Appendix B

Peer Review Comments
And Responses

B Peer Review Comments and Responses

The technical portions of the proposed Basin Plan amendment to incorporate TMDLs for indicator bacteria were peer reviewed by Professor Patricia Holden of the Donald Bren School of Environmental Science & Management, University of California, Santa Barbara, and by Professor Michael Barber of the Washington State Water Research Center, Department of Civil and Environmental Engineering, Washington State University. External scientific peer review of the technical portion of a proposed rule (in this case, the proposed Basin Plan amendment) is mandated by Health and Safety Code section 57004. This statute 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. The San Diego Water Board provided the peer reviewers with the draft Technical Report, the draft Basin Plan amendment, and a list of key issues with discussion for the peer reviewers to address. The list of key issues with discussion provided to the peer reviewers is given below in the first section of this appendix. The peer reviewers' comments and the San Diego Water Board's responses follow in subsequent sections.

Issues for Peer 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.**

   The wet-weather approach chosen for use in this project is based on the application of USEPA's Loading Simulation Program in C++ (LSPC) to estimate bacteria loading in the watersheds. LSPC is a recoded C++ version of USEPA's Hydrological Simulation Program–FORTRAN (HSPF) that relies on fundamental (and USEPA-endorsed) algorithms. LSPC has been been applied and calibrated in multiple watersheds in the San Diego Region in the *Draft Bacteria TMDLs for Beaches and Inland Surface Waters of the San Diego Region*, hereafter referred to as Draft Bacteria TMDL Project I (SDRWQCB, 2005). The regionally calibrated modeling parameters from Draft Bacteria TMDLs Project I were transferred to the watersheds of the San Diego Bay (SDB) and Dana Point Harbor (DPH) impaired shorelines. For a complete discussion of LSPC configuration, validation, and application, refer to Appendix G.

Receiving water models of SDB and DPH were developed to simulate the assimilative capacity of the waterbodies, quasi-steady-state effects of tidal flushing, and bacterial die-off. These models were based on the Environmental Fluid Dynamics Code (EFDC) (Hamrick, 1992 and 1996). Wet-weather flows and bacteria levels from the watersheds were based on LSPC output for the respective impaired shorelines modeled, and were therefore used as boundary conditions to the EFDC models. The EFDC models additionally provided quasi-steady-state simulation of flushing and intrusion of waters high in salinity resulting from tidal hydrodynamics. The models also included assumptions for influence of salinity and temperature on bacteria die-off formulations. A complete discussion of EFDC model development of SDB and DPH is provided in Appendix G.

Please comment on the use of this modeling system for the purpose of calculating TMDLs to impaired waters during wet weather.

3. 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.

4. Reasonableness of assumptions (described in Appendix L) for wet-weather modeling.

Several assumptions are relevant to the modeling system used to simulate the fate and transport of wet weather sources of bacteria. This model was used to estimate both existing bacteria loads and total maximum daily loads. Please comment on the validity of these assumptions. Assumptions for wet weather modeling can be found in Appendix L.

5. Use of wet weather modeling parameters to simulate build-up/wash-off of bacteria from similar studies in San Diego and Los Angeles (SDRWQCB, 2005 and LARWQCB, 2002).

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), and used in Draft Bacteria TMDLs Project I. The parameters include 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 in Draft Bacteria TMDLs Project I through evaluation of model results with local water quality data. Please comment on the application of modeling parameters derived in the Los Angeles Region and validated in Draft Bacteria TMDLs Project I to this project.

6. Use of dry weather and receiving water model to simulate fate and transport of bacteria, and to calculate TMDLs.

The density of bacteria during dry weather is extremely variable in nature. Therefore, to better identify and characterize sources an approach was used that relied on detailed analysis of available data based on statistical relationships between flow, bacteria concentrations, and area of each land use. An approach similar to that used for Draft Bacteria TMDLs Project I was also used to model dry weather watershed sources for the impaired shorelines of SDB and DPH. Also, since dry weather flow data was not available for any of the bay and harbor segments, flow parameters were utilized from the regionally calibrated dry weather model for Draft Bacteria TMDLs Project I.

To represent the linkage between source contributions and receiving waters, steady-state mass balance models were developed to simulate transport of bacteria in the streams and storm drains flowing to impaired SDB and DPH shorelines. These predictive models represent the streams/storm drains as a series of plug-flow reactors, with each reactor having a constant, steady-state flow and bacteria load. Bacteria concentrations in each segment were simulated based on regionally calibrated values for a first-order die-off rate and stream infiltration.

Receiving water models of SDB and DPH were consistent with EFDC models developed for wet-weather analyses, and included linkage to the dry-weather watershed transport model described above. These models simulated the assimilative capacity of the waterbodies, quasi-steady-state effects of tidal flushing, salinity, and temperature, and effects on bacterial die-off. A complete discussion of the modeling approach for dry weather is provided in Appendix G.

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

   Dry weather flow data was not available for any of the bay and harbor segments. Flow parameters were utilized from the regionally calibrated dry weather model for Draft Bacteria TMDLs Project I. In this approach, 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 considered 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. A complete discussion of the approach for dry weather is provided in Appendix G.

8. **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.

9. **Reasonableness of assumptions (described in Appendix L) for dry weather modeling.**

   Several assumptions are relevant to the modeling system used to simulate the fate and transport of bacteria during dry weather in the Region. Please comment on the validity of these assumptions. Additional assumptions for dry weather modeling can be found in Appendix L.

10. **Assumptions used for modeling the impaired shorelines of SDB (B Street and G Street Pier) that had no data for model verification or loading assessment.**

    Sufficient bacteria data were available for three impaired shorelines in this study, including Tidelands Park and Shelter Island Shoreline Park of SDB and Baby Beach of DPH. These data were used for model testing and analyses of loading conditions to the receiving waters. These analyses provided information for assumptions for modeling the other impaired shorelines of SDB (B Street and G Street Pier) that had no data for model verification or loading assessment.

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 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, dry weather and receiving water 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.

13. Calculations of wasteload allocations, load allocations and TMDLs during dry weather and wet weather.

Data and model limitations required that assumptions be made to calculate the dry weather wasteload allocations. The models were incapable of predicting the variability in measured receiving water bacteria concentrations, most likely because of the extreme daily variability in bacteria loading from birds and other localized sources. Additionally, there were no data or literature values to accurately estimate the loading to the shorelines from sources external to the MS4s including bird sources, marine mammals, and boat discharges. However, modeling showed that, because of the small size of the watersheds draining to the impaired shorelines, the MS4s are incapable of contributing a significant portion of the bacteria loads to the receiving water based on measured water quality. Thus, the loads contributed by the MS4s during dry weather are likely orders of magnitude lower than those contributed from bird loading, the principal external source.

Because loads from external sources could not be calculated directly due to lack of data and lack appropriate literature values, the dry weather wasteload allocations were calculated by assuming that the MS4 discharges to the receiving water met the 30-day geometric mean numeric targets. The load allocations were then calculated by subtracting the wasteload allocations from the assimilative capacity of the shoreline areas. The dry weather load allocations were assumed to be the same for the wet-weather condition, and the wet weather wasteload allocations were calculated by subtracting the load allocations from the assimilative capacity of the receiving water.

The assumptions used to calculate the dry weather wasteload allocations, and dry and wet weather load allocations are broad considering that bird loading and other localized sources can result in high temporal variability that may at times result in exceedance of the assimilative capacity of the waterbody. However, the assumptions are reasonable considering the fact that the calculated dry weather wasteload allocations are orders of magnitude lower than the calculated external loads as expected based on size of the watersheds and measured receiving water quality.

Overarching Questions
Reviewers were not limited to addressing only the specific issues presented above, and were 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 (the Basin Plan amendment) 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 were asked to 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.

Comments from Professor Holden

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

Comment: Land use composition was used to “estimate” not to “quantify” fecal indicator bacteria. Nonetheless, it appears that there is no other logical and immediate way to approach this. However, the regression equation in Appendix G is based on Los Angeles data. It would be useful to clarify for the reader how closely the land uses are in the Los Angeles dataset to the ones in the San Diego TMDL region. If the land use percentages are similar between the sites studied and the ones modeled, then this approach (across jurisdictions or regions) is additionally justified or should be qualified.

A continuing concern in this TMDL report is the very small degree to which watersheds are predicted to contribute to the wasteload. Since most of the wasteload cannot be attributed to the watersheds, then either the land use composition data or the LA watersheds as sources for regressions are unrealistic for this setting or in fact the birds (or other unidentified sources) are really the majority source. There is a great deal of uncertainty, in other words.

Response: The regression equations 5 and 6, reported in Appendix G (now revised to Appendix F), were based on data collected from San Juan Creek and Aliso Creek of Orange County, and Tecolote Creek and Rose Creek of San Diego. Given these watersheds proximity to the Dana Point Harbor (Orange County) and San Diego Bay (San Diego County) watersheds, their use in basing land use assumptions was considered justified.

The reason that watershed loading constituted a small portion of the total load to the receiving waters was not associated with land use, but rather due to the relatively small size of the watersheds and the likely contribution of localized sources such as waterbowl and other local sources within the receiving waters. Watershed loads of bacteria associated with dry urban runoff, estimated based on the regression equations, were very small compared to direct, localized loads to receiving waters (e.g., birds). Direct loads from birds and other sources within the receiving waters were not included in watershed load estimates and their regression equations. For this reason, we do not believe there is a great deal of uncertainty with land use composition based on the reviewer's comment.

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

Comment: The use of a mathematical model is good and appropriate. The model concept, as described in Appendix G, would appear to have appropriate elements (reactor assumption, first order decay coefficients, mixing equation) and the calibration to existing data sets appears successful. This reviewer may have overlooked it, but it would be useful to have some explanation in Appendix G regarding the origin of the "observed range" data in Figures starting with G-7. Over what time frame are ranges depicted?

In Section G.3.2.d, the die-off rates are much higher than stated for the watershed model (ca. 0.6/day for the former versus ca. 0.15 / day for the latter). Assuming this is because of salinity, it would be good to be more explicit about how the salinity adjustment recommended by Chapra (1997) was used.

I agree with the last statement of Appendix G regarding the utility of the model. It strikes me that if this is done well, its continued use and refinement can be used to hone in on "lumped" sources that drive the need for inverse simulation approaches.

In Appendix H, it is rather difficult to assess the goodness of fit of the model to the data, beginning with Figure H-57. Is there a way to represent the fit better in a graphical sense? Could the data be plotted against the simulated values and an R-squared value shown? The simulated 30 day geometric means for Dana Point Harbor (H-63 and H-64) are rather good fits, on the other hand, and are more easily depicted graphically.

Response: The observed ranges shown in Figures G-7 through G-14 of Appendix G (now revised to Figures F-7 through F-14 of Appendix F), specific to dry weather model calibration and validation results, are based on observed flows and bacterial densities corresponding to the monitoring performed for Aliso Creek, San Juan Creek, Tecolote Creek, and Rose Creek. Appendix G (now revised to Appendix F) was updated to provide an improved discussion of data associated with model calibrations and validations, as shown in these Figures.

The commentor is correct that higher die-off rates in the EFDC receiving water model are due to the influence of salt water, compared to lower die-off rates in the freshwater watershed models. It should be noted that all die-off rates in the EFDC model were changed to 0.8/day consistent with a typical value reported in Chapra (1997). Based on salinity concentrations predicted by the model, adjustments to bacteria die-off are automatically performed assuming a relationship of ratio of $0.02 day^{-1} ppt^{-1}$ salinity, as reported in Section G.3.2.d (now revised to Section F.3.2.4).

The challenge with presentation of model results and observed data is the extremely high variability of bacteria data. Since bacteria concentrations vary by orders of magnitude, and the objective of the modeling was to follow the general trend and estimate the order of magnitude present in the observed data, the graphical results provided in Figure H-57 (now revised to Figure I-57) are sufficient for the purpose of presenting agreement between orders of magnitude. Comparison of 30-day geometric means is easier to depict graphically due to the reduced impact of highly variable instantaneous concentrations.

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

Comment: The single sample basis is appropriately conservative. However, what is going to be a problem is the fact that TC targets have been set lower than FC (Table 3.1). FC are a subset of TC; TC are typically around 10 times higher than FC and thus it is unlikely that the two targets can be met (TC will always be out of compliance even if FC is met). In fact, Equation 7 in Appendix G gives the formula of TC = 5X FC.

Response: Equation 7 in Appendix G (now revised to Appendix F) is based on a regression analysis of the correlation between total coliform (TC) and fecal coliform (FC) derived from observed data. However, this observed correlation is not relevant to the method by which the targets for TC and FC are selected.

The San Diego Water Board recognizes that the numeric targets used in the Technical Report present what seems to be an error in logic: This apparent problem arises because the total coliform numeric objective for the SHELL use is lower than the fecal coliform objective for the REC-1 use. Fecal coliform is a subset of total coliform, yet numeric targets for total coliform are less than numeric targets for fecal coliform. There are no WQOs for fecal coliform for SHELL. Because the WQOs associated with SHELL are more stringent than the WQOs for REC-1, this results in final numeric targets showing a discrepancy between values for total coliform and fecal coliform.

The result of this discrepancy is that, although the numeric target of 400 MPN/mL is reported for fecal coliform, in practice a lower numeric fecal coliform density will have to be met in order to meet the total coliform target of 230 MPN/mL. This apparent discrepancy is understood when beneficial uses are taken into account.

However, the TMDLs based on the WQOs for SHELL have been removed from this project and technical report and will be addressed in a separate TMDL or water quality standards action. Thus, this comment is no longer relevant.

4. Reasonableness of assumptions (described in Appendix L) for wet-weather modeling.

Comment: As stated below, not all of the parameters could be reviewed in detail, but the assumptions in general and their sources appear to be sound.

Response: The San Diego Water Board agrees that the assumptions and their sources are generally sound.

5. Use of wet weather modeling parameters to simulate build-up/wash-off of bacteria from similar studies in San Diego and Los Angeles (SDRWQCB, 2005 and LARWQCB, 2002).

Comment: It was not possible to review all the modeling parameters as these are found in numerous other studies (as stated in Appendix L) but the sources of the parameters are logical and appear to be sound. The conceptual framework, as described, appears sound for the model. It becomes clear later in Appendix L which die-off rate constants were applied when / where, and it would be useful to ensure that the same clarity is in Appendix G.

Response: Comment noted. Assumptions stated in Appendix L (now revised to Appendix G) are consistent with discussions in Appendix G (now revised to Appendix F).

6. Use of dry weather and receiving water model to simulate fate and transport of bacteria, and to calculate TMDLs.

Comment: A dry weather model is a reasonable idea, and the comments regarding simulation success in my “wet weather” comments apply here. Especially important to recognize in this report is that it appears that the majority sources have been backed out of the models. This is a major concern. If watershed sources don’t account for much at the shore and birds are suspected as the major source, then either data should be available to back this up or data should be gathered to confirm. Further, birds should be considered as a public health concern.

Response: The dry weather model indicated that a significant amount of the observed bacteria levels in the receiving waters could not be attributed to loads originating from the watershed. Observed bacteria levels in the receiving waters exhibited significant variation temporally as well as spatially. The receiving water (EFDC) models were not able to simulate the observed data in any statistically meaningful way.

Because of the variability and unpredictability of modeled bacteria levels in the receiving water compared to observed data, and lack of data about natural (primarily waterfowl) sources, the dry weather receiving water (EFDC) model was used to back-calculate the maximum allowable bacteria load that could be attributed to natural sources. The allowable load calculated from the watershed (LSPC) model was assumed to originate from controllable point sources, namely the municipal separate storm sewer systems (MS4s).

The back-calculated maximum potential bacteria load attributed to natural sources is not the actual load from natural (waterfowl or other) sources within the receiving waterbody. Instead, it is the maximum allowable bacteria load that can be received from the natural uncontrollable sources and still allow the receiving waterbody to assimilate the bacteria load from the watershed sources (from the LSPC watershed model) without exceeding the numeric targets. So, while the TMDLs may include a relatively large contribution from natural sources, the TMDL is still protective of water quality standards. The point sources (MS4s) from the watersheds, which have a relatively low contribution to the receiving waters, are the only sources that are considered controllable.

The San Diego Water Board recognizes that additional data for the natural sources as well as watershed sources would help to further refine the LAs for nonpoint sources and wasteload allocations (WLAs) for point sources. The San Diego Water Board further agrees that as additional data are collected to further characterize the bacteria loads that can be attributed to natural sources, methods for bacteria load estimation and calculation of TMDLs should be refined in the future. However, until those data are available, the approach taken is believed to be the most conservative and protective approach for calculating the TMDLs.

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

Comment: It was good that these data were available, and that the SDRWQCB had the insight to use this available data. But as stated above, it is important in this document to explicitly show the similarities or differences between land uses in the LA watersheds versus the subject San Diego watersheds. If they are very different, then one would think about the value of this exercise in a more critical way. It would also be appropriate for San Diego to start monitoring in its own region. This should begin now, in order to effectively monitor the effectiveness of the TMDL development effort over the long term.

Response: Because the four creeks mentioned in this item are located in the San Diego Region, it is believed that the commenter misunderstood the intent of the item. 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 considered 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. The item was meant to solicit opinion about the application of regression equations developed by these four creeks onto the remaining watersheds.

Comment cont'd: One small comment for G.2.4.b regards the units for the die-off coefficients. The "per day" units are correct and "liters" should not be in the units.

Response: See the response to the comment for item 1. Section G.2.4.b (now revised to Section F.2.4.2) was corrected regarding units of die-off rates.

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

Comment: Because bathers are more frequently at the beach during dry weather, it seems that more stringent targets should be set for the dry weather periods. Sustained loading of fecal indicator bacteria to coastal sediments could occur in the summer following wintertime upland erosional processes and deposition of contaminated sediments to coastal zones. Thus, nearshore sediments deposited from winter processes could have a sustained, and perhaps tidally-influenced, effect on coastal water quality. The geometric mean sets a value for the target which could fluctuate around the mean due to tidal cycling. This is suggested in section 3 (page 11, 2nd paragraph) of the draft Technical Report. Given that tidal cycling is natural and incoming flows will be lower, the geometric mean basis for targets is reasonable, but it should also be considered that swimming is occurring mostly during the summer and this is thus when maximum protection of public health is needed. If the latter is taken seriously, then one time numeric targets should be set. This would also protect the health of swimmers when an accident occurs such as a sewer line break, pump failure, etc. Thus, it is good that both one time and geometric mean targets are set (Table 3.2).

Response: The San Diego Water Board agrees that the use of both single sample maximum and geometric mean targets are appropriate for dry weather targets due to significant fluctuation in bacteria levels that can occur during the tidal cycling in the receiving waterbodies.

***Comment, cont'd*:** As with the wet weather targets (see 4 above), setting the TC target as less than FC is nearly impossible to meet (Table 3.2) because TC is a larger group (by about 10 fold) than FC. Thus, which would be used as the real target: FC or TC?

Response: For the issue about TC and FC targets, please see the response above to the comment for item 3 for the reasons the TC targets are less than the FC targets. However, the TMDLs based on the WQOs for SHELL have been removed from this project and technical report and will be addressed in a separate TMDL or water quality standards action. Thus, this comment is no longer relevant.

Comment cont'd: Lastly, it would be useful in the report to be explicit about why *E. coli* is not included in either Table 3.1 or 3.2. It is clear from Appendix C that there is no WQO for *E. coli* in marine waters, and that FC WQOs do exist. But a statement in Section 3 to that effect would be helpful.

Response: Section 3 has been revised to provide additional explanation for not including *E. coli* targets in Tables 3-1 and 3-2, as in Appendix C (now revised to Appendix A).

9. Reasonableness of assumptions (described in Appendix L) for dry weather modeling.

Comment: The assumptions and sources for assumptions (where not all information is readily available to review) appear reasonable and sound. However, the lack of data regarding the real contributions of birds to the coastal loading of fecal indicator bacteria is problematic.

Response: As discussed in the response to the comment for item 6, the San Diego Water Board agrees additional data would be helpful to further characterize the bacteria loads that can be attributed to natural sources. However, until those data are available, the approach taken in the Technical Report is the most conservative approach for calculating the TMDLs and protecting the designated beneficial uses of the waterbodies.

10. Assumptions used for modeling the impaired shorelines of SDB (B Street and G Street Pier) that had no data for model verification or loading assessment.

Comment: Using data available from other nearby sites appears reasonable under these circumstances.

Response: The San Diego Water Board agrees that the use of data available from other nearby sites is reasonable under these circumstances. Water quality data collected in the future from these shorelines can be used to revisit and refine the LAs, WLAs, and TMDLs, if necessary.

However, the shoreline segments of B Street and G Street have been removed from this project. Thus, this comment is no longer relevant.

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

***Comment*:** It appears that all shorelines are critical points. If they are all frequented to the same degree, then this makes sense. If they are not, then weighting them by visitation frequency of recreational water users makes more sense. The land uses at the different sites imply a possible difference in this regard across sites.

Response: The critical points were selected as the most conservative locations, where the bacteria densities predicted by the receiving water (EFDC) model would be highest. Numeric targets for TMDL calculation are based on the appropriate WQOs. Although the ENT WQOs for REC-1 beneficial use may be different based on swimmer usage, the San Diego Water Board uses the most stringent objective for calculating TMDLs in order to be conservative in protecting public health.

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

***Comment*:** This is fine. Otherwise, an MOS is arbitrary.

The only large issue, and it is not clear where to make it in this list of 12 review issues, is the bird contribution. The documents state that there are no good census data for birds, yet the vast majority of fecal indicator bacteria projected in this study are from birds. The lack of data for the majority projection contributes to a serious amount of uncertainty in this effort. Because the model is constrained by the land use relationships and bacterial die off rates, the majority waste load is predicted to be from a wholly unquantified source: the birds. This is most problematic and leads to a great deal of uncertainty.

Response: The San Diego Water Board agrees there is uncertainty regarding the quantification of bacteria from natural (waterfowl) sources. However, as discussed in the response to the comment for item 6, the TMDL that is calculated includes the maximum allowable bacteria load that can be received from the uncontrollable natural sources and still allow to receiving waterbody to assimilate the bacteria load from the watershed sources without exceeding the numeric targets. Therefore, the TMDL is protective of beneficial uses, even if the bacteria loads attributed to natural (waterfowl) sources are a significant portion of the TMDL. Until a study is performed to quantify the loads from natural sources, the San Diego Water Board believes that the approach taken in the Technical Report is the most conservative approach for calculating the TMDLs and protecting the designated beneficial uses of the waterbodies.

13. Calculations of wasteload allocations, load allocations and TMDLs during dry and wet weather.

***Comment*:** Ironically, the majority of the fecal bacteria loaded to these sites are predicted (by default) to be from waterfowl. The miniscule amounts to be removed from the watershed will likely do little to protect public health. Why are there no efforts in this TMDL to address the birds as sources? Shouldn't data be collected to determine if birds are indeed the major sources? If this is a major source of fecal bacteria to the coastal ocean beaches, then we should be concerned: we already know well as a society that at least viruses can be transmitted from birds to humans. Can the birds as a source of fecal bacteria really be ignored from a TMDL as such?

Response: The San Diego Water Board disagrees that removing the loads from the watersheds will do little to protect public health, because watershed sources such as leaking sewer lines or feces from domestic animals can contain harmful pathogens. However, we agree that loading from waterfowl is a major source of uncertainty when calculating TMDLs.

As discussed in the responses to the comments for items 6, 9 and 12, the calculated TMDLs are protective of the designated beneficial uses, thus public health, even if the bacteria loads attributed and allocated to natural (waterfowl) nonpoint sources are a significant portion of the TMDL. The fact that there are no data available to quantify the load from natural (waterfowl) sources only emphasizes the need for collecting additional data. The calculated TMDLs do not ignore birds as a source of fecal bacteria. Instead, the TMDLs indicate that natural sources are a significant part of the bacteria loading. At this time, the calculated TMDLs assume that natural sources are uncontrollable and are a significant source of bacteria. However, the San Diego Water Board believes that future studies and data collection may help to determine if identified natural sources can indeed be controlled.

<u>Overarching Questions:</u>

(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.

Comment: A main issue is the continuing focus on fecal indicator bacteria and the uncertainty of the relationship to human health in these mostly non-point source scenarios. The development of TMDLs and the implementation of them against a backdrop of great uncertainty regarding their effectiveness to protect human health represents an unwise expenditure of public funds. At the very least, additional scientific understanding needs to be gained regarding the real presence of pathogens, the real incidences of human illness, the real risk to human health, and the probability of animal-to-human disease transmission (particularly in the regions heavily visited by shore birds).

Response: As discussed above, the TMDLs that were developed in the Technical Report are protective of the designated beneficial uses, thus public health, even if the bacteria loads attributed and allocated to natural (waterfowl) nonpoint sources are a significant portion of the TMDL. The water quality standards, which are based on beneficial uses and WQOs, provide the backdrop against which the TMDLs must be developed. The San Diego Water Board recognizes that there is uncertainty in the development of these TMDLs, and agrees that additional information and data are needed to fully evaluate the real risk to human health. However, given the lack of available data, the development of these TMDLs serve as a conservative starting point for restoring and protecting the impaired waterbodies. As additional studies are performed and data collected, additional refinement of these TMDLs and allocations may be conducted.

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

Comment: The technical choices of models and model parameters appear to be sound, and their implementation appears to be sound except for the fact that the majority load is from an unquantified source. Also, as stated above, the current scientific opinion in water quality monitoring is that fecal indicator bacterial concentrations do not adequately capture evidence of pollution relatable to human health in a non-point setting. Without truly knowing the sources and also real presence of pathogens, these TMDL efforts to account for fecal indicator bacteria and to simulate their transport and routing from one place to another does little to really inform water quality managers of the true magnitude of the problem and thus real threat to public health. If the main goal is to serve compliance needs, then TMDL development around fecal indicator bacteria is fine but the actual magnitude of sources needs to be established.

Response: The San Diego Water Board is familiar with the issues raised by the reviewer. However, as the reviewer has commented below, the "number of possible pathogens is too great to make it either practical and perhaps even feasible to monitor them directly." Therefore, bacteria are measured as surrogates for pathogens. Also, given the variability and unpredictability of bacteria levels observed both spatially and temporally in the receiving waters evaluated, a source study would be prohibitively expensive (likely in the millions of dollars) as it would require a significant amount of sampling of over time and in several location for each shoreline segment to establish the potential sources of bacteria. The San Diego Water Board would encourage such studies to be undertaken by the dischargers and other interested parties.

Comment (cont'd): Also, again, as stated above, if birds are related to natural background sources, then a potential threat to human health is being ignored and at least unquantified. Bird fecal material at beaches, especially where it is suspected that this material contributes to the majority of waste load to a beach, really should be addressed.

Response: As discussed above, even though the bacteria loads attributed to natural (waterfowl) sources are a significant portion of the TMDL, the TMDLs that were developed are protective of beneficial uses, as well as public health, because they are based on the WQOs from the Basin Plan. The San Diego Water Board believes that the approach taken in the Technical Report is the most conservative approach for calculating the TMDLs and protecting the designated beneficial uses of the waterbodies evaluated.

Other Specific Comments

Comment:

The language used in this arena of "pathogen TMDLs" is very important to consider. Pathogen TMDLs are rather new and California is newly creating them; many will be templates for elsewhere in the U.S. The concept of indicators and what they can and cannot tell us is confusing, but if we as a society are to improve the indicator system, we must be mindful of describing it accurately so that the public can embrace and understand the need for improvements.

That said, some specific comments regard the use of language from a scientific accuracy standpoint. They include:

1. Executive Summary: "Bacteria have been historically used as indicators of human pathogens because bacteria are easier and less costly to measure than the pathogens themselves". The word "fecal" should precede "bacteria" in both occurrences in this sentence. Also, "easier" and "less costly" are equivalent because "time is money". However, the real reasons for using fecal bacteria as indicators are that: 1) there is historical evidence linking swimmer illness to fecal indicator bacteria, 2) it has been impractical, if not impossible, to monitor all pathogens directly, and 3) indicators, if they are good tracers for pathogens, negate the need for the latter.

Response: The Executive Summary has been revised.

2. Introduction (1st paragraph): Similar comment as above. Additionally, the second paragraph should convey that the number of possible pathogens is too great to make it either practical and perhaps even feasible to monitor them directly. Further, if only a subset of pathogens are monitored, water quality managers risk not detecting others for which they are not assaying. The last two sentences of this paragraph are good.

Response: The Introduction has been revised.

3. <u>Problem Statement (page 4, next to last and last paragraphs):</u> "Fecal indicator" should precede "bacteria" in this statement. There are approximately 10^8 bacteria per gram of surface soil nearly everywhere in the world. Thus, "bacteria" is too general of a work to use in this sentence without the suggested qualifiers. Similarly, in the last paragraph on this page, "fecal" should be added before "bacteria" in every occurrence of the latter.

Response: The suggested revisions were incorporated into the Technical Report.

4. <u>Section 2.1, 1st paragraph:</u> Whether or not the bays's assimilative capacity is indeed "increased" (above what?) due to tidal flushing depends entirely on the amount of mixing and flushing that occurs. With Proposition 40 support, the County of Orange will be testing the use of Oloids off Baby Beach to improve circulation. Given the investment as such, the assimilative capacity must be short of optimal.

Response: The San Diego Water Board agrees that these waterbodies are relatively enclosed bays and flushing may be limited. However, tidal flushing does occur. The mixing and flushing that occurs is greater than if the bays were completely closed. Hence, the assimilative capacity is increased compared to a totally closed waterbody, such as a lake, without the benefit of any tidal flushing whatsoever.

Comments from Professor Barber

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

Comment: This appears to be a potential source of uncertainty in the TMDL values. While the lack of data forces this approach, attempts to correlate land use to fecal coliform and enterococci generally result in correlations coefficients (R^2) between 0.6 and 0.8. Some studies have shown little to no correlation between coliform and enterococci. This is an acceptable first step but more data is needed.

Response: The San Diego Water Board concurs that more data are needed to refine analysis. The approach was designed in such a way that modifications or further verification can be easily performed as new data become available. It is our hope that the technique will be further refined as new data are collected.

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

Comment: LSPC (and its predecessor HSPF) have been used extensively throughout the country to reasonably predict flows and pollutant concentrations for TMDL analysis. It is unclear if the model is capable of handling likely bacteria sources from recreational boats and marinas if those are a potential source in these areas.

Although somewhat less used, EFDC is being touted by EPA as an important tool in their TMDL Toolbox. There is no reason to believe that it would not work in this setting subject to the limitations of any model developed with limited data. Appendix G contains sufficient information on the input parameters used. According to the results shown in Appendix H, the model seems to over estimate temperature during warm (presumably dry) periods. Any impact this may have on fecal coliform die-off or regrowth should be noted.

> ***Response***: We concur that LSPC is incapable of simulating bacteria sources from recreational boats and marinas. However, this model was only applied to the watershed for estimation of bacteria loads from stormwater runoff. Since bacteria loads from recreational boats and marinas are within receiving waters, the EFDC model was used to determine loads associated with these source. Additional detail regarding these modeling assumptions are discussed in Section 7.2.2 and Appendix G (now revised to Appendix F).
>
> For some periods, the EFDC model over-predicted temperature during summer months by 3º C or less. As discussed in Section G.3.2.d of Appendix G (now revised to Section F.3.2.4 of Appendix F), bacteria die-off rates included a slight dependency on temperature, with a factor of 1.01 day^{-1} $ºC^{-1}$ multiplied by the die-off rate. This can potentially result in a 0.03 day^{-1} increase in the die-off rate. It should be noted that all die-off rates in the EFDC model were changed (per peer review comments) to 0.8/day consistent with a typical value reported in Chapra (1997). Compared to this base assumption for die-off, the 0.03 day^{-1} discrepancy will have a minor impact on model predictions.

Comment cont'd: For the general public, the phrase 'quasi-steady-state' should be more clearly defined.

> ***Response***: Steady-state refers to a system that is in a balanced condition of inputs, outputs, and internal gains and losses. For this case, state-state is used to define dry weather conditions that are assumed to represent a constant, average condition representative of critical dry loads and receiving water volume. The "quasi" aspect refers to conditions under steady state that can vary, including tidal variations that affect receiving water volume and hence the assimilative capacity of pollutants.

Comment cont'd: Meteorological data for wind speed and direction were obtained from 1990 to 2004 but it is unclear how this information was used in the SDB area.

Apparently wind was not included in the Baby Beach model. Given the difference in temperature and salinities between freshwater and ocean water, neglecting wind could impact model results.

> ***Response***: Wind speed and direction were used by the San Diego Bay model for simulation of hydrodynamic mixing due to wind effects. As suggested in the comment, wind effects were added to the Dana Point Harbor model and differences were noticed. As a result, wind was added to the model for TMDL calculations. The result is an increase in the load allocation to natural sources. The Technical Report and TMDLs were revised to reflect this change.

Comment cont'd: It is difficult to know if the model domain encompasses the region that would be impacted by the SHELL WQO. The use of SHELL criteria may be overly restrictive if the shellfish beds or areas of potential exposure are some distance from the bay/harbor. It may be that the entire region is restricted by shellfish use but that was not made clear.

> ***Response***: Applicable beneficial uses for San Diego Bay and Dana Point Harbor, according to the Basin Plan, are presented in Table 2-3 of the Technical Report. The SHELL beneficial use is applicable to the waters, as well as the shorelines, of San Diego Bay and Dana Point Harbor, so distance from the shellfish beds or areas of potential exposure is not a factor. However, the TMDLs based on the WQOs for SHELL have been removed from this project and technical report and will be addressed in a separate TMDL or water quality standards action. Thus, this comment is no longer relevant.

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

Comment: Justification for use of single sample maximum exceedance values for wet weather numeric targets is adequate and in line with the USEPA 2000 BEACH Act. These criteria are likely to represent conservative values. States are often left trying to pick whether to regulate based on single-sample maximums or geometric means and there does not appear to be a clear choice.

> ***Response***: The San Diego Water Board agrees that the justification for use of single sample maximum exceedance values are adequate for wet weather numeric targets.

4. Reasonableness of assumptions (described in Appendix L) for wet-weather modeling.

Comment: It is not clear that the selection of 1993 as the critical year because it represents the 90th percentile rainfall data is a conservative assumption. The data shown in Appendix E do not appear to be well correlated with rainfall. In fact, often the data seem to decrease during or immediately following rainfall. It seems like the decision of wet-weather modeling should be based on average 30-day load rather than flow. Furthermore, do the higher flows cause the model to predict higher concentrations at the critical TMDL locations?

Response: Data presented in Appendix E illustrate critical conditions for both dry and wet weather. The fact that most of the data presented in Appendix E appears coincidental with dry conditions is not an indication of lack of correlation with wet conditions, but rather that most data were collected during dry conditions. Also, the criteria for selection of wet and dry days, with wet periods defined by the occurrence of at least 0.2 inches of rainfall (measured at the closest rainfall gage) and the following 72 hours, can potentially lead to identification of wet conditions that were actually more associated with dry, or visa versa. For this reason, results of analyses were qualitative in nature and meant to indicate that both wet and dry conditions result in exceedances of water quality objectives, but not to definitively prove which condition was more critical. Both conditions were considered in separate technical approaches with distinct considerations to pollutant sources and critical conditions. Selection of 1993 as the critical year is specific to wet conditions. Since most wet conditions do not span 30 days and are more episodic in nature, the single sample maximum was considered the most appropriate numeric target, requiring analysis of daily loads and hence daily flows and associated water quality. Dry conditions and associated watershed loads were considered in separate analysis for TMDL calculation. Based on receiving water modeling, higher bacterial densities were observed during wet conditions with higher watershed flows (see Appendix I, now revised to Appendix H).

Comment cont'd: Why wasn't the tidal period chosen to match the period of flow? The criteria for selection of the March-April 2001 observed tidal data was not clear.

Response: The 30-day critical wet weather period, when flow and bacteria were highest, was used for the watershed (LSPC) model. The 30-day critical tidal period, when tidal fluctuation and assimilative capacity of the receiving water was lowest, was used for the receiving water (EFDC) model. The combination of these two 30-day critical periods provide the most conservative possible combination of wet weather flow conditions and low tidal conditions. The Technical Report has been revised to present the criteria for selecting the 30-day critical wet weather period and 30-day critical tidal period more clearly.

Comment cont'd: Appendix L reasonably describes the assumptions that were made in developing the wet-weather model. However, the impacts of these assumptions are not well described. For example, the authors write that the shoreline bacteria die-off rates were 0.6, 0.6 and 0.5/day which were less than Chapra's 0.8/day value. Was any sensitivity done to show how this impacts the results? Why was one of the values less than the other two? It is hard to make the claim later on that the assumptions result in a conservative MOS without understanding the relative impacts of each of the many assumptions.

Response: The original bacteria die-off rate was selected to be slightly lower than Chapra's default 0.8/day value for the consideration of the conservative assumption in the MOS. However, sensitivity analyses were performed and it was noted that the bacteria concentration at the beach area was insensitive to the slight reduction of base die-off rate, indicating that the conservativeness caused from these lower die-off rates is insignificant. As a result, baseline die-off rates for each indicator bacteria were changed to 0.8/day in the model, consistent with the typical value reported by Chapra (1997). The TMDL report was modified to reflect these changes.

5. Use of wet weather modeling parameters to simulate build-up/wash-off of bacteria from similar studies in San Diego and Los Angeles (SDRWQCB, 2005 and LARWQCB, 2002).

Comment: As I am unfamiliar with the similarities and differences between the LA and SD watersheds, it is somewhat difficult for me to assess whether the use of model results for Santa Monica Bay are appropriate. Given the lack of other information and the claim that "..San Diego Region are sufficiently similar to characteristics of …Los Angeles" it would seem like this is a reasonable assumption as a starting point. The variability between watersheds as well as the assumptions underlying the original study should be understood by the authors.

Response: The model developers have been involved in developing LSPC models for both the San Diego and Los Angeles Region (e.g., LA River and San Gabriel River), and differences and similarities between watersheds, associated data, and applicability of modeling parameters are well understood.

6. Use of dry weather and receiving water model to simulate fate and transport of bacteria, and to calculate TMDLs.

Comment: The regression equations used in the plug-flow reactor model for cross-sectional area and width are likely to be wrong. The correlation coefficients were relatively poor to begin with (R^2 = 0.51 for area relationship) and this was for flows up to 15 cfs. The dry weather flows were considerably less than this, with most under 1 cfs. The significance of this in terms of predicted loading to the bays, however, is not clear. At such low flows whether the width is 2 feet or 5 feet may not be significant in terms of load estimates. A sensitivity analysis of the results to this could easily be completed.

Response: The regression equations associated with cross-sectional area and width and the plug flow reactor models were only used in original development of models in Bacteria TMDL Project I to provide verification of model performance at instream monitoring locations (following calibration and validation of stream infiltration and bacterial die-off rates). However, as shown in Appendix F (now revised to Appendix J), all drainage areas modeled in this study consisted of watersheds requiring no routing through downstream subwatersheds. This was due to their small sizes and lack of need for multiple subwatersheds. Therefore, only equations 6, 7, and 8 of Appendix G (now revised to Appendix F) were used to estimate loadings from watersheds of San Diego Bay and Dana Point Harbor. As a result, impacts of regression equations associated with cross-sectional area and width did not require sensitivity analysis as they were not a factor in load estimates.

Additional discussion was added to Appendix G (now revised to Appendix F) to better explain application of the models from Bacteria TMDL Project I to San Diego Bay and Dana Point Harbor, and the lack of simulation of stream routing. In addition, assumptions associated with the plug flow reactor model were mistakenly listed in Appendix L (now revised to Appendix G) that summarized dry weather modeling assumptions, and were therefore removed.

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

Comment: The assumptions inherent in this approach have the potential to introduce significant amounts of uncertainty into the TMDL analysis. The assumption that these four creeks are representative of the area does not appear to have been validated. Insufficient information is provided regarding the relative locations, watershed characteristics, land use patterns, bird habitat, and neighborhood preferences regarding water use practices to adequately evaluate this assumption. Moreover, the use of phase "good fit" to describe R^2 values of 0.74 for flow and 0.67 and 0.77 for correlations between FC and TC and ENT is at least debatable. This is especially true because you end up multiplying flow by concentration to get load so the combined variability could be quite large. Several studies have shown a lack of correlation between fecals (*E. Coli*) and ENT but the ability to extrapolate from regional data is difficult. It is hard to know how this uncertainty affects the conservative assumptions used to justify an implicit MOS.

Most of the dry season flows are less than 1.0 cfs. It would be interesting to know how these small discharges were measured or if they were estimated.

Response: San Juan Creek and Aliso Creek watersheds are both within five miles of Dana Point Harbor (San Juan Creek actually discharges adjacent to Dana Point Harbor). Tecolote Creek and Rose Creek watersheds are both within five miles of most San Diego Bay watersheds. Land uses for each watershed included in this TMDL are summarized in Table G-1 of Appendix G (now revised to Table F-1 of Appendix F), which were based on the same land use datasets used in analyses of San Juan, Aliso, Tecolote, and Rose Creeks. The dominant land uses in these watersheds are shown as low-density residential (LDR), high-density residential (HDR), commercial/institutional (COM), industrial/transportation (IND/TRN), parks/recreation (PRK/OPR), and open space (OPS). Equations 6 and 7 of Appendix G (nor revised to Appendix F), which were regression analyses performed on monitoring data and land use in San Juan, Aliso, Tecolote, and Rose Creeks, showed a correlation based on the following land uses for prediction of dry flows and fecal coliform: COM, OPS, LDR, HDR, PRK, IND, TRN, OPR. These land uses are an exact match to those dominant land uses in the San Diego Bay and Dana Point Harbor watersheds. Data specific to water use practices in the watersheds were not available and though they may have provided some additional evidence of sources of urban runoff, they were not considered in this analysis. Bird habitat information was not considered since such sources are typically very difficult to quantify and correlate with dry urban runoff sources. Although bacteria source identification studies in southern California watersheds typically show a major source of bacteria in runoff to be associated with birds, correlation among watersheds based on bird habitat information is extremely difficult and data intensive, and was not considered productive for this study. Based on the land use and geographical considerations above, as well as previous efforts in Bacteria TMDL Project I, the ability of San Juan, Aliso, Tecolote, and Rose Creeks to characterize conditions of the watersheds of San Diego Bay and Dana Point Harbor were considered justified.

The San Diego Water Board concurs that there is uncertainty for estimation of flows and indicator bacteria based on the regression equations, and although the "good fit" of correlations is debatable, the R^2 values do indicate correlation. In addition to correlations, a general comparison of predicted and observed flows and TC and ENT concentrations are shown in Figures G-3, G-5, and G-6 (now revised to Figures H-3, H-5, and H-6).

The observed and predicted flows in Aliso, Rose, and Tecolote Creeks are shown in Figure G-3 (now revised to Figure H-3) to follow a similar trend, and all are below 1.2 cfs for the watersheds evaluated. Flows from these watersheds were measured and reported by the City of San Diego and the Orange County Public Facilities and Resources Department; specific methods for flow estimation are unknown. Based on the associated equation 6 of Appendix G (now revised to Appendix F), all flows to the San Diego Bay and Dana Point Harbor shorelines were estimated to be less than 0.5 cfs, with flows to Shelter Island Shoreline Park at zero flows. Given these small flows, sensitivities would have varied by insignificant increments of hundredths of a cfs, and were therefore not considered.

We concur that there is much uncertainty in FC, TC, and ENT predictions based on equations 7 and 8 of Appendix G (now revised to Appendix F). However, predicted concentrations for runoff to San Diego Bay and Dana Point Harbor were based strictly on these equations that attempted to provide the best fit to data, and therefore represent typical or average conditions. These predictions did not incorporate additional measures to ensure conservativeness for the implicit MOS.

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

Comment: This is the preferred way to compute long-term numeric targets during low flow (dry weather) conditions. It allows for watershed planning activities to address the big picture issues and reduces the possibility that one aberrant sample will lead to the wrong conclusion.

Response: The San Diego Water Board agrees that the use of geometric means is the preferred way to compute long-term numeric targets during dry weather flow conditions.

9. Reasonableness of assumptions (described in Appendix L) for dry weather modeling.

Comment: The assumptions for dry weather modeling summarized in Appendix L appear justifiable in the current modeling configuration. Given the lack of data, the significant figures associated with several of the calibrated parameters seem interesting and perhaps conveys accuracy that simply isn't present. If the authors believe some or all of these assumptions to be conservative, they could state it in the appendix to strengthen the case for the implicit MOS approach.

Response: The number of significant digits of calibrated parameters, including stream infiltration and bacteria die-off rates, were not meant to convey a degree of accuracy. Rather, these were the actual values used in model predictions and were reported exactly as used. Major assumptions that dominated the conservativeness of the MOS were outlined in section 7.2.6 (now revised to section 7.2.7).

10. Assumptions used for modeling the impaired shorelines of SDB (B Street and G Street Pier) that had no data for model verification or loading assessment.

Comment: There is certainly some uncertainty associated with this assumption as there is no evidence presented to suggest that these two sites should or should not be similar to the other two sites in the SDB. Activities at the G Street Pier may be very different than at Tidelands Park. My lack of familiarity with these locations does not permit me to adequately evaluate this assumption. Given that the model reasonably tracts measured values, it would appear that these assumptions are sufficient for now but likely to cause finger pointing when specific individuals are asked to adopt mitigation practices.

Response: The San Diego Water Board recognizes that uncertainty is associated with the assumptions used for modeling B Street and G Street. However, the shoreline segments of B Street and G Street have been removed from this project. Thus, this comment is no longer relevant.

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

Comment: The use of both SHELL and REC-1 criteria is difficult to follow especially when the concept of interim numeric targets. The locations of SHELL areas were not discussed. The use of the entire coast line as the monitoring location seems reasonable.

Response: The distinction between interim and final numeric targets has been removed from the Technical Report. Additionally, the TMDLs based on the WQOs for SHELL have been removed from this project and technical report and will be addressed in a separate TMDL or water quality standards action

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

Comment: The section of an implicit versus explicit margin of safety continues to be debated in the scientific community and section criteria are nonexistent. It is easier to understand an explicit MOS but the selection of a value is generally quite arbitrary. The implicit MOS method adopted by this study is extremely difficult to assess in the current document as no sensitivity analysis were performed. Consequently, the relative importance of each assumption is impossible to quantify and the reader is left wondering exactly what the conservative assumptions are.

Response: In the wet and dry weather modeling analyses, conservative assumptions were used whenever possible, meaning that worst-case scenarios are taking place in terms of existing loading to the receiving waters or the ability of the receiving waters to assimilate the pollutants. The San Diego Water Board recognizes that the relative importance of each conservative assumption cannot be quantified exactly. However, the San Diego Water Board believes the conservativeness of the assumptions used (i.e., critical wet weather period, critical tidal period, critical location, etc.), though not quantified, provide an adequate margin of safety in calculating TMDLs.

13. Calculations of wasteload allocations, load allocations and TMDLs during dry weather and wet weather.

Comment: There appears to be considerable scientific rationalization involved at developing estimates of dry weather wasteload allocations. While uncertainty in the approach exist, the rationalization seems reasonable especially considering the relative loading between MS4 and waterfowl sources. Several sections in Chapter 7 appear unnecessarily repetitive. The discussion of critical period in Section 7.1 is essentially a repeat of previous discussions. For clarity, these duplications should be minimized.

Sections 8.3 and 8.4 should be expanded to explain the data shown in the subsequent tables. The results of the entire study are presented without much context.

Response: The Technical Report has been revised to incorporate the recommended changes.

Overarching 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?

Comment: I must say that in many ways it seems like this TMDL study is putting the cart in front of the horse. There are many data gaps that required assumptions that will eventually need to be proven in order to justify the expected costs associated with the implementation plan. Some of the watershed percent reduction values presented in Tables 8-2, 8-4, 8-5, 8-6, 8-7, 8-8 (note typos in Table numbers on page 40) are astounding and may not be achievable. As mentioned several times in this review, without a better understanding of the sensitivity of the model predictions it is likely that stakeholders will have a hard time comprehending the significance of what will be asked of them. The implementation plan seems extremely vague given the hopes of reaching up to 99.9 % removal. For instance, Table 8-6 proposes a 99.3 % reduction in enterococcus at the B Street Pier even though the existing watershed load of 25 B MPN/day represents only about 1.5% of the 1640 B MPN/day waterfowl load allocation. It seems that this should be specifically explained.

Response: The San Diego Water Board disagrees that the dry weather load reductions required to meet the WLAs assigned to the MS4s are not achievable. Dry weather flows generated in the urban setting and are completely controllable. If the dry weather flows cease, or are significantly reduced, the dry weather bacteria loads from the watersheds will cease or be significantly reduced.

As for the relative contributions of the existing watershed loads compared to the allocation given to natural (waterfowl) sources, this not an appropriate comparison. The loads attributed to the natural sources are assumed to be constant and uncontrollable, and were calculated as the maximum allowable natural load that may be in the receiving water, which is assigned the natural sources LA, and still meet WQOs. This LA for natural sources was back-calculated by modeling the receiving water to be able to assimilate a load from the watershed that can meet the dry weather numeric targets, which is assigned the MS4 WLA. Therefore, the existing load from the watershed must be compared to the MS4 WLA, not the LA for natural sources. An exceedance of the MS4 WLA will exceed the TMDL if the bacteria loads in the receiving waters are equal to the LA.

Comment (cont'd): Although perhaps outside the scope of this document, a discussion of Best Management Practices that could be used to address the reduction targets could be used. Furthermore, although this may be outside the purview of the

Board, it would seem like requiring NPDES holders to participate in public education and awareness campaigns should be included in the implementation plan.

Response: The Implementation Plan in the Technical Report has been revised to include more details about potential structural and non-structural BMP options for implementation.

Comment (cont'd): When examined in its entirety, the approach appears to be consistent with practices typically adopted for TMDL development. There are a number of assumptions involving professional judgment and empirical relationships necessary due to the lack of site-specific data. In the future, it would be advisable to collect this information to verify these assumptions and make adaptations where necessary.

Response: Monitoring and data collection are required in the Implementation Plan. As additional data are made available, the TMDLs may be revisited and revised, if necessary.