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December 14, 2015

Jeanine Townsend, Clerk to the Board
State Water Resources Control Board
P.O. Box 100, Sacramento, CA 95812-2000

RE: North Coast Water Quality Objective Update and Editorial Amendment

Ayukii Ms. Townsend,

The California State Water Resources Control Board (State Board) has solicited comments regarding its "*Proposed Approval of an Amendment to the Water Quality Control Plan for the North Coast Region to Make Nonsubstantive Revisions to Section 1 (Introduction) and Section 5 (Plans and Policies) and to Update Section 3 (Water Quality Objectives)*". We have reviewed the public notice and associated documents and offer the following comments. We focused our review on the Water Quality Objectives (NCRWQCB 2015b), as that section is the most substantive.

We support the most of the proposed amendments to the Water Quality Objectives, with one notable exception. The overall approach for the revisions to the dissolved oxygen (DO) objectives is good, including the concept of a natural conditions clause, but we disagree with one important detail. The natural conditions clause states:

> "Upon approval from the Executive Officer, in those waterbodies for which the aquatic life-based DO requirements are unachievable due to natural conditions[11], site specific background DO requirements can be applied as water quality objectives by calculating the daily minimum DO necessary to maintain 85% DO saturation during the dry season and 90% DO saturation during the wet season under site salinity, site atmospheric pressure, and natural receiving water temperatures[12]. In no event may controllable factors reduce the daily minimum DO below 6.0 mg/L." (NCRWQCB 2015b, p. 3-5) [for the sake of brevity, the two footnotes are not include here]

We support the approach of developing site-specific percent saturation DO objectives based on site salinity, site atmospheric pressure, and natural receiving water temperatures, but we disagree with the choice of 85% DO saturation as the dry season value. Instead, we recommend a more protective value of 90%. Admittedly, the choice between 85% or 90% is a judgment call, but such judgements should be based on a thorough analysis of available DO data collected within North Coast streams. No such analysis has yet been done. Until such an analysis is conducted, we recommend the choice of the more protective criteria. The 2009 Peer Review Draft of the proposed DO revisions (NCRWQCB 2009a) and the final Klamath River TMDL staff report (NCRQWCB 2010) did good

job of summarizing relevant literature on the topic, but not data from within the North Coast streams. In the remainder of our comments, we provide details to illustrate this point.

The follow excerpt from the public review draft of the Klamath River TMDL (NCRWCB 2009b) provides some useful thoughts on the choice of 85% vs 90%:

> "The Hoopa Valley Tribe's DO objective for the protection of the Klamath River within the Hoopa Valley Indian Reservation were derived in part from a preliminary draft Regional Water Board staff report describing staff's proposed revisions for DO in the North Coast Region. Zabinsky and Azevedo (2005) described both the concept of calculating percent saturation based on natural temperatures and the use of 90% as an appropriate criterion. Since 2005, staff has continued to research the issues associated with DO saturation and natural variation. This research has led staff to propose an 85% saturation criterion as appropriate for establishing the range of fluctuation expected in healthy, free-flowing rivers. Staff proposes 85% saturation as an estimate of background, instead of 90%, for a number of reasons:
>
> 1. 85% and 90% of saturation both fall within the range of saturation values (80-100%) expected to represent natural background.
>
> 2. ODEQ (1995) called a Technical Advisory Committee, chaired by Gary Chapman of USEPA, to review its water quality objectives for DO. The Technical Advisory Committee concluded that Oregon's former water quality criteria of 90% and 95% of saturation were too conservative because natural conditions in some streams will cause DO levels to fall below 90%. Staff is concerned that erroneous violations of the water quality standard if set at 90% would unnecessarily trigger regulatory response. This is particularly true in a basin such as the Klamath which is naturally productive and could reasonably experience fluctuations in DO saturation below 90%.
>
> 3. Davis (1975) demonstrated that few members of a salmonid population will show the effects of oxygen stress if DO is at or above 85% saturation at temperatures up to 20°C and 93% of saturation at temperatures up to 25°C, suggesting that a percent saturation less than 85% may cause harm at higher temperatures. Because of the threatened and endangered status of some salmonid species in the North Coast Region, staff believes it necessary to provide at least the protection afforded by 85% of saturation, recognizing that the Klamath River mainstem does not naturally provide ideal conditions at all times."

Preliminary results from the Klamath River TMDL simulation model's natural conditions scenario suggested that the minimum DO concentrations in many sections of the Klamath River dropped as low as 85% saturation and that the Hoopa Tribe's 90% saturation objective was unachievable (NCRWCB 2009b); however, these were erroneous results were caused by a geographically simplistic representation of atmospheric pressure within the initial simulation model. In response to comments regarding this issue, the final version of the TMDL simulation model was revised to enable calculation of atmospheric pressure for each model node (i.e., every 75-300 meters) using an equation based on altitude. This refined representation of atmospheric pressure substantially improved the accuracy of the DO saturation calculations, and as a result the minimum concentrations of DO increased to 90% for the middle reach of the Klamath River in California

including at Hoopa (the uppermost and lowermost reaches dropped as low as 86% saturation)(NCRWCB 2010). Therefore, the dry-season objectives for minimum DO percent saturation adopted for the Klamath River vary by reach (90% in some reach, 85% in other reaches) (NCRWCB 2010).

The main text of the staff report for the proposed revision to the Water Quality Objectives (NCRWQCB 2015a) provides little justification for why 85% saturation was chosen for the regionwide objective instead of 90%. It states:

> "Regional Water Board staff has prepared the Peer Review Draft Staff Report for the Revisions of Dissolved Oxygen Water Quality Objectives, March 2009 (Appendix C), which has undergone scientific peer review, as required by law. The two reviewers generally concurred with the scientific assumptions, assertions, and conclusions that this revision to the DO objective reflects, although each had suggestions for strengthening the discussion and expanding the scope of the amendment. Staff provided responses to the peer review comments (Appendix D) including explanations for those recommendations that were viewed as out of the scope of the proposed amendment. Staff also revised the recommendations in the peer review draft staff report based on peer review comments, when applying the principles of the approach to the development of site specific DO objectives for the Klamath River mainstem. The modeling conducted of conditions in the Klamath River, which formed the basis for adopted site specific DO objectives, informs this proposed regionwide objective for DO. Most notably, the Klamath River modeling indicated that while 85% DO saturation (under natural temperatures) reasonably represents natural dry season conditions, 90% DO saturation (natural temperatures) better represents natural wet season conditions. The peer reviewers' specific comments and Regional Water Board staff's response can be found in Appendix F of this document. Key elements of the staff report for the Proposed Site Specific Dissolved Oxygen Objectives for the Klamath River in California (2010) are included in Appendix E. The full report can be found on the Regional Water Board's website at
> http://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/klamath_river/100927/staff_report/13_Appendix1_Site-SpecificDOObjStaffReport.pdf"
> (p. 3-5 to 3-6)

In our opinion, it is not appropriate to rely so heavily on an analysis of the mainstem Klamath River for the setting of regionwide objectives. The Klamath River is a unique waterbody within the region. For example, it is the largest river within the region, is extremely productive, has reservoirs on its mainstem that host prolific algal blooms, and has higher nutrient concentrations than most other streams. Water quality has been intensively studied within the Klamath River and therefore more DO data are available than is the case for other streams within the region. The Klamath River thus provides a fertile ground for analysis and insight, but it should not have been the only stream analyzed to develop regionwide DO objectives. In addition, given that the Klamath River is on the extreme high end of productivity and therefore presumably has greater daily oscillations in dissolved oxygen (i.e., both higher daily DO maximums and lower daily DO minimums) than other streams, the fact that the NCRWQCB set site specific objectives for DO at 90% saturation for a large portion of the Klamath River is a strong argument that 85% DO saturation would be a weak regionwide standard.

Examination of March 2009 Peer Review Draft Staff Report for the Revisions of Dissolved Oxygen Water Quality Objectives (NCRWQCB 2009a) provide little additional justification for the choice of 85% vs 90%. Excerpts include:

> "Staff calculated the theoretical DO concentrations under varying temperatures and elevations to produce Figure 2 (100% saturation) and Figure 3 (85% saturation). Figure 3 indicates staff's rough estimate of the minimum DO concentrations that occur as a result of the natural fluctuation in DO concentrations resulting from photosynthesis, respiration, turbulence, and biological and chemical oxidation. Staff assumed this to be reasonably represented by a DO saturation of 85%." (p. 40)

> "An additional challenge of calculating background DO objectives using this technique is that it might not reasonably apply to streams and rivers that have DO-related attributes that are uncharacteristic of most other North Coast streams. For example, 85% of saturation might not reasonably represent the natural diurnal fluctuation in DO in a low gradient, widely meandering, wetland complex with large solar exposure and high summer temperatures. In this example, a background DO objective might more reasonably be developed as a site specific objective based on the unique attributes of the system." (p. 58)

A logical step in evaluating whether 90% or 85% is a more appropriate objective would be to compile and analyze existing DO measurements from streams within the North Coast Region. Such a review could help answer questions such as how DO saturation varies according to 1) intrinsic stream attributes such as channel slope, drainage area, or elevation, and 2) general degree of anthropogenic alteration (i.e., comparing reference streams and impaired streams) and nutrient enrichment. No such analysis has yet been conducted within North Coast streams, perhaps because it would require substantial effort. In the absence of such an analysis, it seems unwise to reduce the level of protection for streams by choosing the 85% value.

We view water quality standards as an important tool for protecting water quality and beneficial uses in the North Coast Region and thus strongly object to them being weakened unless there is a compelling justification. Therefore, we strongly urge that you not approve the proposed DO natural conditions clause as-is. Instead, we recommend that either:

1) The 85% dry-season value be replaced with 90%, or
2) Both 85% and 90% be listed, with a directive that site specific attributes be used to select an appropriate value based on a thorough evaluation of regional data. For example:

> "Upon approval from the Executive Officer, in those waterbodies for which the aquatic life-based DO requirements are unachievable due to natural conditions[11], site specific background DO requirements can be applied as water quality objectives by calculating the daily minimum DO necessary to maintain *an appropriate percent (85% or 90%, to be determined according to intrinsic site specific attributes[12]) DO saturation* under site salinity, site atmospheric pressure, and natural receiving water temperatures[13]. In no event may controllable factors reduce the daily minimum DO below 6.0 mg/L.

[12] *The method(s) used to determine the appropriate percent for a given waterbody or stream length must be approved by the Executive Officer and may be informed by a regional analysis of measured DO data which would assesses how DO saturation varies in streams according to their relative degree of anthropogenic alteration as well as intrinsic site-specific attributes such as channel slope, drainage area, and elevation.*"
[note: suggested revisions are *italicized*]

Regretfully, we did not bring this issue to the attention of the North Coast Board during the February-April 2015 comment period. We did receive the February 25, 2015 email notification soliciting public comments, but did not notice its significance (perhaps because "Nonsubstantive Revisions" is near the beginning of the title) and thus did not review the draft document. We realize that it is far from ideal to raise this issue now rather than prior to the North Coast Board adopting the amendments. However, we are concerned that that if adopted as-is, the DO natural conditions clause would set an unfortunate precedent of weakening water quality objectives based on incomplete analysis.

Please contact me, scorum@karuk.us, (530) 469-3456, with any questions regarding these comments.

Sincerely,

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