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CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION
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SCIENTIFIC PEER REVIEW COMMENTS AND STAFF RESPONSE

The following comments address the external scientific review of the Total Maximum Daily Load for Pathogens (TMDLs) in Aptos Creek, Valencia Creek, and Trout Gulch. The reviewer was Stefan Wuertz, Ph.D. of the University of California at Davis, who completed his review on October 1, 2007.

Central Coast Water Board staff asked the reviewer to determine whether the scientific portion of the TMDLs was based upon sound scientific knowledge, methods, and practices. We requested the reviewer make this determination for several issues that constituted the scientific basis of the TMDLs. The issues are presented below, with the reviewer's comments and staff's response.

The reviewer provided overall positive assessments of the work as typified by the following statement:

> "Taken in their entirety the proposed measures as outlined in the Final Project Reports for the three watersheds should reduce the level of fecal microbial indicators in creeks, rivers and estuaries by improvements to the wastewater collection and storm water drainage systems." (Wuertz regarding all three Final Project Reports for the Aptos Creek Watershed, Soquel Lagoon Watershed and San Lorenzo River Watershed)

I. Scientific Peer Review of the TMDLs for Pathogens in Aptos Creek, Valencia Creek, and Trout Gulch. All of the following comments are provided by Professor Stefan Wuertz.

Modification of the Aptos Creek Watershed Prohibition

1. <u>Reviewer's comment:</u> Reviewer finds the modification of the Aptos-Soquel Creek Watershed Prohibition as planned by the Water Board scientifically sound and balanced with one exception. The allocation of FIB [fecal indicator bacteria] from natural sources constitutes a significant load and should be accounted for in the proposed TMDL. If it is expected to remain unchanged because the Water Board has no regulatory authority over waste discharges from wildlife, then calculations should be done showing to what extent other waste loads need to be reduced to meet the TMDL allocations.

Staff response: Staff did not include calculations to show what extent other waste loads need to be reduced in order to meet the TMDLs because staff concluded that all controllable sources should be reduced or eliminated to the maximum extent practicable, or to the point that the numeric target is achieved. This approach is necessary because the precise contribution from uncontrollable sources is not known, therefore, the magnitude of reduction of the controllable sources to achieve the numeric target is not known.

Source Analysis

2. Reviewer's comment: Source analysis was partially based on the Source Identification Study by the County of Santa Cruz, Environmental Health Service Water Resources Program (see Section 2 of this review) as well as a variety of other sources detailed in the Final Project Report prepared by staff. The Source Identification Study has been carefully interpreted and ribotyping data for fecal source identification are used mostly to make qualitative assessments of wildlife, livestock, pets and humans as sources of pollution. Stormwater and collection system leaks, blocks and spills are identified as controllable NPS pollution, an assessment that is fully justified by the available data.

   Staff response: Staff agrees with the reviewers comment.

3. Reviewer's comment: Staff also concluded that seasonal variations in water quality data are not a factor in terms of exceedances. This assessment was reached in part because insufficient indicator data were available for the wet season. Reviewer recommends re-visiting the assumption once more monitoring data are in hand. Seasonal influences seem very likely due to different precipitation patterns and flows in the watershed.

   Staff response: Staff will revisit this assumption during the implementation phase of the TMDLs, as the reviewer suggests. Staff acknowledges that seasonal influences due to rainfall are probable. However, the numeric targets and implementations actions will remain the same whether there is seasonal influences or not because the numeric target and TMDLs are based on an enforceable water quality objective.

4. Reviewer comment: The Water Board also estimates that a higher proportion of indicator bacteria are contributed from bird, wildlife and rodent sources than from human sources. Wet season sampling will serve to investigate if the human sources of fecal contamination increase during wet weather, as suggested in the Final Report. There is uncertainty associated with assigning host-specific loads (see Section 2); and it is important to analyze a sufficient number of colonies per water sample if the ribotyping method is used for MST.

Staff response: Staff agrees with the reviewer's comment regarding the inherent uncertainty in assigning loads based on ribotyping data. Staff used ribotyping data, along with other data and information, to develop a source analysis of fecal indicator bacteria. Staff did not, however, develop load-allocations and assign them to responsible parties based on the ribotyping data. Therefore, the uncertainty is not transferred to responsibility on an allocated load basis.

Numeric Targets

5. Reviewer comment: FIB [fecal indicator bacteria] water quality objectives in terms of mean and maximum fecal coliforms and *E. coli* and *Enterococcus* concentrations for REC1 waterbodies and the US EPA Ambient Water Quality Criteria for Bacteria (1986) are proposed as numeric targets. In the absence of real pathogen data or sufficient scientific knowledge about the public health risks associated with FIB in recreational waters impacted by NPS pollution these targets are reasonable.

   Staff response: Staff notes the reviewers comment and agrees that, in the absence of real pathogen data, fecal indicator bacteria should be used.

   Also, implicit in the reviewers comment is the fact that FIBs are not always good indicators of real pathogens. The scientific community is uncertain whether any one of the traditionally used FIBs (fecal coliform, E. coli, Enterococcus) are any better indicators of pathogens than the others. The Water Quality Control Plan (Basin Plan) contains numeric objectives for fecal coliform that are used as FIBs. Therefore, since no single FIB stands out as a superior indicator of pathogens over the others, and since current water quality objectives use fecal coliform as the indicator, staff concluded that fecal coliform should be used as the indicator for the TMDLs. Staff removed E. coli *and* enterococcus *as numeric targets from the TMDL Project Report, leaving fecal coliform as the FIB. Staff made this decision based on current information and after consultation with a number of scientists (including Kenneth Schiff of the Southern California Coastal Water Research Project Authority) and State Water Board staff, as well as information from workshop findings and journal articles.*

TMDL targets and allocations

6. Reviewer comment: Reviewer does not follow the rationale presented by the Water Board to set TMDLs as the same set of concentrations as the numeric targets. Such an approach would seem to ignore the mixing effects of receiving waters and different sources of influents and the overall influence of different flows on the indicator concentrations. It is also unclear how the considerable load from natural (largely uncontrollable) sources will be accounted for.

Staff response: Staff acknowledges that the given approach does not account for mixing effects of receiving water and different flows; doing so might take into account dilution affects, thereby potentially allowing a greater load allocation. Therefore, the proposed TMDLs, which do not take into account potential dilution, are a more conservative approach, thereby creating an implicit margin of safety.

Additionally, there is inherent inaccuracy in laboratory methodologies that determine fecal indicator bacteria concentrations, so staff concludes that conservative TMDLs are appropriate. Finally, the TMDLs proposed are based on existing numeric water quality objectives. Therefore, proposing TMDLs that exceed current water quality objectives, e.g. to account for dilution and mixing affects, potentially carries regulatory challenges.

Finally, the load from uncontrollable sources will be accounted for after such time that all implementation efforts have been exhausted to the maximum extent practicable, leaving the "largely uncontrollable" fraction of fecal coliform indicators.

7. Reviewer comment: It is stated in the Final Project Report that public health risks are based on organism concentration and that pathogens are not readily controlled on a mass basis. The same argument could be used for other constituents for whom TMDLs are being developed. There is no reason to doubt that pathogen load allocations from storm drains and wastewater collection systems can be reduced by the measures proposed by the Water Board.

   Staff response: The reviewers comment stems from the fact that a concentration based TMDLs are being used, rather than load-based TMDLs. However, as the reviewer states and staff agrees, there is no reason to doubt that pathogen load allocations from storm drains and wastewater collection systems can be reduced by the measures proposed in the implementation plan.

8. Reviewer comment: Further, it seems important to derive Pathogen TMDLs that are flexible enough to allow for the use of real pathogen data or microbial source tracking data during the implementation and monitoring stages and that can pinpoint the predicted effects of reductions in specific load allocations.

   Staff response: Staff agrees that tracking real pathogen data (not indicators of pathogens) is preferred. Staff will seize these opportunities when methods and resources needed to monitor pathogenic organisms, at the scale required to develop and implement TMDLs, become available.

9. Reviewer comment: The EPA Protocol for Developing Pathogen TMDLs (2001) states that "…TMDLs can be expressed in terms of organism counts (or resulting concentration), in accordance with 40 CFR 130.2(i) ….." (see page 7-1 in First

Edition). However, given the availability of FIB data for the watershed and the many user-friendly statistical and mass balance models developed for TMDL calculations, it is advisable to use the tools available for simulation in the design of Pathogen TMDLs.

Staff response: Staff agrees that modeling is useful and informative; it also typically requires more historic data than available, particularly flow data. Staff will consider using modeling approaches during the implementation phase if resources and data become available. Modeling during the implementation phase may inform the progress of achieving the TMDLs and result in a more precise distinction between uncontrollable and controllable sources.

10. Reviewer comment: The main advantage of expressing Pathogen TMDLs in terms of mass loadings is that the effect of various source load reductions can be estimated and allocation scenario loadings calculated. The Water Board has proposed that the load allocations for controllable sources will be equal to the TMDLs. This intention can also be realized by simply multiplying the flow rate associated with that load by the water quality standard. Reviewer thinks that natural (uncontrollable) sources may contribute a sufficiently high load so the FIB levels will remain high in the watershed. Simulating the effect of various controllable load reductions can help predict the outcome of improvements in wastewater collection systems and stormwater systems.

    Staff response: Staff agrees that uncontrollable sources may be a significant contribution to the entire load of fecal indicator bacteria. Staff also acknowledges that modeling approaches may predict what those uncontrollable loads are. However, staff did not have the data necessary to run and calibrate a model to make this prediction, e.g. the flow rate. Therefore, staff is proposing maximizing reduction of controllable sources of fecal indicator bacteria. Staff may consider an evaluation of the uncontrollable fraction after maximum reduction of controllable sources.

11. Reviewer comment: Even if simulation tools are not employed, simple calculations for TMDL allocations can be conducted that express TMDL values in terms of number of FIB per day. An example of TMDL allocation is shown on pp. 7-4 to 7-7 in Protocol for Developing Pathogen TMDLs (2001) where the TMDL was calculated based on allowable concentration at the mouth of the river.

    Staff response: The reviewer is referring to calculations to determine mass-based loading of fecal bacteria indicators, in this case, fecal coliform. The calculations require historic stream and/or discharge flow volume, which was not available to staff during TMDL development. However, if flow volume was available to staff during TMDL development, staff is confident that the resulting implementation would not be different than currently proposed, i.e., the same responsible parties and allocations would be identified. Staff will consider

assessing loads during the implementation phase of the TMDLs if the resources and data necessary to run such a model become available.

12. Reviewer comment: It is stated that the Margin of Safety (MOS) is set implicitly by setting the TMDL equal to the WQS. If the Water Board decides to change the way the TMDL is calculated by defining it on a mass basis, it would be useful to include a separate MOS a certain percentage point lower than the WQS of a geometric mean for those allocations, which are clearly predominantly of human origin.

    Staff response: Staff chose not to define the TMDLs on a mass basis.

Implementation Plan

13. Reviewer comment: The proposed approach to first target controllable sources of anthropogenic origin is feasible and supported by previous monitoring and source identification studies in the watershed. Microbial Source Tracking data from the ribotyping study conducted by County of Santa Cruz as well as general FIB contributions from creeks affected mostly by natural sources do suggest that natural sources may contribute significantly to the microbial load. The proposed Implementation Plan takes into account that additional measures may be necessary based on site-specific objectives.

    Staff response: Staff agrees. The strategy is to first target controllable sources of fecal indicator bacteria during the implementation phase while assessing the feasibility of achieving the allocations during implementation.

Monitoring Plan

14. Reviewer comment: The proposed general monitoring plan is feasible and includes specific stormwater outfalls. It is reasonable not to include those individual measurements to ascertain compliance with the TMDL. However, such data points are very useful to verify the effectiveness of management actions, as stated in the Final Project Report.

    Staff response: Staff Agrees and will consider during the implementation and monitoring phase.

15. Reviewer comment: There is one remaining uncertainty for the adaptation of monitoring plans in case of continuing exceedances of WQO after controllable sources have been reduced or eliminated. The potential for re-growth of microbial indicators in the watershed is largely unknown. It is uncertain that mere monitoring of water quality using FIB could address this possibility. Such a monitoring program may involve a research component ("Feasibility of re-growth of microbial indicators in situ in San Lorenzo Watershed") and would benefit

tremendously if real pathogen data were collected at the same time.

Staff response: Staff agrees that a study to address potential re-growth would be valuable. The implementation plan does not require responsible parties to study potential fecal indicator bacteria re-growth. However, staff would consider results of such a study during the implementation and assessment phase of the TMDLs.

Time schedule for achieving the TMDLs

16. Reviewer comment: The proposed timeline is reasonable.

    Staff response: Staff agrees.

General conclusions

The reviewer made general comments directed at three TMDL projects. The three TMDL projects had similar analysis approaches and findings. Most of the general comments are addressed specifically in the comments and responses above. The following are comments and staff's response to those not yet addressed.

17. Reviewer comment: The proposed measures to reduce allocations from controllable sources are supported scientifically and may be adequate to achieve necessary load reductions and compliance with a mass-based TMDL.

    Staff response: Staff agrees.

18. Reviewer comment: Sampling campaigns should include a sufficient number of wet events during the implementation and monitoring phases.

    Staff response: Staff agrees. Staff will insure that wet-event sampling occurs during the monitoring phase.