

## *Final Study Plan*

# Klamath Hydroelectric Project Interim Measure 11 Study Activities for 2017

*Version: June 5, 2017*

## Introduction

The Klamath Hydroelectric Settlement Agreement (KHSA; as amended on April 6, 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 11, the KHSA 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 year<sup>1</sup> for studies or pilot projects in consultation with the Interim Measures Implementation Committee<sup>2</sup> (IMIC).

This study plan describes the proposed studies that PacifiCorp will conduct during the remainder of 2017 to address the Interim Measure 11 objectives. A draft study plan was circulated to the IMIC for review in April 2017. Based on comments from the IMIC, two projects were removed from the Study Plan (Link River Algae Removal Demonstration Project: Phase 2, and Benthic Anatoxin-A Producer Investigation). The specific studies described in this 2017 Study Plan are follow-on study activities for studies from the 2016 study plan.

The current list of 2017 studies or pilot projects to address Interim Measure 11 includes:

1. Development of a Priority List of Projects: Phase 2
2. Continued Evaluation of Intake Barrier System for Water Quality Improvement from Iron Gate Powerhouse Releases

An overview of the work involved for each of these studies is summarized in the following sections.

## 1: Development of Priority List of Projects: Phase 2

### Purpose and Objectives

In 2017 the Priority List of Projects - Phase 2 project will finalize the Priority List of Projects (PLP). Per the amended KHSA, the PLP is to be implemented after the Dam Removal Entity’s (DRE) acceptance of the Federal Energy Regulatory Commission (FERC) surrender order. Following the DRE’s acceptance of the FERC surrender order, PacifiCorp will provide funding of up to \$5.4 million for implementation of projects from the PLP approved by the Oregon Department of Environmental Quality (ODEQ), the North Coast Regional Water

---

<sup>1</sup> 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 KHSA 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.

<sup>2</sup> The IMIC is comprised of representatives from PacifiCorp and other parties to the KHSA. 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 KHSA.

Quality Control Board (Regional Board), and the State Water Resources Control Board (State Board), and up to \$560,000 per year to cover operation and maintenance expenses related to those projects.

The PLP is being informed by the information gained from the specific studies conducted to-date under IM 11. The PLP also is being informed by, among other things but not limited to, the information gained from: the Interim Measure 10 *Klamath Water Quality Improvement Project Report*; Upper Klamath Basin Comprehensive Agreement (April 18, 2014); the U.S. Bureau of Reclamation's (Reclamation) *Water Quality Improvement Plan for the Klamath Project*; and other sources as they are available.

The development and implementation of the PLP is being accomplished in four phases:

- *Phase 1: PLP selection process.* A matrix of water quality improvement projects assessed or evaluated to-date was prepared. This included a summary of findings with regard to relative effectiveness and costs. Project categories were identified that are candidates for the PLP and then those project categories were ranked. Top-ranked project categories were identified that will be subject to more-detailed assessment in Phase 2.
- *Phase 2: PLP selection process refinement.* Working from the process and information collected in Phase 1, gather additional information (if available) to create quantifiable metrics on the top-ranked projects identified in Phase 1. This will allow more-definitive comparisons between project categories. This additional information will be gathered in collaboration with members of the IMIC with expert knowledge. Working with the IMIC, identify and determine the specific PLP using Phase 1 results and the additional data and information gathered in Phase 2. Define the process and governance anticipated to be necessary to fund, contract, and implement specific project activities from the PLP. Determine estimated funding allocations for the project categories to be implemented from the PLP. As per IM 11, final approval of the PLP will be provided by the ODEQ, Regional Board, and the State Board.
- *Phase 3: Establish implementation framework.* Put in place the governance process, including possible fiscal agent, for project implementation (as defined in Phase 2). Issue Requests for Proposals from potential contractors to develop plans and designs of specific projects to be implemented from the PLP. Select contractors for implementation, obtain necessary permits and other regulatory approvals of projects.
- *Phase 4: Implementation.* Using project selected in Phase 3, apply funding and implement projects from the PLP.

Phase 1 of PLP development as summarized above occurred in 2016 and was completed in early 2017. This 2017 IM 11 Study Plan describes the proposed tasks and work elements to be conducted during the remainder of 2017 to accomplish Phase 2 of PLP development as summarized above. Phases 3 and 4 would be accomplished at a future date under separate study plans.

## Task and Work Elements

The tasks and work elements associated with this activity during the remainder of 2017 will include the following:

- PacifiCorp will conduct outreach to the IMIC and coordinate as necessary to refine the specific scope for this activity. This will most likely occur via conference call with interested members of the IMIC and other experts.
- PacifiCorp will gather additional information on potential projects for the final PLP. During Phase 1, five top-ranked categories of potential projects were identified for further consideration in developing the final PLP. These five top-ranked categories include (in no particular order): Diffuse Source Treatment Wetlands (DSTWs); Riparian Fencing and Grazing Management; Irrigation Efficiency and Water Management Projects; Natural Wetlands Restoration; and Algae Biomass Removal (Harvesting) at Link

Dam. Additional information and data will be gathered in Phase 2 to allow more precise differentiation between the five top-ranked project categories. Discussion with the IMIC is proposed to identify and plan for additional information and assessment needed to allow the IMIC to make more specific determinations on the PLP. For example, additional specific information on the top-ranked project categories identified in Phase 1 will be further developed to guide final PLP development in Phase 2. The additional specific information developed and assessed in Phase 2 could include:

- Targeting of priority projects by geographical area or location<sup>3</sup>
  - Refined costing information to better inform allocation of funds
  - Nutrient-removal efficiency information or metrics to allow additional comparisons of effectiveness of project categories
  - More information on who-is-dong-what in the upper basin to consider where project categories may cumulatively benefit ongoing water quality work
- Once the previous step is complete, PacifiCorp will facilitate a second workshop with IMIC participants to discuss and select the final specific PLP. The specific PLP will be determined using both the Phase 1 results (as described in PacifiCorp 2017) and the additional data and information gathered in the previous step. During this second workshop participants will:
    1. Review the additional information on top-ranked project categories.
    2. Identify and determine (likely by ranking the project categories) the final PLP.
    3. Discuss the approach to allocation of funding amounts.
    4. Discuss the process and governance needs anticipated to be necessary to implement the PLP. The process and governance considerations will include discussions of: final authorization and contracting of priority projects; funding amounts for different priority projects; use of a fiscal agent for contracting of work and payment of funds; and responsibilities for oversight of project implementation, progress, and outcomes.
  - As discussed in IM11, the ODEQ, Regional Board, and State Board have final approval authority on the PLP. PacifiCorp will participate in meetings with the decision makers from these organizations to discuss PLP development and rationale, and support obtaining final approval of the PLP.

## Schedule and Deliverables

IMIC meetings and conference calls pertinent to this activity will occur either within existing IMIC meetings or on a schedule to be determined. The second workshop with IMIC participants also will be conducted on a schedule to be determined but is anticipated to take place in summer 2017. The meeting(s) with ODEQ, the Regional Board, and the State Board on the final PLP will be conducted on a schedule to be determined by those entities.

A final Phase 2 PLP report will be prepared that will provide: (1) documentation of the process and rationale for selection of the specific PLP; (2) details developed during Phase 2 with regard to allocation of funding amounts for the PLP and the process and governance anticipated to implement the PLP; and (3) appropriate recommendations for follow-up Phase 3 activities (e.g., development of specific plans and designs of projects to be implemented from the PLP; obtaining regulatory approvals; and selection of contractors for implementation).

---

<sup>3</sup> We note that planned work to be conducted as part of the Upper Klamath Basin Watershed Action Plan (UKBWAP) will include identification of specific candidate sites for DSTW, irrigation efficiency work, and natural wetland restoration (M. Skinner, pers. comm.). Therefore, the UKBWAP may be used as a key source of information for targeting of priority projects by geographical area or location.

## 2: Continued Evaluation of Intake Barrier System for Water Quality Improvement from Iron Gate Powerhouse Releases

### Purpose and Objectives

The concept behind the curtain remains focused on controlling the depth at which water is withdrawn from the reservoir into the intake, and thereby enhancing water quality downstream of Iron Gate dam. The enhanced water quality occurs by excluding or reducing the potential entrainment of biomass from blooms of cyanobacteria (blue-green algae) and potential associated algal toxins (i.e., microcystin). The goal of the system is to seasonally improve water quality conditions in the Klamath River during the interim period prior to planned dam removal.

The purpose of the 2017 effort is to continue to evaluate an intake barrier system for water quality control from Iron Gate reservoir to improve water quality in Iron Gate powerhouse releases to the Klamath River. With 2 years of data on curtain operation and effectiveness, work in 2017 will focus on refining curtain operations. Beyond reducing algae in releases to the Klamath River, the 2016 evaluation illustrated the potential for curtain operations to affect dissolved oxygen and water temperatures downstream of Iron Gate dam. The tasks described below would specifically focus on how to operate the curtain to minimize the risk to dissolved oxygen while still segregating the surface waters of the reservoir to enhance downstream water quality. The tasks will be refined as data analysis for 2016 is completed.

### Task and Work Elements

PacifiCorp will redeploy the long-term monitoring equipment on both sides of the curtain and in the river downstream of Iron Gate dam (e.g., thermograph strings and data sondes). With a focus on refining curtain operations, the monitoring will likely include more frequent vertical profiles of dissolved oxygen, temperature, and cyanobacteria levels upstream and downstream of the curtain. This information will be used to adjust the curtain depth, if necessary, on a more frequent basis. Based on information from 2015 and 2016, the curtain will likely be deployed later in the season (perhaps sometime in July instead of June) and to a shallower maximum depth (e.g., 20-25 feet deep instead of 35 feet deep). A consistent comment on the previous studies has been that cyanobacteria concentrations were not abundant enough to fully evaluate curtain operations. By waiting until July before deploying the curtain, primary production should increase to a level where an adequate amount of cyanobacteria are present (even if they are not toxin-producing species) such that a change can be observed between pre- and post-curtain deployment. Additionally, by deploying the curtain in July instead of June, the available cold-water pool in Iron Gate reservoir would remain untapped and provide operational flexibility.

PacifiCorp will conduct a focused investigation into the short-term changes in water quality and cyanobacteria levels during curtain deployment. This investigation will clarify the rate of water quality changes from the curtain to the Klamath River downstream of Iron Gate dam. Monitoring data from 2016 did not include information during the period immediately before and after deployment (curtain lowering). The proposed 2017 monitoring results, coupled with 2016 data, will provide insight for managers when tasked with curtain lowering and raising operations in response to near “real-time” water quality conditions in the reservoir or the river downstream.

This focused investigation would occur before, during, and after the initial deployment of the curtain, over a period of 4 days. Throughout this period, water samples would be collected upstream and downstream of the curtain as well as downstream of the dam. At a minimum, these samples would be analyzed for cyanobacteria and chlorophyll-a. Water quality will be monitored with the data sondes and thermographs in place for the duration of the season. Additional fixed-depth data sondes would be deployed upstream and downstream of the curtain during this period to track changes at depth.

As was the case in 2015 and 2016, PacifiCorp expects that pre-deployment conditions on both sides of the curtain will be the similar. In the short-term (hours) following deployment, PacifiCorp expects that the

downstream conditions will show some mixing and a reduction in temperature and dissolved oxygen levels. In the longer-term (12-24 hours), PacifiCorp expects that conditions downstream of the curtain and in the river downstream of Iron Gate dam will be similar and reflect conditions found in deeper water upstream of the curtain. Clarification on the mixing time and the time to stability downstream of the curtain and in the river downstream of Iron Gate dam is important for managing the curtain in terms of water quality downstream.

### **Schedule and Deliverables**

Specific schedule and deliverables for this activity are related to completion of field sampling in 2017 followed by data analysis and report preparation in early 2018.