

Final Study Plan

Klamath Hydroelectric Project Interim Measure 11 Study Activities for 2021

~~July 30, 2021~~ REVISED October 13, 2021

Introduction

The Klamath Hydroelectric Settlement Agreement (KHSAs; as amended on November 30, 2016) includes Interim Measure 11 (Interim Water Quality Improvements), which is intended to address water quality improvement in the Klamath River during the interim period leading up to potential dam removal. Regarding Interim Measure (IM) 11, the KHSAs states “The emphasis of this measure shall be nutrient reduction projects in the watershed to provide water quality improvements in the mainstem Klamath River, while also addressing water quality, algal and public health issues in Project reservoirs and dissolved oxygen in J.C. Boyle Reservoir.” The measure calls for PacifiCorp to spend up to \$250,000 per year¹ for studies or pilot projects in consultation with the Interim Measures Implementation Committee² (IMIC). Specifically, 2021 Activities described in this study plan that are related to IM 11 include:

1. Water Quality Monitoring of Beaver Dam Analog Performance on Deming Creek
2. Klamath Drainage District Modernization Study, Phase 1: Irrigation Modernization Assessment
3. Iron Gate Intake Barrier Curtain System Management for Water Quality Improvement of Powerhouse Releases

Additionally, two projects have been provisionally approved by the IMIC.

4. Biochar Filtration, Phase 2, Deliverable 1.
5. ~~Jenny Creek Barrier Removal Planning~~

Phase two of the Biochar Filtration is an extension of the ongoing Phase 1 project, 2021 funding is predicated on a successful outcome of Phase 1. Jenny Creek Barrier Removal planning ~~is had been~~ provisionally approved based on remaining available funds after funding for all other projects ~~is formally was~~ allocated.

In late July 2021, PacifiCorp decided to provide funds to collect thermal data from J.C. Boyle Dam to the headwaters of Copco Reservoir (Activity 6). The Jenny Creek Barrier Removal Planning was delayed until 2022 and those funds were re-allocated to the thermal imagery data collection.

¹ Per year until the date that the Dam Removal Entity (DRE) accepts a Surrender Order issued by the Federal Energy Regulatory Committee (FERC) regarding the Klamath Hydroelectric Project. The KHSAs indicates that up to 25 percent of the funding in this measure for pre-surrender-order acceptance studies and post-surrender-order acceptance implementation may be directed towards in-reservoir water quality improvement measures, including but not limited to J.C. Boyle Reservoir.

² The IMIC is comprised of representatives from PacifiCorp and other parties to the KHSAs. The purpose of the IMIC is to collaborate with PacifiCorp on ecological and other issues related to the implementation of the Non-Interim Conservation Plan Interim Measures set forth in Appendix D of the KHSAs.

1: Water Quality Monitoring of Beaver Dam Analog Performance on Deming Creek

Submitted by: Trout Unlimited (TU)

Overview

Over the past two years, TU has partnered with the USFWS to install eight Beaver Dam Analogs (BDAs) on a section of Deming creek in the headwaters of the Sprague River basin making it the largest BDA project to date. As part of this project, TU and its partners are monitoring changes in groundwater elevation and channel geometry post-BDA implementation. However, suspended sediment monitoring is not a part of current funding. It is predicted that BDAs will reduce suspended sediment and thus particulate nutrient concentrations by reducing stream velocity. Further, hydrologic residence time post-BDA implementation is not known.

This project provides a unique opportunity to assess the ability of a BDA complex to reduce water velocity and suspended sediment concentrations in the Upper Klamath Basin. TU is well positioned to complete this work as evidenced by our productive relationship with the landowner and ongoing habitat restoration work on this property.

Tasks and Work Elements

With this funding, we will monitor turbidity, a proxy for suspended sediment, using two continuous long-term sensors upstream and downstream of the BDA complex. Further, at least two hydrologic residence tests will be completed, one under high flow conditions in late spring and the other under low flow conditions in early fall. Results from this work will inform future BDA designs in the Upper Klamath Basin.

2: Klamath Drainage District Modernization Study, Phase 1: Irrigation Modernization Assessment

Submitted by: Farmers Conservation Alliance (FCA)

Overview

Over the last 6 years, FCA has developed the Irrigation Modernization Program (IMP) to help irrigation districts and the farmers they serve revolutionize their infrastructure. The Klamath Drainage District (District) delivers water to approximately 27,000 acres in the Klamath Basin through over 30 miles of canals. The District also has an extensive drainage system, which terminates at the Klamath Straits Drain. The Klamath Straits Drain also collects the majority of the Klamath Project's tailwater from all the Klamath Reclamation Project districts. However, much of this infrastructure is aging and inefficient. Modernizing this infrastructure could improve water conveyance efficiency, reduce tailwater discharges, allow for managed groundwater recharge, reduce energy use, expand the use of solar power, and reduce operations and maintenance costs.

Tasks and Work Elements

FCA's irrigation modernization study is the first step to inform strategic planning and on-the-ground project implementation needs for the District. FCA's irrigation modernization study will identify the infrastructure improvements and pathways to permitting, funding, and implementation that are unique to the District. As part of the Irrigation Modernization Study process FCA will complete the following tasks:

- 1. Initial findings assessment.** FCA will work closely with District staff and board members, Reclamation staff, and other stakeholders to understand the District's goals and objectives related to irrigation modernization; the potential benefits of, opportunities for, and barriers to irrigation modernization; the District's existing infrastructure; and previously identified priority projects. Correspondingly, FCA will review existing data and reports to understand current conditions and identify any data gaps. FCA will develop an initial findings' report that outlines its initial findings and informs the subsequent irrigation modernization process.
- 2. Early-action project assessment.** FCA will work closely with Reclamation staff, the District staff and board members, and other stakeholders to identify any projects for accelerated implementation prior to the completion of a modernization strategy. These projects typically include actions that meet identified goals and objectives, have strong District and partner support, and complement potential future modernization efforts.
- 3. Stakeholder engagement.** FCA will work with the District staff and board members as well as Reclamation staff to understand their relationships with local, state, federal, and tribal partners. FCA will engage stakeholders with an interest in the District, and/or the resources potentially affected by modernization, to identify, consider, and develop the full range of opportunities related to irrigation modernization efforts. These stakeholders typically include farmers and ranchers; local, state, and federal agencies; and non-profit organizations. Stakeholder engagement will continue throughout the irrigation modernization process to ensure that a modernized system meets the identified needs.

Specific deliverables will include an Initial Findings Report, System Improvement Plan and preliminary Modernization Strategy that the District can use to implement projects, which will benefit patrons and the environment.

3: Iron Gate Intake Barrier Curtain System Management for Water Quality Improvement of Powerhouse Releases

Submitted by: PacifiCorp

Purpose and Objectives

The purpose of this activity is to operate the intake barrier system in Iron Gate Reservoir to improve water quality in Iron Gate Powerhouse releases to the Klamath River. Annual studies from 2015 to 2020 indicate that the curtain upstream of the intake is effective as a means of reducing algae entrainment into the intake.³ Work in 2021 will continue to inform management and operation of the system.

The concept behind the curtain is to control the depth at which water is withdrawn from the reservoir into the intake, and thereby enhance water quality downstream of Iron Gate Dam by reducing the entrainment of biomass from blooms of cyanobacteria (blue-green algae) and potential associated algal toxins (i.e., microcystin). These studies have provided valuable insights into the performance of the curtain system under varying conditions. The curtain has been deployed to different depths for different periods of time over the last 6 years with associated sampling and monitoring. This work has collectively indicated that the curtain functions as it was designed and selectively limits the entrainment of surface water in Iron Gate Reservoir. More recent operations indicate that curtain can serve to both reduce entrainment of cyanobacteria and potential associated algal toxins, as well as provide springtime reduction in water temperatures downstream of Iron Gate Dam, when deployed to the design depth early in the season.

Task and Work Elements

The tasks and work elements associated with this activity in 2021 will include the following efforts. Final data summary and reporting would occur after data collection is complete and likely be completed in early 2022.:

- Curtain deployment in the spring, summer, and early fall of 2021 to provide early season temperature benefit and summer and early fall reduced entrainment of cyanobacteria.
- Field data collection at the curtain in 2021 will focus on collecting information to manage curtain operations. PacifiCorp will deploy data sondes and thermograph arrays upstream and downstream of the curtain to continuously monitor conditions throughout the summer and early fall. The data sondes are automated to profile at fixed intervals and transmit data in real-time to operators so that curtain performance can be observed and adjustments can be made in an efficient manner. Detailed vertical profiles will be conducted immediately before and after curtain deployment and repeated a few days after curtain deployment. These data, coupled with a data sonde downstream of the dam and a local meteorological station will add to the information collected over the previous years and allow PacifiCorp to continue to manage the curtain to maintain downstream water quality benefits prior to dam removal.

³ PacifiCorp. 2017. 2016 Evaluation of Intake Barrier Curtain in Iron Gate Reservoir to Improve Water Quality in the Klamath River. Oct. 113 pp.
Watercourse Engineering, Inc. (Watercourse). 2016. Water Quality Effects of an Intake Barrier Curtain to Reduce Algae Concentrations Downstream of Iron Gate Reservoir. Prepared for PacifiCorp. July. 67 pp.
Watercourse Engineering, Inc. (Watercourse). 2020. 2019 Iron Gate Intake Curtain Barrier Data Summary. Technical Memorandum prepared for PacifiCorp dated November 4. 2020. 26 pp.
PacifiCorp. 2021. Final Intake Barrier Curtain Summary Report. May.186 pp.

4: Biochar Filtration, Phase 2, Deliverable 1 ONLY

(Provisionally Approved)

Submitted by: BioLogic Carbon, Delaney Forestry Services, and the Klamath Watershed Partnership

Purpose and Objectives

The biochar system that has been deployed at the Running Y farm site will filter phosphorus-laden water over the irrigation season. As the phosphorus is removed from the farm irrigation water it will build up within the biochar media. This media could have value as a fertilizer. To test the saturated media's potential as a fertilizer, two tests will be completed to reach the following outcomes.

- Outcome 1: Determination of how much filtered phosphorus within the biochar media is available to plants.
- Outcome 2: Conduct a greenhouse trial (likely using alfalfa) to see if the saturated phosphorus biochar media boosts yields and nutrient content in the crop. Also determine how much biochar is needed to invoke a positive plant response.
- Outcome 3: Prepare a summary report of findings of this study.

Funding for this project is provisionally approved by the IMIC pending the results of the ongoing Phase 1 biochar study indicating successful uptake of phosphorus by the filter media. A detailed scope of work will be developed that would provide the specific methods necessary to evaluate these potential outcomes before providing funding for Phase 2, Deliverable 1.

5: Jenny Creek Barrier Removal Planning

(Provisionally Approved Delayed until 2022)

Submitted by: PacifiCorp

Purpose and Objectives

About a mile upstream from Iron Gate Reservoir on Jenny Creek is an abandoned diversion dam. At several feet high, this concrete structure spans the channel and creates a barrier to fish movement. Access is limited since there are no roads to the location. Planning for removal would include development of a detailed removal plan, post-removal channel restoration design, evaluation of historic/cultural resource status of the structure itself as well as any resources along the access route, permitting, and landowner approval (the structure may or may not be on PacifiCorp property). Removal of this structure would allow fish access to about a mile of stream before the Jenny Creek falls are reached that create a natural barrier to migration. Completion of planning work would allow for removal to proceed if funds could be found.

IM11 funding for this project is provisionally approved by the IMIC pending the final costs of other 2021 projects currently being pursued. This project has been delayed until 2022 to allow funding to be allocated to the thermal imaging project (Activity 6).

6: J.C. Boyle Dam to Copco Reservoir Thermal Data Collection

Submitted by: PacifiCorp

Purpose and Objectives

In January 2021, PacifiCorp proposed to collect some thermal data and associated imagery in the bypass reach downstream of J.C. Boyle. This effort was removed from consideration for funding when the National Marine Fisheries Service (NMFS) indicated that Humboldt State University (HSU) was going to provide similar services for NMF's ongoing reservoir reach tributary habitat prioritization study. It turned out to be impossible to provide the thermal camera they needed and access permit for HSU.

To meet the original objectives of what NMFS and HSU had planned, PacifiCorp contracted E&S Environmental Chemistry and NV5 Geospatial to collect the same data using a thermal imaging camera mounted on a helicopter. The deliverables from this work are a calibrated and orthorectified thermal image mosaic for the 22 miles of river from J.C. Boyle Dam to the headwaters of Copco Reservoir for the full river width at 0.5 meter resolution. A full report will also be provided. This data should prove useful in understanding where cold-water inflows occur in this reach. This in turn will allow for flow and fish management post-dam removal as well as for habitat improvement work in the mainstem.

This shift in focus for some of the 2021 IM 11 funds was communicated to the IMIC in early August, 2021. Because there was no opposition and some support was received from IMIC members, PacifiCorp contracted with E&S to complete this work in late summer 2021 with fully processed data and reporting due to PacifiCorp by the end of December 2021.