Independent Scientific Review Panel
for the Northwest Power & Conservation Council
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Memorandum (ISRP 2009-41) **October 16, 2009**

To: W. Bill Booth, Council Chair

From: Eric Loudenslager, ISRP Chair

Subject: Final Review of Accord Proposal, Twin Lakes Enhancement Proposal (#2008-111-00)

Background

At the Council's July 1, 2009 request, the ISRP began a review of the Colville Confederated Tribes' *Twin Lakes Enhancement Proposal* (#2008-111-00), a Columbia River Fish Accords project. The purpose the project is to improve summer habitat for native inland redband trout in Twin Lakes, Washington by enhancing dissolved oxygen levels in bottom waters.

On July 24, 2009, we released an initial review and requested a response (ISRP 2009-32). In our initial review, we found that the proposal lacked sufficient technical justification, background information, and detail in other areas (including study design, objectives, and methods) to enable a scientific evaluation. On September 7, 2009, the Colville Confederated Tribes (project proponents) responded to our comments by providing a revised proposal and a letter highlighting some of the changes they made to their proposal. Our review of the revised proposal follows below.

ISRP Recommendation

Does Not Meet Scientific Criteria

In its current form the proposal does not meet scientific review criteria because the oxygenation only temporarily treats the symptom (anoxic hypolimnion), but does not consider alternative treatments that have the potential to solve or provide longer-term treatment of the phosphorous eutrophication problem. An adequate future proposal should specifically address the comments and recommendations in sections (1), (2), and (7) of the ISRP's detailed comments, below.

Overall Summary Comments

The Colville Confederated Tribes are commended for fostering past studies and providing scientific information to develop management approaches for Twin Lakes. The proponents' revised proposal provided responses to many of the ISRP's questions and comments, but some of our major concerns still remain unaddressed.

The ISRP suggests that a future proposal having the same water quality goal might be warranted if:

- if consideration of alum treatment (possibly combined with even less expensive calcium) were included;
- if measurement of trout survival were included, and
- if significant progress in community efforts to reduce external nutrient loading could be shown by (1) presenting the calculations for quantitative estimates of external phosphorus loading before and after the program of reducing cultural inflow was undertaken (thus estimating progress until now) and (2) incorporating procedures into the project that would quantitatively measure and monitor external loading before and during in-lake treatment.

The project's stated objective is to remedy the problem of a dissolved oxygen/temperature squeeze on trout survival. The severity of the problem is assumed but not directly measured, as discussed in item (1) below. The proponents propose mainly to perform hypolimnetic oxygenation, which would need to be continued annually as long as the problem continues. The proposal does not state how many years the proponents plan to conduct this annual procedure before it is discontinued, only to have the same problem recur the next summer in the lakes' hypolimnia.

As well as not giving data on external nutrient reduction, the revision does not consider alternative methods for contending with internal recycling of phosphorus, as the ISRP recommended in its previous comments. We again suggest that the proponents consider the alternatives for that as reviewed by Cooke et al. (2005), particularly chapter 8, and cover the possibility of alum treatment (see item (2) below) if a future proposal is developed. Oxygenation might make sense for a few years in conjunction with measures having longer-term effect, such as alum treatment – and if there was a significant reduction of human-caused external nutrient loading, the fundamental source of the problem.

The 2008 pilot project at the site had no enduring benefit. Furthermore, focusing on a short-term treatment, such as hypolimnetic oxygenation, can distract from a genuine solution such as external nutrient reduction, and can mask the water quality symptom.

ISRP Specific Comments on Revised Proposal

The ISRP comments below are organized by the issues raised in our initial review (ISRP 2009-32).

(1) Summary results and reports (with web based links to reports if available) from the three years of redband trout studies in Twin Lakes by the Colville Confederated Tribes should be included in the Technical Justification section.

The revised proposal includes summary results from a number of additional applicable reports. From these reports and the revised proposal, the following points are evident: (1) the summertime dissolved oxygen/temperature "habitat squeeze" restriction of trout to the metalimnion, most importantly their exclusion from the hypolimnion, adversely affects trout by inhibiting feeding and body growth, and this degrades the quality of the fishery in terms of body size of fish, and (2) the proponents indicate but do not substantiate that the dissolved oxygen/temperature squeeze leads to inordinately poor survival of stocked hatchery trout during

summer, and they cite some hypotheses to that effect from previous reports but do not present quantitative data on mortality rates and their causes.

The ISRP concludes that without measurement of mortality, and specifically without showing that mortality from dissolved oxygen/temperature squeeze is the leading (or even a significant) cause of mortality for the stocked trout population during the summer, the project cannot be technically justified. Indeed, the proponents state that issue as the project's main justification (page 4): "It is the primary goal of this project to improve the water quality conditions in North and South Twin Lakes to significantly increase summer survival of native salmonids." Reviewers suggest that the issue needs clarification and that a more direct assessment of trout mortality is needed to assess project success.

(2) What are the sources of anthropogenic phosphorous loading to Twin Lakes?

The proponents indicated that external phosphorous loading comes from the wastewater of resorts, septic tank seepage, and other sources, and they described management actions taken to reduce or eliminate further excess inputs. However, the revised proposal presents only qualitative discussion of such sources and of measures taken to reduce their input. It states that 22 years ago Juul (1987) identified sources of external nutrient loading; estimated their contribution to the lakes' total nutrient load; ***hypothesized*** that although external loading was significant, internal recycling contributed more of total load; and suggested ways to reduce external loading and control internal loading. Seven steps were taken in 1989-1990 to control external loading including: livestock fencing, modification of sewage and septic systems, and a moratorium on expansion of "developed" areas. A follow-up study (Juul & Hueftle 1992) concluded that external loading had been reduced and that internal recycling of nutrients continued to be a major problem. The revised proposal ***does not present quantitative annual phosphorus budgets*** that those studies may have estimated. How much was external loading reduced? Is it still significant? Apparently, no further assessment of external loading has been done in the last 17 years. The proponents have begun a program of artificial hypolimnetic oxygenation each summer to control phosphorus recycling from lake sediment, and the proposal is to continue it.

As indicated in our comments on the initial proposal, artificial oxygenation of the hypolimnion is known as an effective but temporary form of symptomatic relief from dissolved oxygen depletion. It must be done throughout every summer for as many years as people are willing to pay for fending off the internal phosphorus-recycling problem. More feasible, longer-term solutions can involve lake treatment with alum and, most importantly, require *sufficiently* reducing input from human-generated external sources of phosphorus. Proper alum treatment, far less costly than oxygenation, blocks re-entry of phosphorus from sediment for at least 10 years (personal communication, Eugene Welch - University of Washington, and chapter 8 in Cooke et al. 2005). This and the lake's internal production of less-phosphorus-rich sediment cover the excessively phosphorus-rich sediment and reduce internal loading to non-problem levels. How fast effective covering by internal organic production alone can happen is uncertain. In the interim, however, alum treatment at intervals of 10 or more years would be far less costly than annual hypolimnetic oxygenation. The option of alum treatment was mentioned in the ISRP's previous review of the proposal, and we are not sure why this management action has apparently been dismissed by project proponents. Short-term hypolimnetic oxygenation (or simpler and less costly aeration) might sometimes be reasonable in combination with alum treatment. Some biologists fear that alum treatment will destroy the lake's benthic organisms, but if the hypolimnion is anoxic, benthos will be absent, and studies have shown that in the probably few

cases where alum initially harmed epi- and mesolimnetic benthos, rapid recovery occurred (Cooke et al. 2005, chapter 8).

(3) The proposal does not present basic limnological data about the project lakes. Data on catchment basin area, water surface area, maximum and mean water depth, shoreline development, water sources and flux, and the characteristics of lakebed sediments and aquatic macrophyte are needed. Lacking such basic information, the ISRP cannot evaluate the scientific merit of the project.

The proponents provided limnological data and results of a watershed analysis that allow a better evaluation of the potential effectiveness of the project. A "watershed area" statistic was added, which, however, included land beyond the lakes' true catchment, so it is not entirely relevant. The proposal would be further improved by showing the area of the actual catchment basin for each lake. The information on development and its effects is not quantified.

(4) Include a discussion of how redband trout can be re-established in an already diverse fish community dominated by non-native species.

The proponents included a general discussion of how fisheries management actions in Twin Lakes might allow native redband trout to become re-established.

(5) Section E indicates that this is a new project, but clearly this project is ongoing (~three years?). Please explain.

This is adequately explained in the response.

(6) Unless there are mortality or growth data on redband trout available from Twin Lakes studies, the objectives in Section F will need to be revised.

Quantitative mortality data are missing. See comments above under first bullet.

(7) Work Elements (WE) 2 and 3 (the main ones) are too general, and much more detail is needed on hydroacoustic and creel survey designs and methods.

The proponents indicate that the fish monitoring is the responsibility of the Hatchery project (198503800), and so they moved these work elements to the Hatchery Project's Statement of Work. However, as one of the main benefits of this project is "to increase the survival of native redband trout….", the methods for monitoring this species need to be included in this proposal in sufficient detail for reviewers to evaluate their adequacy.

(8) Can golden shiner be used to monitor changes in methyl mercury during the study?

This was not addressed. The ISRP recommends that monitoring at least one species of fish for mercury levels would be an excellent way to demonstrate benefits of the project.

Reference:

Cooke, G.D., E.B. Welch, S.A. Peterson and S.A. Nichols. 2005. Restoration and management of lakes and reservoirs. CRC--Taylor & Francis, 591 pgs.