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Focus: Conclusion 3 Narrative Biological Objective Guidance

I have carefully read the staff report and all other review documents, particularly Section 3 regarding narrative biological objective guidance. Scientific community and water-quality resource managers have recognized the inadequacy of chemistry-based water quality objectives and physical assessments in protecting and restoring key beneficial uses of aquatic ecosystems for decades. In the past decades, great progress has been made to develop and test indicators of biological integrity based on scientifically sound methods, but surprisingly water-quality biological objectives have been put into regulation by only a few states. I am pleased to see that CA-EPA is leading this over-due change.

The narrative biological objective guidance proposed in this report is concise and informative, and the method used to derive it for the development of future numerical waterbody-specific or waterbody-type biological objective is scientifically sound and sufficient to protect the beneficial uses of streams and other aquatic ecosystems. The biological objective as defined in this report is consistent with the definition of "biological integrity" proposed by Dr. Karr in the 1990s, a concept that has been widely accepted by the scientific community for fulfilling the requirements of the Clean Water Act. The guidance uses the reference approach or unaltered analogous waters to define expected biological conditions, consistent with Karr's definition of biological integrity. Considering that many streams in California are still little disturbed by human activities, it is appropriate to define reference conditions based on minimally-disturbed streams, rather than based on other approaches, such as historical records or reconstruction of natural communities. I am also glad to see this report take the most advanced method to establish site-specific reference conditions, i.e., modelling and predicting the value of a biological metric expected under natural or unaltered conditions at a given site. This method is often far more effective to remove the effects of multiple natural environmental gradients (e.g., climate, altitude, and geology) on biotic metrics than traditional stream classification based on ecoregion, stream size, or other stratum.

The report proceeded to discuss the importance of ecological balance, resiliency, and native species composition for the beneficial use of ecosystems. Unaltered waters or reference sites appeared to be assumed to hold these properties in this report. This assumption holds well in general because biological communities typically have reached relative balance with their natural environments and among their constituent species through adaptation and interactions over thousands of years, and become resilient to natural disturbances, such as drought, flood, and fire, and certain human disturbances such as alien species invasion to some extent. I would make the assumption explicit.

Comments on other sections of the Staff Report

1. Section 4.1, Page 30, Paragraph 2. Citations are needed regarding use of biological criteria in Ohio and North Carolina.
2. S4.4.1, P37, Par. 2, "Unlike… stress." No model could explain all natural variation among biological communities. However, the approach taken here is the best one available and normally more effective to reduce the compounding effects of natural factors in assessing biological conditions at a site than ecoregion or other stream classifications. Most other states should adopt the approach to re-calibrate their biological indicators.
3. S4.4.3, P41, Par 1, "however, due to . . . Figure 5)." Some other factors may also contribute to the uncertainty in CSCI, including sampling variability, modelling errors,

and unknown random processes. However, 10th percentile appears appropriate as the threshold.

4. S4.4.4, P43, Par 2, “stream segment”. This term needs to be defined. Is it stream reach in USGS-HDPlus?
5. S4.4.4, P43, Par 2, “the cause of a low . . . origin.” Do natural causes need to be identified or remain general?
6. S4.4.4, P44, regarding natural occurrence factors. As I mentioned earlier, a CSCI score slightly lower than the 10th percentile may be due to sampling variability. If so, re-sampling may be needed to confirm the result.
7. S4.4.4, P15, Par 1, “some groundwater . . . interactions.” Interesting example. In fact, groundwater discharge often increase flow and decrease water temperature, and then benefits benthic macroinvertebrates and increase the CSCI score. However, it is difficult to detect and quantify groundwater discharges at the regional scale.
8. S5.1, P71, Par 2, I have three questions here.
   i) “When included . . . . receiving waters”. I understand that the receiving water is referred to as the stream segment receiving discharge. Does it include downstream segments, too? How far downstream? A clear definition of receiving waters will be helpful.
   ii) “In many cases, ... percentile objective.” I also see the potential space lag in the effect of a discharge. For example, discharge of fine sediments and nutrients into a fast-running creek segment, the direct receiving water, may not cause many biological changes, but could cause eutrophication, siltation, and in turn biological impairment downstream where the stream gets larger and slows down. Is the downstream reach still part of the receiving water? Clarify.
   iii). Strong dispersal from upstream sources might also reduce or overwrite the biological signal of a discharge (or other disturbances) into receiving stream segment. Is that a concern?
9. S5.3.3, P77, Par 2, “The Receiving . . . and sources.” When applicants need to collect biological and habitat data themselves, do they have the necessary expertise or training? Or, do they simply turn to consulting services for help? Just wondering.
10. S.5.3.3, P79, Par 1, “The Receiving Water . . . wadeable streams.” Any specific requirement on how far upstream and downstream from a discharge point the assessment should be done?

Comments on Basin Plan Chapter 4 Implementation

1. P1, Par 2, “the ecology of a stream”. Is “ecological properties / characteristics” a better term than “ecology”?
2. P13, Par 2, “Monitoring may be . . . bioassessment.” Do most permittees have the expertise needed to perform bioassessment? Will San Diego Water Board provide training and technical help?
3. P18, Par 3, “when a CSCI score . . . . reference sites.” Two questions: i) how is inter-annual variability calculated? Over how many years? ii) how to define “similar reference sites”? In the case of O/E Index, stream groups are defined. One may take the sites in a group to which a test site is predicted to belong with the highest probability as “similar reference sites”. However, in the case of CSCI, no stream groups are defined. Clarify.
4. P18, Par 4, “ . . . Stream Biological Objectives though . . . ” Should it be “through”?
5. P20, Figure TBD, Step 3. “Peer-reviewed and Published”. Many new online journals come out each year and some do not appear to have a rigorous review process. I

would like to add some phrase like “in a reputable journal”, but who will define “reputable”?

The Big Picture

The Staff Report and other documents are well written. The scientific portion of the proposed rules as a whole is based on sound scientific knowledges, methods, and practices. In the past decades, substantial progress has been made in terms of understanding biological beneficial use of waters, defining reference conditions for specific stream sites, and diagnosing the cause of biological impairment. This report well incorporated the progress and developed a set of rules that will greatly complement chemical-physical water quality criteria in protecting and restoring freshwater resources.

The methods used in this report to define reference conditions, protect, and restore biological conditions of aquatic ecosystems are based on a fundamental premise that the biological conditions in a stream segment are largely controlled by natural chemical and physical environments and human disturbances at both local and watershed scales. This premise are well supported by scientific data from streams. However, some biological processes, particularly species dispersal may mediate the responses of biological communities to human disturbances and natural environment. In the case of restoration, the responses of biological communities to improved water quality and habitat improvements could be constrained by lack of species sources. Similarly, the biological impact of a given disturbance may be underestimated because of strong species dispersal from upstream. Certain human activities, such as transportation, boating, and fishing, may not significantly affect water quality or habitat quality, but they could introduce invasive species and then reduce biological conditions through competition or predation. I understand that a biological process is often location-specific and not easy to model, but it may play a significant role under certain circumstances. A short discussion may be needed to address the implications of biological processes for bioassessment.