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SCIENTIFIC PEER REVIEW COMMENTS AND STAFF RESPONSE

The following comments address the scientific review of the Watsonville Slough Total Maximum Daily Load (TMDLs) Implementation Plan for Pathogens, and Shellfish Harvesting Beneficial Use designation. The reviewers are Guy R. Knudsen, Ph.D. of the University of Idaho, who completed his review on October 18, 2005, and George Tchobanoglous, Ph.D., of the University of California, Davis, who completed his review on October 28, 2005. Regional Board staff asked the reviewers to determine whether the scientific portion of the TMDL is based upon sound scientific knowledge, methods, and practices. We requested the reviewers make this determination for several issues that constitute the scientific basis of the TMDL. The issues are presented below, with the reviewers' comments and staff's response.

Both reviewers provided overall positive assessments of the work as typified by the following statements from Drs. Knudsen and Tchobanoglous, respectively:

“Generally, I found the plan to be well organized and thorough.”

“My overall observation is that the staff and consultants have done an excellent job of gathering together the existing data, collecting new data, and applying scientific methods of typing for pathogenic indicator organisms in addressing the TMDL for the Watsonville Slough.”

**Source Analysis**

Reviewer's comment (Knudsen): The sample size for Dr. Olson's genetic analysis study was small (16 samples), so that the conclusions are quite general. However, the study provides interesting suggestions about the potential relative importance of different *E. coli* sources. One major advantage of the toxin biomarker gene method, which is apparent from the draft report but could perhaps be stressed more, is its compatibility with an MPN (most probable number) sampling approach for either fecal coliforms or *E. coli*. Enumeration of fecal coliforms or *E. coli* from water samples typically is done either by membrane filtration (followed by plating + colony counts), or using MPN. Ribotyping methods are compatible with colony count methods (since pure cultures are needed for ribotyping) but not with MPN, at least not without significant additional sample processing. Whereas, the toxin biomarker gene method should be compatible with either method. Since MPN is designated the method of choice for TMDL monitoring in this proposal, there would seem to be an opportunity to include some level of source tracking concurrently, in the implementation of the project.

Staff response: Staff concurs that such an opportunity exists, however in the first iteration of implementation and monitoring, staff recommends that the Water Board leave it to the discretion of the responsible parties as to whether they pursue genetic source tracking concurrent with enumeration of fecal coliform counts. We recommend this both because of the high cost of genetic source tracking at this time, and the fact that reductions in fecal coliform loading (the goal of the implementation plan) would be discernable even without genetic source tracking.

Reviewer's comment (Knudsen): The section (5.3) on Potential Influence of Circulation on Bacteria Concentrations is of very limited utility, and does not contribute significantly to the draft proposal, in my opinion. The drafters clearly recognize that the amount of data is very limited, and not sufficient to address the hypothesis of a relationship between circulation and bacterial counts. However, to conclude that "It is apparent from this limited data set that no strong correlation exists" (Section 5.3, page 42) is incorrect. It would be more appropriate to conclude that the data are insufficient to show either way, whether a strong correlation (or any correlation at all) exists or not.

Staff response: Staff's summary statement on the same page (42) is consistent with Dr. Knudsen's suggestion. Staff will revise the text identified by Dr. Knudsen to be consistent with the summary.

Reviewer's comment (Knudsen): Similarly, the statement on page 43 that "...these results do not rule out the possibility that stagnant waterbodies capture, retain, and reproduce bacteria in a manner that explains high concentrations" may be technically true, but it's potentially misleading. A finding that *E. coli* are reproducing in these stagnant waters would be extremely surprising, why bring it up at all, if there is no evidence even to suggest it as a possibility?

Staff response: Staff and researchers in Watsonville and surrounding agricultural areas often document very high numbers in almost every agricultural drainage monitored—numbers that appear inconsistent with sources and expected rates of decay. We feel this is adequate evidence to suggest the possibility of retention and reproduction. Put another way, we continue to pose several hypotheses to explain the observed conditions, including bacterial reproduction.

The phenomenon of bacteria reproduction in ambient waters is not widely addressed by the literature, but at least one publication, Ambient Sources of Fecal Indicator Bacteria in Coastal Waters<sup>1</sup>, seems to strongly support the idea of persistence and possibly growth of indicator bacteria in natural substrates in temperate waters. Staff chooses to retain the section without changes.

### **Numeric Target**

Reviewer's comment (Knudsen): The U.S. EPA has recommended that states begin a transition process to using *Enterococcus* or *E. coli* as indicators for fecal contamination of freshwaters (EPA 1986, 2002). The draft proposal does not indicate that the newer EPA standard will be used in assessing the Watsonville Slough water quality. If the older standard is to be used, a rationale for doing so would probably be appropriate.

Staff response: Currently applicable Basin Plan standards are the basis for the numeric target. Water Board staff has initiated the process of updating the standards per USEPA 1986 guidelines but adoption of the new criteria will not be soon enough to include in this TMDL. Staff intends to revise the numeric targets when we amend the Basin Plan to incorporate the USEPA guidelines. In the interim, staff is confident that the effectiveness of implementation efforts can be measured through monitoring for fecal coliform parameter and application of the existing water quality objective for the REC-1 beneficial use.

### **TMDL Allocations**

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<sup>1</sup> Richard Whitman, Muruleehara Byappanahalli and Meredith Nevers, Lake Michigan Ecological Research Station, Porter, IN, United States Geological Survey. This article was revised from a paper originally presented at the 2004 Sustainable Beach Summit, 2004, Sand Destin, Florida, Clean Beaches Association.  
[http://www.healthebay.org/assets/pdfdocs/cbi\\_workshop/whitman\\_et\\_al\\_sediment\\_FIB.pdf](http://www.healthebay.org/assets/pdfdocs/cbi_workshop/whitman_et_al_sediment_FIB.pdf)

Reviewer's comment (Knudsen): One minor and perhaps semantic point, but the references to "pathogens" (e.g., "pathogen source control") throughout the proposal are somewhat inaccurate, since fecal coliforms are not invariably pathogenic (actually, the majority are not). Rather, they serve as indicator organisms for the subset of fecal coliforms (including some but not all *E. coli*) that are potentially pathogenic to humans, as well as for other potential human pathogens of fecal origin (e.g., certain other bacteria, viruses, protists).

Staff response: Staff have reviewed the report for accurate usage of the term "pathogens" and made edits where appropriate.

### **Implementation Plan**

Reviewer's comment (Knudsen): It may be feasible to determine, circumstantially at least, whether a particular livestock or manure spreading operation contributes excessively to the fecal coliform load, by concurrent sampling immediately upstream and immediately downstream of the source. If samples did not differ quantitatively...the owner/operator could argue that their activities did not excessively load the watershed. This would seem to be the only way that an owner/operator could provide "*documentation that their activities do not cause livestock animal waste to pass into waters of the Watsonville Slough Watershed*" (requirement #2 in the Implementation Plan).

Staff response: That is one way, but alternatively owners and operators could provide physical evidence that their activities do not discharge to Slough waters by, for example, providing evidence (e.g. photos) that their operations are well buffered from waterways by distance and/or vegetation, or by other landscape features.

Reviewer's comment (Knudsen): It is unclear whether the burden of performing this type of assessment would fall on the state or the owner/operator (perhaps through a consultant).

Staff response: The Implementation Plan states clearly that the burden of monitoring falls on responsible parties.

Reviewer's comment (Knudsen): Either way, it would be useful to have standards in place for such an assessment, since it apparently is an allowable alternative to submitting an approvable Nonpoint Source Pollution Implementation Control Program.

Staff response: The Monitoring Plan indicates that parties would need to follow a Water Board-approved sampling and analysis plan. We would base approval on completion of a Quality Assurance Program Plan for the sampling and analysis.

Reviewer's comment (Tchobanoglous): In reviewing the proposed stormwater management costs for the city of Watsonville, it would appear that they are somewhat underestimated. For example, the cost for "*Illicit discharge and detection*" is estimated at \$3,750.00. More than that amount could easily be spent tracking down a single illicit discharge, especially if it happened to be a leaky sewer.

Staff response: City of Watsonville Stormwater program staff provided the cost information presented in the Implementation Plan in the early stages of developing the City's stormwater pollution prevention plan. Water Board staff were not able to secure more recent cost estimates for Watsonville's costs, but compared to other cities' costs, the estimates presented in the TMDL do appear to significantly underestimate the costs of stormwater program implementation. For example, stormwater costs range

from \$18 to \$46 per household in a 2003-survey of 16 California cities<sup>2</sup>. Assuming 11,381 households (www.census.gov) in Watsonville, the per household cost of the stormwater program would be about only \$3, based on the earlier estimates provided by the City.

Staff will retain the cost estimate in the TMDL Implementation Plan, but will provide the qualifications discussed above to clarify the level of confidence we have in those estimates.

### **Monitoring Plan**

Reviewer's comment (Knudsen): An important positive aspect of the monitoring plan is its flexibility, and the provision for periodic (every three years) evaluation and modification as necessary. The potential for including *E. coli* source tracking as a component of the monitoring plan seems to be implicit, but could be spelled out more specifically. The science of bacterial source tracking is evolving very rapidly, and the availability of simpler and less expensive protocols, or even "kits", is very likely in the near future. One challenge will be maintaining quality standards for data that may be provided by parties to the implementation (e.g., livestock owners and/or their consultants), while avoiding being locked into a rigid set of protocols (since the field is changing so quickly, and today's optimum methods will be at least partially obsolete in several years' time).

Staff response: Staff describes the role that source tracking can play in demonstrating compliance with the TMDL in both the Implementation Plan and Monitoring Plan. It is implied that *E. coli* bacteria would be the focus of that activity, but the monitoring requirement is for fecal coliform because the numeric target is currently expressed in fecal coliform counts. Because the current laboratory convention is to analyze for both fecal coliform and *E. coli*, we are confident that *E. coli* will be analyzed for in sampling and analysis programs associated with this TMDL.

Reviewer's comment (Tchobanoglous): It is recommended that the variability of the analytical measurements performed by the different laboratories be determined based on a minimum of three samples. Similarly, multiple samples should be collected from each sampling site to assess sampling variability. Also, given the variability observed in coliform data, it may be appropriate to collect a few samples at random locations to verify compliance with the TMDL.

Staff response: These are reasonable suggestions for monitoring and analysis for this project. Staff will consider these as well as other quality control and quality assurance issues in designing, recommending approval of and/or executing monitoring programs for this TMDL.

### **Time-Schedule for Achieving the TMDL**

Reviewer's comment (Tchobanoglous): The ten-year window for achieving the TMDL following its adoption is reasonable. Because it is possible that the contribution from birds or other natural sources may make achieving the TMDL goal in specific locations difficult to achieve, a contingency plan should be developed.

Staff response: Staff's contingency plan is to develop site-specific objectives for indicator bacteria in the waterbody. This is described in the Implementation Plan.

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<sup>2</sup> NPDES Stormwater Cost Survey. Office of Water Programs, California State University, Sacramento, January 2005. p. 50.

Reviewer's comment (Knudsen): ...successfully achieving the recommended TMDL targets in the given timeline will be more a function of source control and adequate monitoring, rather than the ecological fate of bacteria that have entered the water. Given that only a miniscule fraction of the watershed will ever be sampled, efficient sampling is critical. The attention to sampling in this proposal is encouraging, especially the intention to establish stormwater outfall sampling locations and other site-specific monitoring. Follow-up on bacterial source tracking should also be helpful in achieving the TMDL within the allotted time schedule.

Staff response: Comment noted.

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