California Regional Water Quality Control Board
San Diego Region

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Arnold Schwarzenegger
Governor

TO: Gerald Bowes,
Chief, Standards Development Section
State Water Resources Control Board

In Reply Refer to:
WQS: 79-0056.02:carias

FROM: *Signed by John H. Robertus*
John H. Robertus
Executive Officer
San Diego Regional Water Quality Control Board

DATE: December 21, 2004

SUBJECT: **Request For Scientific Peer Review for the Basin Plan Amendment Incorporating the *Bacteria-Impaired Waters Total Maximum Daily Load Project I for Beaches and Creeks in the San Diego Region***

The purpose of this memorandum is to request that you begin the process for selection of scientific peer reviewers, pursuant to the requirements of Health and Safety Code section 57004, for the proposed Basin Plan amendment to incorporate the *Bacteria-Impaired Waters Total Maximum Daily Load Project I for Beaches and Creeks in the San Diego Region* (Bacteria TMDL Project I). This project addresses 17 bacteria-impaired waterbodies including coastal shoreline and inland surface waters (creeks) in the San Diego Region. These waterbodies were listed pursuant to the federal Clean Water Act, section 303(d), for impairment due to exceedances of the water quality objectives for bacterial indicators. Appropriate disciplines that relate to the subject matter of this project include **environmental health sciences and environmental engineering**. We specifically request reviewers with background or knowledge in **hydrology and water quality watershed models**.

In order to assist in the selection of reviewers, the following information is provided as attachments to this letter:

1. A brief summary of the Bacteria TMDL Project I;
2. A brief review of the scientific issues that require peer review; and
3. A list of individuals involved in the development of this project.

Basin Plan amendment language adding the Problem Statement, Source Analysis, Numeric Targets, TMDLs, Margin of Safety, Waste Load Allocations and Reductions to Chapter 4 of the Basin Plan was not included as part of this submittal. This information, as well as implementation plan language, will be provided to the peer reviewers.

The San Diego Regional Board at its regularly scheduled meeting on December 14, 2005 will consider the proposed amendment. The draft Technical TMDL Report and supporting material will be available for peer review by January 17, 2005. Once peer reviewers have been selected, I

am requesting that the review by accomplished within 30 days. Please contact Christina Arias if you have any questions or need further information, at (858) 627-3931 or carias@waterboards.ca.gov.

Thank you for your assistance with this matter.

Attachments (3)
CC: John Richards, OCC
Ken Harris, Chief, Basin Planning Unit

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Bacteria Impaired Waters TMDL Project I for Beaches and Creeks in the San Diego Region

Summary of Proposed Action

Summary of Technical Report

The Regional Board proposes an amendment to the Basin Plan to incorporate Total Maximum Daily Loads (TMDLs) for several beaches and creeks in the San Diego Region that are listed as water quality limited segments for bacteria indicators pursuant to Clean Water Act section 303(d). Specifically, there are 16 distinct listings (open shoreline and creeks) for which this amendment would establish TMDLs. The goal of this amendment is to improve water quality by establishing load and waste load allocations to attain specified TMDLs. This will eventually restore the impaired beneficial uses of these waterbodies, namely water contact recreation and shellfish harvesting.

The Basin Plan amendment will consist of the problem statement, numeric target, source analysis, total maximum daily loads, margin of safety, and load and waste load allocations and reductions for each of the 16 listed segments, plus implementation provisions and a compliance schedule. The implementation provisions will include a range of regulatory alternatives available to the Regional Board to require the dischargers to meet the load and waste load reductions. Specifically, the Regional Board can issue or amend existing Waste Discharge Requirements, including those that implement National Pollutant Discharge Elimination System (NPDES) regulations, or Waivers of Waste Discharge Requirements, or adopt Basin Plan prohibitions. The implementation provisions may also require studies by the dischargers to fill data gaps, refine the TMDLs and reductions, or modify compliance requirements. The dischargers will also be ordered to conduct monitoring to assess the effectiveness of the implementation measures at meeting the load and waste load reductions.

Scientific Portion of the Basin Plan amendment: Problem Statement, Source Analysis, Numeric Targets, TMDLs, Margin of Safety, Waste Load Allocations and Reductions

Current source loads and total maximum daily loads were calculated separately for wet weather conditions and dry weather conditions for each of the 16 listed segments. TMDLs are ultimately calculated by setting the numeric targets equal to the water quality objectives for total and fecal coliform and enterococci bacteria expressed in the Basin Plan and Ocean Plan.

For wet weather conditions, a regional watershed-based approach (model study) was developed to determine existing bacteria loads and calculate TMDLs for these impaired waterbodies. The model was used to simulate the build-up and wash-off of bacteria, and the hydrologic and hydraulic processes that affect delivery to the impaired waters. The wet weather approach was based on the application of the U. S. Environmental Protection Agency's (USEPA) Loading Simulation Program in C++ (LSPC) to estimate bacteria

loading from streams and assimilation within the waterbody. In addition to TMDL calculation, the necessary load and waste load allocations necessary for TMDL attainment were also determined.

For dry weather analysis, a different approach was necessary due to the variable nature of bacteria concentrations in the receiving waters during low flow conditions. A steady-state mass balance model was developed based on regression analysis to simulate transport of bacteria within the watersheds. The model was created to predict bacteria concentrations from various land use types and watershed sizes in the San Diego Region. The modeling system was used to estimate existing bacteria loading, calculate TMDLs for the impaired waterbodies, and the necessary load and waste load allocations for TMDL attainment. The regression model was developed using water quality and flow data from four local creeks, assuming a first-order bacterial die-off rate, and assuming values for stream infiltration rates and basic channel geometry.

An implicit margin of safety (MOS) was incorporated into the TMDL and allocation/reduction calculations. This was done by incorporating a series of conservative assumptions regarding current source loading of bacteria from the watersheds, as well as assumptions regarding the assimilation of bacteria into the waterbodies and surrounding environment.

Bacteria Impaired Waters TMDL Project I for Beaches and Creeks in the San Diego Region

Description of Scientific Issues to be addressed by Peer Reviewers

The statute mandate for external scientific peer review (Health and Safety Code Section 57004) states that the reviewer's responsibility is to determine whether the scientific portion of the proposed rule is based upon sound scientific knowledge, methods, and practices.

We request that you make this determination for each of the following issues that constitute the scientific basis of the proposed regulatory action. An explanatory statement is provided for each issue to focus the review.

1. **Use of land use composition to quantify bacteria sources from all watersheds to affected beaches and creeks in the San Diego Region.**

   Bacteria are ubiquitous in the environment, as there are numerous sources including both controllable and non-controllable. Controllable sources include sewage related sources (spills, leaking sewer lines), trash, farm animal waste, and pet waste. Non-controllable sources include aquatic and terrestrial wildlife, decaying matter, and soil. To manage this abundance of sources and quantify them in a useful way, land-use types were identified in the San Diego Region and quantified in terms of bacteria generation.

   Various bacteria sources are present across different land-use categories. For example, wildlife can be present in both urbanized and non-urbanized areas. Despite this source variability, loading can be highly correlated with land use practices. For this reason, it was decided to quantify the bacteria load coming from each land use type rather than quantify the sources directly. This approach was applied to both wet weather and dry weather conditions.

2. **Use of wet weather model to simulate fate and transport of bacteria, and to calculate TMDLs, to affected beaches and creeks.**

   A regional watershed-based approach (model study) was developed to simulate the build-up and wash-off of bacteria, and the hydrologic and hydraulic processes that affect delivery of bacteria to the impaired waters. In this approach, bacteria re-growth is assumed to be zero.

   This approach was based on the application of the U. S. Environmental Protection Agency's (USEPA) Loading Simulation Program in C++ (LSPC) to estimate bacteria loading from streams and assimilation within the waterbody to determine existing bacteria loads, as well as total maximum daily loads, to receiving waters. LSPC

integrates a geographical information system (GIS), comprehensive data storage and management capabilities, a dynamic watershed model (a re-coded version of EPA's Hydrological Simulation Program—FORTRAN [HSPF]), and a data analysis/post-processing system into a convenient PC-based windows interface that dictates no software requirements. Please comment on the use of this modeling system for the purpose of calculating TMDLs to impaired waters during wet weather.

3. Selection of a Los Angeles watershed as a "reference" for background loading of bacteria in the San Diego Region during wet weather.

The interim numeric target for the TMDL calculations is based on the use of a "reference watershed approach," a concept that was introduced by the Los Angeles Regional Water Quality Control Board in the Santa Monica Bay Beaches TMDL (LARWQCB, 2002). In this approach, a certain amount of exceedances of the single sample maximum water quality objectives are allowed, based on the frequency of exceedances expected in a relatively pristine, or "reference," watershed. Since there are natural sources of bacteria in a reference watershed, a certain amount of exceedances of the water quality objectives are expected. It is assumed that these exceedances are not from anthropogenic origin. This exceedance frequency is incorporated into the waste load allocations that were calculated for all urbanized watersheds. However, if water quality is better than that of the reference watershed in a particular location, no degradation of existing bacteriological water quality is permitted. This approach ensures no further bacteriological degradation of water quality where existing conditions are better than that of the reference watershed.

In the San Diego Region, candidate watersheds for use as a "reference" for TMDL development have been identified. However, to date, these candidate watersheds do not have sufficient data needed for characterization. In lieu of suitable data originating from the San Diego Region, the exceedance frequency of the reference watershed used for TMDL development in Los Angeles, the *Arroyo Sequit* watershed, were used. Specifically, the allowance frequency of 22 percent was used in the calculation of the interim TMDLs. Final TMDLs for wet weather were calculated using the single sample maximum water quality objectives (no allowable frequency of exceedance).

4. Use of single-sample maximum objectives for wet weather numeric targets.

Bacteria water quality objectives have two temporal components: single sample maximum values and 30-day geometric mean values. As a conservative measure for wet weather analyses, the single sample maximum values were chosen as TMDL numeric targets.

Wet weather events, and subsequent high bacterial counts, are sporadic and episodic. Wet weather runoff and flows contain elevated bacteria densities, but have a quick time of travel. Thus, bacteria densities remain elevated for relatively short time periods following storm flows. Storm events do not typically result in an exceedance

of the 30-day geometric mean bacteria densities, even though single sample densities are very high. Therefore, the single sample maximum values were used as numeric targets for the wet weather simulations.

5. **Reasonableness of assumptions (described in Appendix J) for wet weather modeling.**

   Several assumptions are relevant to the LSPC model developed to simulate the fate and transport of wet weather sources of bacteria in the Region. This model was used to estimate both existing bacteria loads and total maximum daily loads. Please comment on the validity of these assumptions.

6. **Use of wet weather modeling parameters to simulate build-up/wash-off of bacteria from a similar study in Los Angeles (LARWQCB, 2002).**

   As explained earlier, sources of bacteria are quantified by correlating land use types to bacteria loading.

   Land use data was classified into 13 distinct categories. Each category had a unique parameter describing the amount of bacteria loading directly to the *critical point* (defined as the culmination point at the bottom of each affected watershed). These unique parameters were obtained by using those that were previously defined in the TMDL for Santa Monica Bay (LARWQCB, 2002). This includes land-use-specific accumulation rates and build-up limits. Using these values assumes that land use characteristics for all categories in the San Diego Region are sufficiently similar to characteristics of all land use categories in the Los Angeles Region. This assumption was validated through evaluation of model results with local water quality data. Please comment on the application of modeling parameters derived in the Los Angeles Region to the San Diego Region.

7. **Use of dry weather model to simulate fate and transport of bacteria, and to calculate TMDLs, to affected beaches and creeks.**

   During dry weather conditions, bacteria levels are highly variable and not predicted well using standard modeling techniques, such as the LSPC model developed for wet weather. To account for this variability, empirical equations were developed to represent water quantity and quality associated with dry weather runoff from various land uses. Concentrations of fecal coliform were developed using regression analysis as a function of total area and land use composition in each subwatershed. Concentrations of total coliform and enterococci were developed as functions of fecal coliform concentrations.

   The predictive model represents the streams as a series of plug-flow reactors, with each reactor having a constant source of flow and bacteria. Although it is understood that dry weather flows and bacteria densities vary over time for any given stream, for

prediction of average conditions in the stream, flows and concentrations are assumed to be in steady state. Bacteria re-growth is assumed to be zero.

8. Use of data from Aliso, San Juan, Rose, and Tecolote Creeks to characterize dry weather source loading in the entire San Diego Region.

Data from Aliso Creek, San Juan Creek (Orange County), Rose Creek, and Tecolote Creek (San Diego County) were used for characterization of dry weather flows and water quality because the data sets associated with these creeks are assumed sufficient in size. Data from these four creeks were used to generate regression equations describing flow and water quality as functions of land use composition and watershed size. Conditions in these four creeks are assumed representative of conditions throughout the Region.

9. Use of geometric mean objectives for dry weather numeric targets.

Bacteria water quality objectives have two temporal components: single sample maximum values and 30-day geometric mean values. For dry weather analyses, the geometric mean values were chosen as TMDL numeric targets. This is because the dry weather model simulates steady state flow for predictions of average conditions in the creeks. To compare the conditions of these average flows to water quality objectives, the geometric mean is more appropriate since this value likewise represents average conditions over 30 days.

10. Reasonableness of assumptions (described in Appendix J) for dry weather modeling.

Several assumptions are relevant to the empirical model developed to simulate the fate and transport of bacteria during dry weather in the Region. Please comment on the validity of these assumptions.

11. Location of *critical points* for TMDL calculation.

The *critical point* for loading assessment is defined as the culmination point at the bottom of the watershed, before inter-tidal mixing takes place. Both current loading and total maximum daily loading is calculated at the critical point for each watershed having an impaired waterbody. High bacteria loading is predicted at the critical point, and is therefore considered a conservative location for TMDL calculation. TMDL calculations were determined at the critical point in both wet and dry weather.

12. Use of conservative assumptions to comprise an implicit Margin of Safety.

Rather than incorporating an explicit margin of safety (MOS) to TMDL calculation, the conservative assumptions built into both the wet weather and dry weather models are considered sufficient to account for any uncertainties. The implicit MOS was thus generated by incorporating a series of conservative assumptions regarding current

source loading of bacteria from the watersheds, as well as assumptions regarding the assimilation of bacteria into the waterbodies and surrounding environment.

Reference: LARWQCB (Los Angeles Regional Water Quality Control Board). 2002. *Total Maximum Daily Load to Reduce Bacterial Indicator Densities at Santa Monica Bay Beaches During Wet Weather*. Los Angeles Regional Water Quality Control Board, Los Angeles, CA.

Overarching Questions

Reviewers are not limited to addressing only the specific issues presented above, and are asked to contemplate the following "big picture" questions.

(a) In reading the staff technical reports and proposed implementation language, are there any additional scientific issues that are part of the scientific basis of the proposed rule not described above? If so, please comment with respect to the statute language given above.

(b) Taken as a whole, is the scientific portion of the proposed rule based upon sound scientific knowledge, methods, and practices?

Reviewers should also note that some proposed actions may rely significantly on professional judgment where available scientific data are not as extensive as desired to support the statute requirement for absolute scientific rigor. In these situations, the proposed course of action is favored over no action.

The preceding guidance will ensure that reviewers have an opportunity to comment on all aspects of the scientific basis of the proposed Board action. At the same time, reviewers also should recognize that the Board has a legal obligation to consider and respond to all feedback on the scientific portions of the proposed rule. Because of this obligation, reviewers are encouraged to focus feedback on the scientific issues that are relevant to the central regulatory elements being proposed.

Bacteria Impaired Waters TMDL Project I for Beaches and Creeks in the San Diego Region

List Of Scientists and Engineers Involved in Development of Proposed Basin Plan Amendment

San Diego Regional Water Quality Control Board
- John Robertus
- Art Coe
- David Barker
- Julie Chan
- Christina Arias

Consultant
- Steve Carter, Tetra Tech, Inc.
- John Craig, Tetra Tech, Inc.
- Amy King, Tetra Tech, Inc.

USEPA Region IX
- Peter Kozelka
- Terry Fleming

Stakeholder Advisory Group

Name	Organization	Stakeholder Category
Karen Helyer	Port of San Diego	San Diego Bay Watersheds
Ruth Kolb	City of San Diego	San Diego/Mission Bay Watersheds
Kathy Weldon	City of Encinitas	Carlsbad/San Dieguito Watersheds
Mo Lahsaie	City of Oceanside	Santa Margarita River/San Luis Rey Watersheds
Nancy Palmer	City of Laguna Niguel	San Juan Watershed
Sheri McPherson	County of San Diego Department of Public Works	San Diego County Watersheds
Amanda Carr	County of Orange Resources & Development Management Department	Orange County Watersheds
Ed Kimura	Sierra Club	Environmental
Gabriel Solmer	San Diego Baykeeper	Environmental
Rick Gersberg	San Diego State University	Academic/Research
Chi Vargas	Caltrans	California Department of Transportation

Name	Organization	Stakeholder Category
Harold Bailey	Padre Dam Metropolitan Water District	Publicly Owned Treatment Works
Alan Langsworthy	Southern California Association of Publicly Owned Treatment Works	Publicly Owned Treatment Works
Valerie Mellano	University of California Cooperative Extension	Agriculture
Marilyn Schwartz	Industrial Environmental Association	Business and Industry