensive Plans.
- Section 7.0. Literature Cited.

My goal with WRI was aimed at first to use GIS to delineate watershed in Lassen National Forest. I have been asked by my previous supervisor, at Hat Creek ranger district, to create pour points which particularly uses TopModel modeling. However, this task was way out of my

background training and out of the time range of this internship. My revised goal is within the scope of my education and has helped me to understand and grasp what I have studied in my undergraduate years as an Environmental Science and geology major. My task in this project was to survey PAD created by PG&E particularly focusing on section 6.0. potential resource issues, studies, and analysis, read the FERC's scoping documents(SDs) particularly SD2, and briefly look at each stakeholder's comments on the PAD documents including US Forest Service, and finally compare all these organizations responses from both sides of the Eel and Russian River watershed, to provide my input opinion based on what I have learned from this project survey.

### **Project Approach**

To achieve task and goal of this experiential learning project several procedures have been followed to search, read, analyze and evaluate the documents at hands. Prior to any search or creating any strategical procedures, a section of an interest has been suggested by the project supervisor, which was focusing briefly on potential resource issues, potential studies and analyses, and by focusing on scoping documents 2 comments as well as study request by other stakeholders and organizations. A primary step started with the reading of PG&E's PAD document followed by reading the USFS study request, which comments on the "Potter Valley Hydroelectric Project" PAD reflects on section 6.2 Potential Studies and Analyses. Forest Service is requesting 26 new studies addressing areas of Aquatic Resources, Terrestrial Resources, Cultural Resources, Land Resources, Recreation Resources, Potential Study Plan Development, with each addressing seven study criteria:

Criteria 1- Goals and objectives of the study

Criteria 2- Explain the relevant resource management goals

Criteria 3- Explain any relevant public interest considerations

Criteria 4- Describe existing information concerning the subject of the study proposal

Criteria 5- Explain the nexus between project operations and effects on the resources to be studied.

Criteria 6- Explain how any proposed study methodology is consistent with generally accepted practice.

Criteria 7- Describe considerations of level of effort and cost.

Also, additional study requests are included in addition to earlier PG&E potential studies and analyses to address information needs that have not been previously identified in the PAD.

The second approach was to survey Scoping Document 2 general comments on issues raised by participants. Some of these entities were: Water Board, National Marine Fisheries Service, Round Valley Indian Tribes, Wildlands Conservancy, Willits Environmental Center, Humboldt County 3rd District Supervisor, Pacific Rivers, Native Fish Society, Center for Biological Diversity, Save California's Salmon, Pacific Coast Federation of Fishermen's Associations, and San Francisco Crab Boat Owners Association, American Whitewater, California Sportfishing Protection Alliance, California Trout, Friends of the Eel River, Friends of the River, Trout Unlimited, the Redwood Chapter of Trout Unlimited, and North Coast Rivers Alliance. These organizations suggested alternatives ranged from full decommissioning with the removal of project facilities, to removal or lowering of Scott Dam. Other comments were given on the behalf of Dam Safety and New Study request, which have been mentioned above.

The third approach was to look at each entities study request and focus on critical issues that all these organizations responded upon the pre-application document of PG&E and find strong common ground. My focus was to briefly look at these responses by stakeholders: Center for Biological Diversity, United States Department of the Interior national park service, North Coast Regional Water Quality Control Board, Pacific Coast Federation of Fishermen's Association (PCFFA), Wiyot Tribe, Round Valley Indian Tribe and by briefly looking at National Oceanic and Atmospheric Administration (NOAA).

## **Project Outcomes**

Since the duration of this relicensing project surpasses my experiential learning at USFS and the time for me to look at the further outcomes of these studies, and any updates are limited, I finalize this project outcome according to my comprehension of these entities comments and study request regarding PAD:

### ***Center for Biological Diversity***

The center for biological diversity urges FERC to consider, where applicable and where information is available, the beneficial or adverse effects of the projects on a variety of resources or interests, including but not limited to:

- (1) listed threatened or endangered species;
- (2) economic viability of a project, including costs of resource protection measures;
- (3) river targeted for fish recovery;
- (4) feasibility of fish passage;
- (5) consistency with comprehensive plan(s);
- (6) protected river status (e.g., scenic river, wilderness area);
- (7) effectiveness of past mitigation measures and availability of future measures;
- (8) support by applicant or other party for decommissioning;
- (9) Tribal lands, resources, or interests;
- (10) water quality issues, including presence of toxic sediments;
- (11) potential opportunities for recreation;
- (12) physical condition of project;
- (13) presence of existing project-dependent development (e.g., houses abutting reservoir);
- (14) other non-power project-related benefits (e.g., municipal water supply, flood control, irrigation);
- (15) project-dependent resource values (e.g., recreation, wetlands, wildlife, habitat);
- (16) need for power and ancillary services;
- and (17) historic properties.

### ***National Park Services (NPS) (Comments on Study Request)***

The NPS pays specific attention to discussions of designated Wild and Scenic Rivers (WSRs) within and downstream of the Potter Valley Project Area. The NPS focuses on discussions of recreation use and opportunities in the Project Area, especially those related to whitewater boating. The NPS mentions that the applicant proposes to conduct a Whitewater Boating Flow Assessment, but claims that no further studies are needed as the available information is sufficient to conduct the assessment and that there are no information gaps. The NPS



believes that the Applicant is unable to come to this conclusion without conducting a formalized whitewater boating study that would provide more reliable and comprehensive data that can be used in making recommendations on enhancing whitewater boating opportunities and experiences.

***North Coast Regional Water Quality Control Board (Regional Water Board)***

The Regional Water Board requests a comprehensive study of water quality conditions, their drivers, and the degree to which project operations affect those water quality conditions. The water quality study should address temperature, dissolved oxygen, pH, mercury, nutrient cycling, cyanobacteria harmful algal blooms (CyanoHABs), and aluminum. The goal of these water quality Study is to: (1) characterize existing water quality conditions in Lake Pillsbury; (2) determine consistency with state and federal water quality standards; and, (3) identify potential Project operation and maintenance-related causes of water quality objective exceedances and/or impairment of beneficial uses.

***Pacific Coast Federation of Fishermen's Association (PCFFA)***

The PCFFA request that the following studies be part of the process:

1. A study of economic impacts to the Eel River and North Coast from the loss of the commercial fisheries and recreational opportunities
2. Full cost/benefit analysis of the Potter Valley Project
3. An economic analysis of the benefits of a restored Eel River
4. Water rights and public trust investigation into the Potter Valley Project, which includes options to replacement water to Russian River water rights holders in the event dams are removed
5. A full analysis of habitat available above the dams that include the mapping of in reservoirs springs and possible refugia for salmon, inundated habitat, and numbers of salmon and trout that could be produced in the area based on new habitat assessments
6. An analysis of water quality impacts of the reservoirs which explores reservoir actions that could address these impacts. This analysis should look at temperature

impacts, Dissolved Oxygen impacts, toxic algae, along with mercury and methylmercury production

7. An analysis of sediment fill and effectiveness for storing water, including water to be used for chilly water releases
8. An analysis of Dam safety and needed to be changed to operations to address the dam safety issues
9. A study that explores species genetics, and suggests a reintroduction plan for Spring Chinook Salmon
10. A study that discusses sediment needs (coarse gravel) and scouring needs below both dams

### ***Wiyot Tribe***

Wiyot Tribe state that because Scott Dam prevents upstream migrating anadromous fishes from spawning habitat that exists above Lake Pillsbury, the geographic scope for fisheries analyses should be modified to include those tributaries. The requested studies by this tribe are in 4 elements focusing on; 1) passage constraints for Impacted Species; 2) considering Pacific lamprey passage issues at cape horn dam; 3) Pacific lamprey passage issues at Scott Dam; 4) assessment of all migration barriers above Scott Dam with an assessment of available spawning habitat below identified barriers to lake Pillsbury;

### ***Round Valley Indian Tribe***

The Round Valley Tribes propose five alternatives for evaluation in the EIS: 1) retention of all existing project facilities, refinement of river flow management to provide improved conditions for Eel River fisheries, construction of volitional or other fish passage around the project facilities on the Eel River (adult migration, juvenile outmigration) for both salmonids and lamprey, and investigation and implementation of water management and fisheries improvements to minimize impacts on the Russian River, including Potter Valley Irrigation District (PVID);

2) removal of all project facilities, restoration of full fish access for all native species, restoration of the Eel River within the footprint of project facilities, and investigation and implementation of

water management and fisheries improvements to minimize impacts on the Russian River, including PVID;

3) removal of Scott Dam to restore fish access for all native species, retention of Van Arsdale Dam and diversion, maintenance of the Van Arsdale fish ladder, retention of diversion and powerplant structures but with seasonal operation (December-April/May), and investigation and implementation of water management and fisheries improvements to minimize impacts on the Russian River, including PVID;

4) retention of all existing facilities for cold water pool and climate change opportunities, shifting primary flow management focus to provide improved conditions for Eel River fisheries, providing volitional or other fish passage around the project facilities on the Eel River (adult migration, juvenile outmigration) for both salmonids and lamprey, and investigation and implementation of water management and fisheries improvements to minimize impacts on the Russian River, including PVID;

5) phased implementation of the Second Alternative, based on the resolution of water supply and fisheries impacts on the Russian River, project ownership changes, funding, and/or improved scientific understanding of future fisheries responses.

## ***NOAA***

Any information or study request (NMFS\_Potter Valley PAD response p-77) must contain:

1. Effects of the Project on Fish Passage at Scott Dam and Lake Pillsbury
2. Effects of the Project on Fish Passage at Cape Horn Dam and Van Arsdale Reservoir
3. Anadromous Salmonid Reintroduction Plan
4. Evaluating Upper Eel River Habitat for Anadromous Salmonids
5. Evaluating Eel River Habitat Downstream of Scott Dam for Anadromous Fish
6. Chinook Salmon, Coho Salmon, and Steelhead Quantitative Life-Cycle Models to Assess

the Effects of the Potter Valley Hydroelectric Project.

7. Effects of the Project and Related Activities on Water Temperatures for Anadromous Fish Migration, Holding, Spawning, and Rearing Needs.

8. Effects of the Project and Related Facilities Evaluated Through a Water Quality Model

9. Effect of the Project on Hydrology for Anadromous Fish and their Habitat

10. Effects of the Project and Related Facilities Evaluated Through an Operations Model

11. Effects of the Project on Fluvial Processes for Anadromous Fish Habitat

12. Effects of the Project on the Distribution and Abundance of Sacramento Pikeminnow in the Eel River and Lake Pillsbury with Implications to Anadromous Fish Populations.

*The Facilities and Operations to be Investigated:*

- **Scott Dam**

“Scott Dam is a concrete, gravity-type, ogee-shaped structure with a maximum height of 130feet and a total length of 805 feet.” (NMFS p. 2) Scott Dam physically obstructs flow and physically blocks upstream and downstream migrating fish from passage. Fish swimming upstream or downstream encounter the physical structure that blocks the natural river channel watercourse. Prior to reaching Scott Dam, upstream migrating fish will encounter Cape Horn Dam, and subsequently its forebay, Van Arsdale Reservoir. Cape Horn Dam is equipped with a fish passage facility that is operational in most river conditions; however, may impede passage during and following high flow events. Once fish ascend the fish way at Cape Horn Dam and navigate through Van Arsdale Reservoir, their destination either ends at the base of Scott Dam, within the approximate 13-mile reach of the Eel River between Scott and Cape Horn Dams, or within one of the few spawning and rearing tributaries between the two dams.

- **Lake Pillsbury**

“Lake Pillsbury, shaped by the building of Scott Dam situated on the upper Eel River, has a surface area of approximately 2,275 acres at the normal maximum water surface elevation of 1,828.3 feet and a current storage capacity of 76,876 acre-feet (ac-ft.). The reservoir is operated

to preserve a minimum reservoir storage of at least 10,000 ac-ft., resulting in a normal usable storage of 66,876 ac-ft.” (PG&E 2017, pg. 4-31).” (NMFS p-2). The lacustrine environment created by Lake Pillsbury includes water depths, velocities, and potentially water quality conditions that do not resemble the pre-dam historic condition, or the riverine environment typically encountered by adult salmonids migrating upstream or juvenile and adult salmonids migrating downstream. It is unclear if anadromous fishes passed over Scott Dam and entering Lake Pillsbury would successfully migrate to the upper Eel River watershed. It is also unclear whether downstream migrating anadromous kelts or juveniles originating in the upper Eel could successfully, in a volitional way, migrate through Lake Pillsbury and locate downstream passage facilities near Scott Dam. In most years big volumes of water spillover Scott Dam during the winter and early spring months. Anadromous fish going down through Lake Pillsbury during these spillover events may pass over Scott Dam moving downstream, but most likely get injured or perish on the concrete surface at the base of Scott Dam. Therefore, the possibility of effective downstream passage over or through Lake Pillsbury’s current infrastructure is low, and the likelihood of injury and mortality is high – due to the height of the dam, the hydraulic and mechanical circumstances in route through the needle valve and predation interactions below. Investigations of these impacts are valuable information requirements for this licensing process, to allow suitable preventive measures to be prescribed or contemplated for prescription. (NMFS p-3).

### ***State Water Resources Control Board***

State Water Board staff was disappointed that PG&E deviated from standard practices demonstrated in other Commission relicensing processes (such as the Yuba River Development) of proactively developing and proposing draft study plans in its PAD. The following is the list of seven studies requested by State Water Board staff:

1. Water Quality Monitoring Study
2. Water Temperature Model Study
3. Water Balance/ Operations Model Study
4. Instream Flow Study

5. Fluvial Processes Study
6. Fish Population Study in the East Branch Russian River
7. Special Status Amphibians and Reptiles Study

## **Conclusions**

After all, looking at other alternatives to replace the Hydropower one comes to the conclusion that solar energy is the best option available. According to John Rosenblum (2017), it is feasible to replace hydropower with Solar batteries within Ukiah's City limit because:

- I. 3 acres of solar photovoltaics (13 MW rated) on parking lots.
- II. 27 MWh battery storage
- III. \$40 million installed cost

Looking at Figure 3 one can see the high amount of energy releases by solar PV or solar grid replacing the hydropower.

## **Internship Assessment**

Involving shortly In Hydropower relicensing of PG&E with the help of my supervisor Dawn Alvarez, I have been able to see beyond what I have studied as theory and experience the reality of what is environmental law, which sits at the corner of the Politics, science, economics, ethics, health and much more

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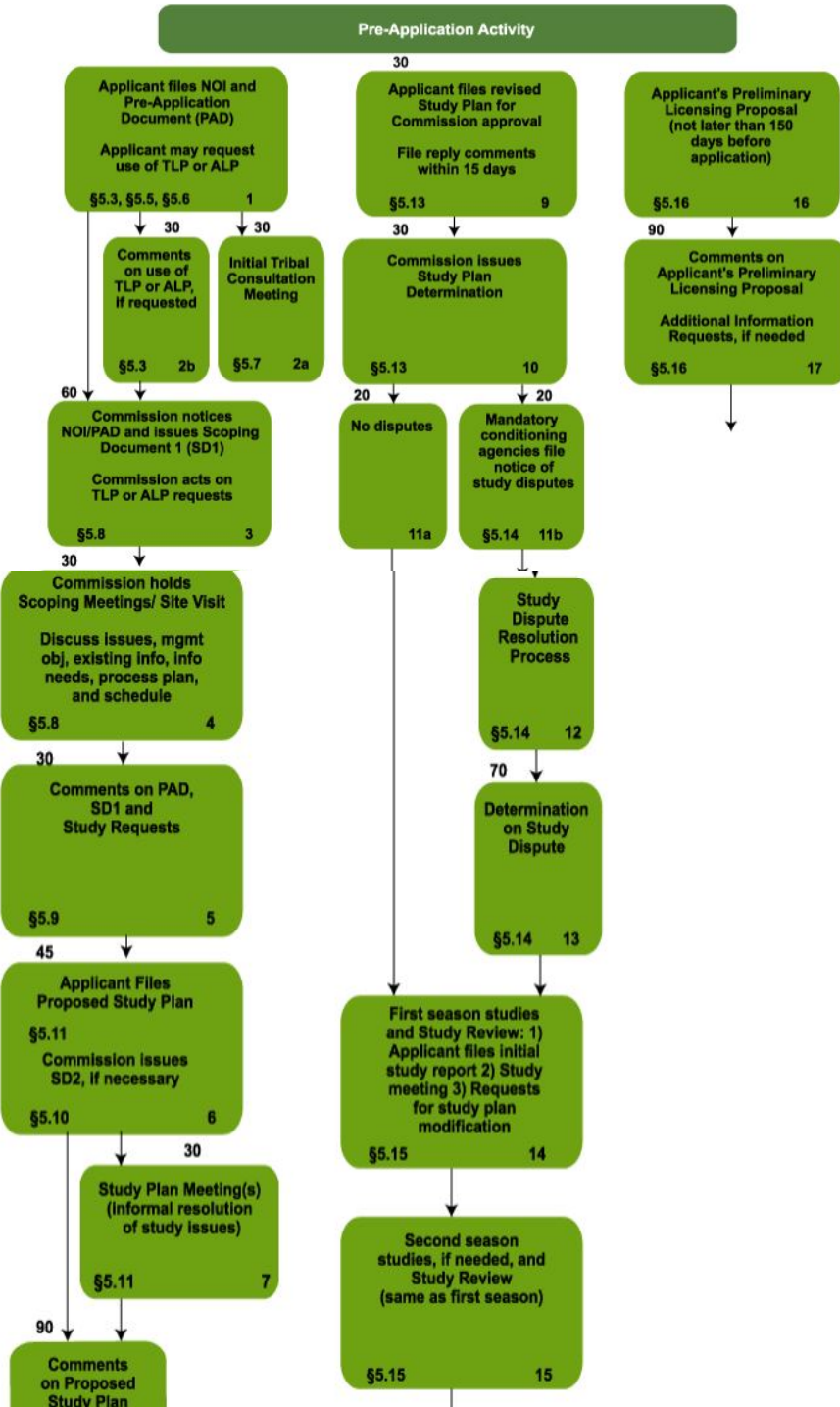
## Acronyms, and Abbreviations

FERC or Commission	Federal Energy Regulatory Commission
GIS	Geographic Information System
ILP	Integrated Licensing Process
kg	kilogram: 1,000 grams
km <sup>2</sup>	square kilometer
km/day	kilometer(s) per day
kV	kilovolt: 1,000 volts
kVA	kilovolt ampere
kW	kilowatt
NEPA	National Environmental Policy Act
NFSL	National Forest System Land(s)
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NRCS	Natural Resources Conservation Service
PG&E or Licensee	Pacific Gas and Electric Company
ppm	parts per million
ppt	parts per thousands
Project Vicinity	The area extending to about 5 miles from the Project Boundary.
PVID	Potter Valley Irrigation District
SWRCB	State Water Resources Control Board
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey



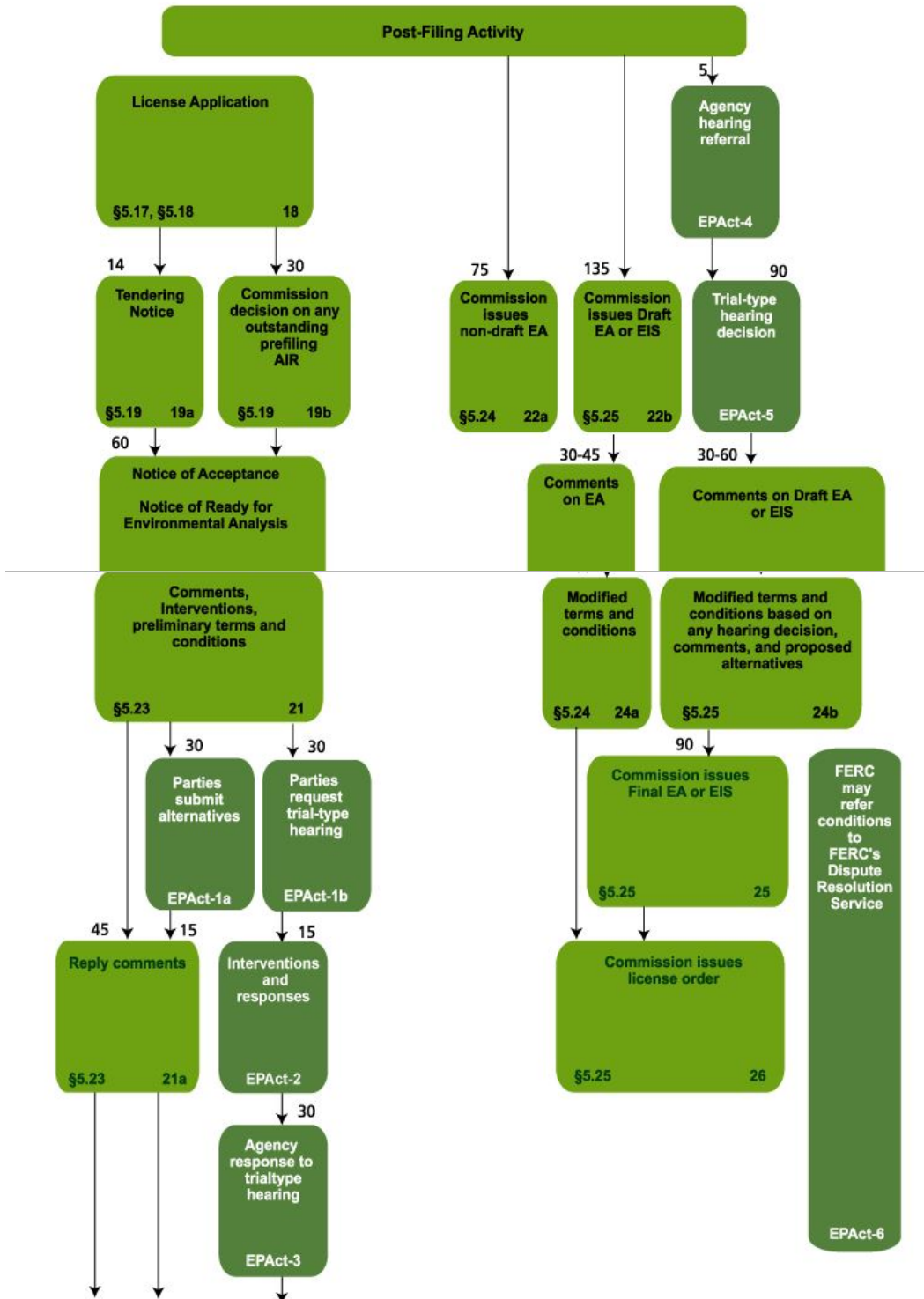
PROCESSES FOR HYDROPOWER LICENSES  
Integrated Licensing Process (ILP)

5.5-5 years before expiration for relicense

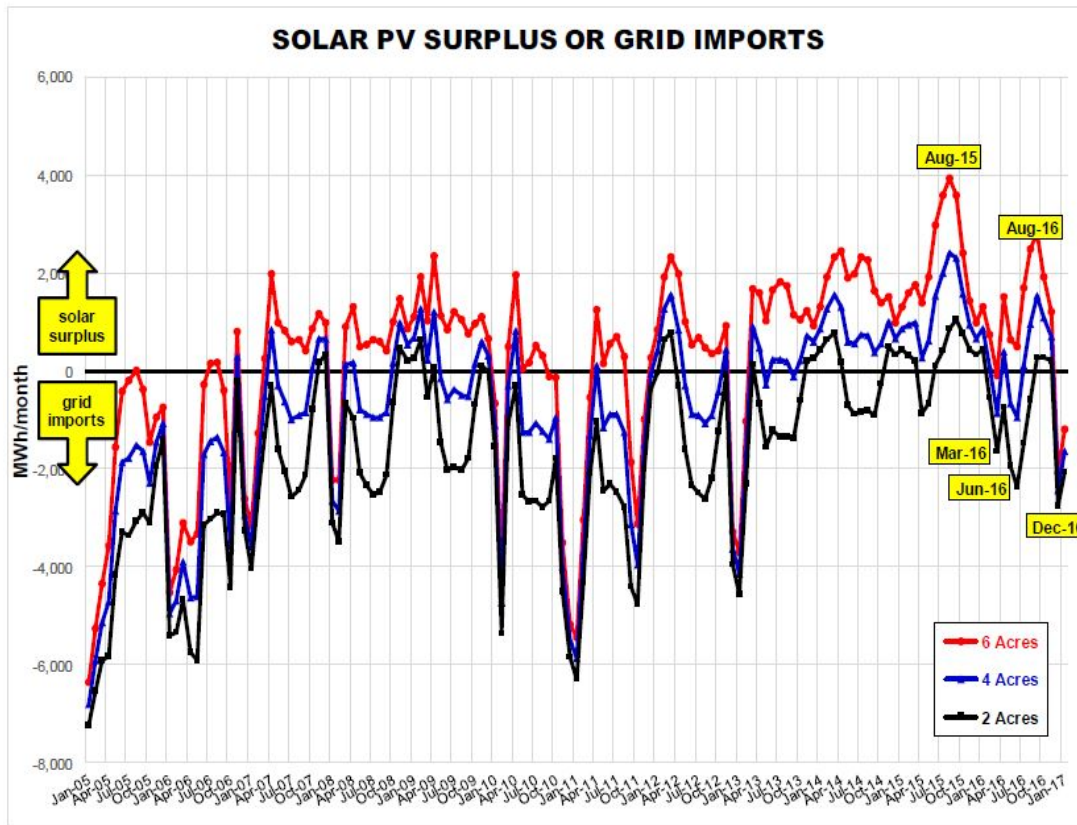


**Figure 1-** ILP for Hydropower Licenses, which takes 5.5-5 years before expiration for relicense.

2 years before expiration for relicense



**Figure 2-** ILP Post-Filing Activity of the Hydropower, 2 years before expiration for relicense



- with 6 acres of solar PV, there would always be surplus energy – except for large winter and spring releases (e.g. Mar-16; Dec-16)
- Since 2013, 4 acres of solar PV would mostly provide a surplus – except for large winter and spring releases
- Even 2 acres of solar PV could be sufficient when combined with wind, efficiency, and load shifting – but validation requires data about supply through 5 PG&E substations along the 101 corridor.

Figure 3- Solar Energy Surplus.

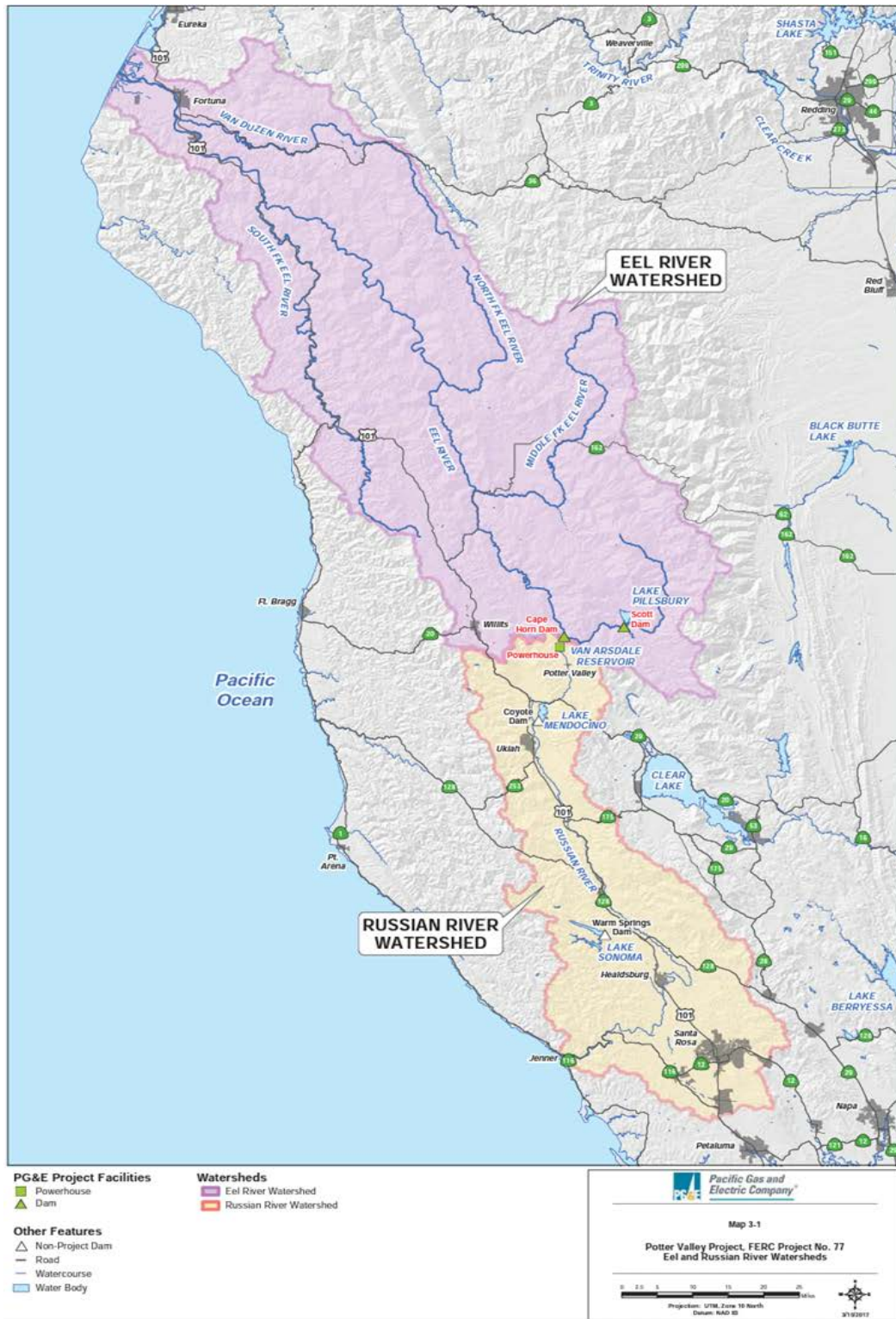


Figure 4- Location of the project (Source: PG&E).



Figure 5- Potter Valley Project (P-77-285) (image by USFS)