Additional Information Requested by the San Diego Water Board

At the Board Meetings on December 14, 2005 and February 8, 2006, the San Diego Water Board Members made comments and requested additional information on these subject areas:

1. The percent reduction required for discharger categories in each watershed;
2. The cost of surface water monitoring for viruses;
3. Adaptability of the TMDLs to new information after adoption of the Basin Plan amendment; and
4. Justification for the need to address beaches and creeks simultaneously in calculating TMDLs.

Responses to comments and information on these subjects are provided in the following paragraphs.

1. Load Reductions Required for Discharger Categories and Recalculation of Allocations

Comment: At the December 14, 2005 meeting, Board Member Johnson commented that the percent reductions for wet weather discharges reported in the draft Technical Report were for all dischargers collectively in each watershed, thereby making it difficult to ascertain the percent reductions required from each discharger category (municipal MS4s, Caltrans, controllable nonpoint sources such as agriculture and animal facilities, and uncontrollable sources). He also noted that the watershed-wide load reduction percentages were misleading because they were smaller than the load reduction percentages for the individual discharger categories.

Response: We revised the tables in section 9 of the draft Technical Report to show the percent load reductions required for each of the discharger categories, instead of showing the percent reduction needed on a watershed-wide basis, as was reported previously. Please see Supporting Document 5 for a discussion of the changes that were made to section 9 and Appendix I as a result of this comment.

2. Cost Estimates for Virus Surface Water Monitoring

Comment: At the February 8, 2006 meeting, Board Member Anderson requested information regarding cost estimates for monitoring pathogens.

Response: Pathogens are defined as agents that cause disease, and include microorganisms like bacteria, viruses, or fungi. In response to this comment, we analyzed the costs associated with monitoring viruses, since this analysis has been done (although not widely used), and information is readily available.

Industry standards for virus detection are not available, and methods that have been used to date are expensive. However, expenses are expected to decrease significantly within the next few years due to new techniques that are being developed. Two types of viruses should be considered for water quality monitoring: the coliphages and human adenoviruses. Adenoviruses can cause large-scale epidemics of respiratory illness, however, they also are the second leading cause of gastroenteritis in children. Adenoviruses are consistently found in raw sewage throughout the world and are considered hardy, with a 2-log reduction in population size in 99 days (Jiang, et al., 2001).

Although adenoviruses were detected in the majority of samples collected from urban waterways and polluted coastal areas, Jiang (2002) reported that hepatitis A and enteroviruses were found in water samples where adenoviruses were absent. Therefore, the author concluded that adenoviruses alone cannot serve as an index for human viral contamination in Southern California. Hence, two measurements of viral populations/ communities are provided in the present report. A quantitative test using polymerase chain reaction (PCR) techniques for one species of human adenovirus costs approximately $2,000/sample (Ken Schiff, SCCWRP, personal communication, March 15, 2006).

Coliphages are viruses that infect *Esherichia coli* (*E. coli*) bacteria. Coliphages are found in high concentrations in sewage, with concentrations typically ranging from 100 to 10,000 infectious units per milliliter (Sobsey, 2002).

A quantification technique for coliphages, applying traditional microbiological techniques, involves growing coliphages using *E. coli* concentrated on an agar medium. The water sample, which possibly contains coliphages, is then incubated in the agar plate (Sobsey, 2002). The 28-day assay test is very expensive, approximately $1,500/sample. Conversely, a simple presence/ absence test for coliphage costs between $50 to $100/sample, but provides limited information (Ken Schiff, SCCWRP, personal communication, March 15, 2006).

Despite the possible high concentrations, viruses can be very difficult to isolate and usually require sampling large volumes of water (20 to 40 liters) (Ken Schiff, SCCWRP personal communication, March 15, 2006). The quoted prices include concentration of viruses from the water samples, which can be time-intensive. Assuming that a two-person sampling team can collect samples at 5 sites per day, at 100 miles round trip, using the PCR technique for adenovirus and the 28-day standard methods test for coliphage, the total cost for one day of sampling would be $18,974.

Table 1. Cost Estimates for Surface Water Monitoring for Viruses

Expenditure	Cost per Unit
Laboratory Analyses	
Adenovirus, one species, PCR	$2,000/sample
Coliphage, 28-day test	$1,500/sample
Coliphage, presence/absence test	$50 - 100/sample
Field Sampling Costs – two people	$1,440 per day
Vehicle Costs	$34 per 100 mi

3. Adaptability of TMDLs and Compliance Schedules Based on New Data or Information

Comment: At the February 8, 2006 meeting, several Board Members requested clarification regarding the adaptability of TMDLs and associated compliance schedules if new data or information becomes available.

Response: As with all TMDLs, the development of the bacteria TMDLs was characterized by data gaps and uncertainties. Scientific uncertainty is a reality within all water quality programs, including the TMDL program, and this uncertainty cannot be entirely eliminated. The TMDL program must move forward in the face of these uncertainties if progress in attaining WQOs in impaired waters is to be made.

The National Research Council addressed this issue in their report for the US Congress entitled *Assessing the TMDL Approach to Water Quality Management* (2000) and concluded that

> "… the ultimate way to improve the scientific foundation of TMDLs is to incorporate the scientific method, and not simply the results from analysis of particular data sets or models, into TMDL planning. The scientific method starts with limited data and information from which a tentatively held hypothesis about cause and effect is formed. The hypothesis is tested, and new understanding and new hypotheses can be stated and tested. By definition, science is this process of continuing inquiry. Thus, calls to make policy decisions based on the "the science," or calls to wait until "the science is complete," reflect a misunderstanding of science. Decisions to pursue some actions must be made, based on a preponderance of evidence, but there may be a need to continue to apply science as a process (data collection and tools of analysis) in order to minimize the likelihood of future errors."

We have structured an adaptive implementation plan in the draft Technical Report that simultaneously makes progress toward achieving bacteria WQOs while relying on monitoring data to reduce uncertainty and fill data gaps as time progresses. This monitoring data can be used to revise and improve the initial TMDL forecast over time. This type of approach will help ensure that implementation of TMDLs is not halted because of a lack of data and information, but rather progresses while better data are collected to verify or refine assumptions, resolve uncertainties, and improve the scientific foundation of the TMDLs.

Once adopted, modifications to TMDLs can be incorporated with a subsequent Basin Plan amendment, if appropriate. The request to initiate the amendment process may be voiced by interested persons to the San Diego Water Board at any time.

One option for revising these TMDLs, once adopted into the Basin Plan, is the Triennial Review process. During the Triennial Review, the public may recommend issues that the San Diego Water Board should address in the near future that will result in Basin Plan amendments. The San Diego Water Board develops and adopts a prioritized list of Basin Plan issues that may be investigated over a span of three years. These issues include interpretation of WQOs and incorporation of implementation plans. Initiation of the Basin Plan amendment process can take place during the Triennial Review or upon the San Diego Water Board's direction to staff at any time.

4. Addressing Beaches and Creeks Simultaneously

Comment: At the February 8, 2006 meeting, Board Member Kraus requested that clarification be provided concerning the need to address both beaches and creeks simultaneously, rather than in separate analyses.

Response: TMDLs for saltwater beaches were expressed together with TMDLs for the five freshwater creeks (Aliso Creek, San Juan Creek, the San Diego River, Forrester Creek[1], and Chollas Creek[2]) because the beaches and creeks are connected hydrologically and sources of bacteria to both beaches and creeks are the same; namely urban runoff. Thus reducing bacteria loading from urban runoff would restore water quality both in the creeks and at the beaches. The models predicted the accumulation of bacteria on the watershed surfaces and the loading at the critical points, defined as the bottom-most point in each watershed before the creeks discharge to the beaches and intertidal mixing takes place. Even though beaches and creeks are separate waterbodies with distinct WQOs, it is appropriate to analyze them concurrently because all creeks included in this analysis eventually discharge to a marine beach. In other words, creeks and beaches are part of the same hydrologic system, and creek water quality directly affects beach water quality.

We chose the more stringent of the marine or freshwater WQO for each indicator bacteria as the numeric target for TMDL calculations for the five beach/creek

[1] Forrester Creek is tributary to the San Diego River

[2] The mouth of Chollas Creek does not have a beach per se, but the REC-1 and SHELL uses are designated in San Diego Bay, the downstream receiving water.

watersheds. For total coliform, the more stringent WQO is associated with the SHELL beneficial use for marine beaches. For fecal coliform, the more stringent WQO is associated with the REC-1 beneficial use for marine beaches. For enterococci, the more stringent WQO is associated with the REC-1 beneficial use for freshwater creeks.

Several dischargers expressed concern that simultaneously analyzing creeks and beaches erroneously imposes creek WQOs onto beaches, and beach WQOs onto creeks. However, this is not the case. The TMDLs do not require that SHELL total coliform, nor REC-1 fecal coliform objectives, be met throughout the creek, or that freshwater enterococci WQOs be met at the beach. We revised the text in the draft Technical Report to make this clear.

In terms of protecting creek water quality, we chose the more stringent enterococci WQO for creeks because the creek is the upstream receiving water. Even though the marine beaches have less stringent enterococci WQOs associated with them, dischargers have no more of a burden to meet this standard at the beach, since the more stringent WQO already has been met upstream.

In terms of protecting beach water quality, we used the more stringent total and fecal coliform targets (these WQOs are more stringent than the WQOs associated with creeks). In taking this approach, we assumed that attainment of the WQOs at the point where the creeks discharge to the beaches will result in attainment of the WQOs at the downstream beach. If WQOs are met at the mouth of the watershed, then WQOs likely also are met at the beach because dilution with the wavewash has taken place. This approach is justified because (1) the beaches are the ultimate receiving waterbodies, and all creeks included in this project discharge to a beach, (2) the beaches have more recreational users than creeks, and (3) the beaches are designated with the most sensitive beneficial use, shellfish harvesting, whereas creeks are not.

References

Jiang, S., R. Noble and W. Chu. 2001.Human Adenoviruses and Coliphages in Urban Runoff-Impacted Coastal Waters of Southern California. Applied and Environmental Microbiology 67:1:179-184.

Jiang, S. 2002. Adenovirus as an Index of Human Viral Contamination. IN: Microbiological Source Tracking Workshop, February 5, 2002, Irvine, CA. National Water Research Institute, Fountain Valley, CA.

Sobsey, M. 2002. Coliphage Tracking to Identify Sources of Fecal Contamination. IN: Microbiological Source Tracking Workshop, February 5, 2002, Irvine, CA. National Water Research Institute, Fountain Valley, CA.