

MEMORANDUM

Dan Cloak Environmental Consulting

To: Clean Estuary Program Technical Committee
From: Dan Cloak
Environmental Technical Representative to the Clean Estuary Program
Subject: **Comments on Draft Technical Memorandum for CEP Project #4.07
“Use of Conceptual and Numerical Models to Guide TMDL
Development and Implementation in San Francisco Bay.”**
Date: 21 April 2004

Following our discussion of this work product at the 7 April 2004 Technical Committee meeting, the committee requested that I provide additional comments in writing by today.

General Comments

The memo is well-written and well-organized. It presents a good overview of the methods, purposes, and relative scales of different types of numerical models. To this extent, it is consistent with the objectives expressed in the project Draft Conceptual Scope of Work.

However, to my way of thinking, the perspectives expressed in the memo are somewhat myopic regarding the role of modeling in the TMDL process. In particular, the memo seems to presume that a numerical model is always necessary (or at least desirable) to implement a TMDL, and that the more complex the model that can be afforded, the better.

This bias is reflected throughout the text, but is most obvious in items #4 and #8, both on page 15 of the memorandum.

Comment #1. The draft memorandum construes the role of conceptual models in TMDL development far too narrowly.

The draft conceptual scope of work (Attachment #3 in the 7 January 2004 agenda packet) proposes to address the question “How can *numerical* models be used in an efficient and cost-effective fashion to guide TMDL development and implementation? (emphasis added).

The draft memorandum states that roles of conceptual models include “guiding numerical model development” and “providing a mechanism to explain modeling to all stakeholders,” the latter purpose because “not all stakeholders have the training to understand how these [numerical] models operate.”

In fact, conceptual models serve other valuable purposes. These include:

- Representing a particular view or understanding of the sources, fate, transport, and effects of a pollutant.
- Identifying and illustrating the presumed causal links between these processes.
- Specifying the sources and magnitude of uncertainty that exist at each causal link, and illustrating how these add up to a cumulative uncertainty over the entire model.
- Providing a basis for reaching a common understanding and consensus among technical workers and technical reviewers regarding the causal links and the associated uncertainty.
- Identifying potential control points (i.e., management measures).
- Providing a starting point for development of an adaptive implementation plan.

None of these purposes presume development of a numerical model.

Comment #2: The memorandum should consider examples where a very simple model (e.g., a diagram, hand-calculation, or spreadsheet) may be all that is needed.

From the perspective of dischargers, regulators, and advocates alike, one of the most useful purposes of a conceptual model may be to show why a numerical model is either (1) not needed or (2) unlikely to successfully reduce the uncertainty in decision-making.

The memorandum references the report *Assessing the TMDL Approach to Water Quality Management* (National Research Council, 2001, available at <http://www.nap.edu/books/0309075793/html/>) but should put more emphasis on the NRC's conclusion that:

Simple water quality problems can be addressed with simple models. Complex water quality problems may or may not require the use of complex models. (NRC 2001, p. 52, item #4)

Comment #3: The discussion of uncertainty should note that in many cases, uncertainty in the parameters makes it impossible to construct a useful numerical model, and that this uncertainty often cannot be feasibly reduced.

Item #1 on p. 14 of the memorandum notes that uncertainty may result from “(a) the necessary simplification of natural processes, (b) mis-specification of the model structure or incorrect parameterization, and (c) the collective variation in model parameters.”

The memorandum should note here or elsewhere that (c) needs to be analyzed *before* embarking on a numerical modeling effort. The variation in model parameters is often natural variation, particularly in dynamic ecosystems. In some cases, neither more complex modeling nor additional data collection will substantially reduce this uncertainty.

Figure 3 in the memorandum should to be revised or annotated to reflect the reality that more complex models may or may not successfully

reduce uncertainty. Also, what are the axes on this figure? Is the ordinate “cost,” and the abscissa “complexity/time to implement?”

Comment #4: The memorandum should emphasize the importance of the scientific method and adaptive implementation with respect to modeling.

The memorandum should incorporate the perspective in Chapter 5 of NRC (2001), specifically the description of science and the TMDL process beginning on page 89 of that document. In particular:

...the ultimate way to improve the scientific foundation of the TMDL program is to incorporate the *scientific method*, not simply the results from analysis of particular data sets or models, into TMDL planning (emphasis in original).

In particular, item #8 on page 15 of the memorandum seems contrary to the NRC’s perspective on adaptive implementation.

Comment #5: The memorandum should incorporate the NRC’s (2001) balanced assessment regarding previous experience with numerical modeling.

See for example, the following statements in the NRC report:

The strategy of accounting for data-limited TMDLs with increasingly detailed models needs rigorous verification before it should be endorsed and implemented. Starting with simple analyses and iteratively expanding data collection and modeling as the need arises is the best approach. (p. 62)

The focus on detailed mechanistic models has resulted in complex, costly, time-consuming modeling exercises... potentially taking away resources.... Given the variety of existing watershed and water quality models available, and the range of relevant model selection criteria, EPA should expand its focus beyond mechanistic process models to include simpler models. This will support the use of adaptive implementation. (p. 62)