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May 3, 2010

Mr. Peter Kozelka
TMDL/303(d) Regional Coordinator
Water Division (WTR-2)
U.S. EPA Region IX
75 Hawthorne Street
San Francisco, CA 94105

Subject: Comments on proposed revisions to the LA TMDL Consent Decree
Heal the Bay, et al. v. Browner, C. 98-4825 SBA
FSI 037033

Dear Mr. Kozelka:

On behalf of the Cities of Signal Hill and Downey, Flow Science is pleased to provide these comments on the proposed revisions to the LA TMDL Consent Decree. This comment letter addresses three primary issues: TMDLs for bacteria, TMDLs for Dominguez Channel and LA/LB Harbor toxics, and bioassessments.

TMDLs for bacteria. We support the removal from the Consent Decree of eight water quality limited segments (WQLS) listed as impaired for "coliform."

The Los Angeles Regional Board is proposing a Basin Plan amendment, scheduled to be heard in July 2010, to remove fecal coliform from the water quality objectives for freshwater. (*E. coli* objectives would remain in the Basin Plan, consistent with USEPA's 1986 recommendations.[1]) We support this proposed change to the water quality objectives for recreational uses and note that the Los Angeles Regional Board plans additional changes to the objectives, including further developing the natural sources exclusion approach, and clarifying how single sample maximum (SSM) and geometric mean (geomean) criteria are to be implemented.[2] As detailed in a letter submitted to the Los Angeles Regional Board on April 19, 2010 (and provided here as Attachment A), we believe that these and additional changes to the water quality standards for contact recreation are warranted ***prior to*** the development of TMDLs.

For these reasons, we have encouraged the Los Angeles Regional Board to delay adoption of bacteria TMDLs (specifically the Los Angeles River Bacteria TMDL, which is required under the current Consent Decree to be completed before March 23, 2012) until the standards have been evaluated for their application to urban runoff and storm

[1] Ambient Water Quality Criteria for Bacteria – 1986, USEPA 440/5-84-002, January 1986.
[2] See http://www.swrcb.ca.gov/losangeles/water_issues/programs/basin_plan/BasinPlanTriennialReview/Draft%202008%20Triennial%20Review%20Staff%20Report%20final.pdf, document dated January 29, 2010, at pp. 13-14.

water, and we encourage USEPA to amend the Consent Decree for the region accordingly. Implementation costs for the Los Angeles River TMDL are estimated by the Regional Board to be as high as $5.4 billion,[3] and we believe that appropriate changes to bacteria standards could reduce the costs of compliance significantly while still protecting public health.

We look forward to working with both the Los Angeles Regional Board and USEPA to evaluate and amend bacteria standards for contact recreation as appropriate.

TMDLs for Dominguez Channel and LA/LB Harbor toxics. The Consent Decree Notification/Revision attachment specifies that "extra pollutants" will be added for several waterbodies in the Dominguez Channel and Los Angeles/Long Beach Harbor waterways. Peter Kozelka of USEPA indicated to us that the list of "extra pollutants" was available on the Regional Board's website for the development of this TMDL.[4] Review of that information indicates that TMDLs would be required for twenty-one (21) toxic pollutants in water and sediment. Of most concern would be the development of TMDLs for sediments.

The State of California adopted Sediment Quality Objectives (Phase 1) to protect benthic communities from direct exposure to toxic pollutants in sediment; these objectives became effective on August 25, 2009, when USEPA issued its approval letter. The adopted Sediment Quality Objectives (SQO) specify that three lines of evidence (chemistry, toxicity, and benthic community health) must be collected to assess whether or not an SQO exceedance has occurred, and further specify that stressor identification must be performed to identify the pollutant(s) responsible for the SQO exceedance prior to taking management action. However, this approach has not been followed for the proposed toxics TMDL, and in fact the proposed TMDL targets have been developed without stressor identification (i.e., we do not know that the pollutants proposed for the TMDL are in fact responsible for toxicity and other impacts in the sediments, and other pollutants than those on the list may be responsible for the exceedances). Further, the proposed TMDL targets are based upon sediment quality guidelines, which are outdated and do not represent a sound scientific approach.[5] For this reason, we request that

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[3] Los Angeles River Watershed Bacteria Total Maximum Daily Load, Draft, April 20, 2010. Available at http://www.waterboards.ca.gov/losangeles/board_decisions/basin_plan_amendments/technical_documents/bpa_80_New_td.shtml.

[4] Total Maximum Daily Loads for Toxic Pollutants in Dominguez Channel and Los Angeles/Long Beach Harbor Waters, Draft: Water Quality Assessment, Problem Statement, Numeric Targets. Available at http://www.waterboards.ca.gov/losangeles/board_decisions/basin_plan_amendments/technical_documents/66_New/10_0323/06%20Harbors%20Tox%20and%20Metals%20TMDL%20Problem%20Stament%20and%20Numeric%20Target.pdf, dated March 2010.

[5] The use of sediment quality guidelines as TMDL targets was determined to be inappropriate by the Scientific Steering Committee convened by the State Water Resources Control Board during the Sediment Quality Objective development process (see Attachments B and C) and by an independent peer review

USEPA remove the Dominguez Channel and Los Angeles/Long Beach Harbor toxics from the Consent Decree. At a minimum, the sediment-related WQLS-pollutant combinations should be removed from the Consent Decree, and TMDL development for these should be pursued only after the Sediment Quality Objectives policy is followed to (a) evaluate whether or not Sediment Quality Objectives are exceeded and (b) perform stressor identification to determine the pollutant(s) responsible for the exceedance.

Bioassessments. Finally, we note that Malibu Creek is proposed for addition to the Consent Decree for benthic macroinvertebrate bioassessments. The State Water Resources Control Board recently began a process of developing bioassessment criteria for the State of California[6], and we would urge USEPA to remove bioassessment TMDLs from the Consent Decree list until the State's bioassessment criteria are complete.

Thank you for the opportunity to provide comments on the proposed Revisions to the LA TMDL Consent Decree. Please contact me if you have any questions.

Sincerely,

/s/

Susan C. Paulsen, Ph.D., P.E.
Vice President and Senior Scientist

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panel convened to review TMDL targets for the Organochlorines TMDL in Newport Bay (Attachment D to this letter).

[6] See http://www.waterboards.ca.gov/plans_policies/docs/biological_objective/kickoff_ltr.pdf, February 2, 2010.

Attachment A

Flow Science Letter to Los Angeles Regional Board, April 19, 2010

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April 19, 2010

California Regional Water Quality Control Board, Los Angeles Region
320 W. 4th Street, Suite 200
Los Angeles, CA 90013

Attention: Renee Purdy
Ginachi Amah

Subject: Comments prepared in response to the CEQA Scoping Meeting Notice
Proposed amendment to the Water Quality Control Plan for the Los Angeles Region (Basin Plan) to update the bacteria objectives for freshwaters designated for contact recreation by removing the fecal coliform objectives
FSI 037033

Dear Ms. Purdy and Dr. Amah,

Flow Science, on behalf of the City of Signal Hill, appreciates the opportunity to submit comments in response to the April 6, 2010 CEQA Scoping Meeting Notice for the above-captioned proposed Basin Plan amendment.

As detailed below, Flow Science supports the proposed change (removal of objectives for fecal coliform) and urges the Regional Water Quality Control Board (Regional Board) to consider additional changes to the objectives at the same time. We also urge the Regional Board to delay the adoption of bacteria TMDLs until the standards for indicator bacteria are reconsidered.

Support for removal of fecal coliform objectives. The original water quality objectives for fecal coliform were established in 1968 on the basis of epidemiological studies conducted in 1948, 1949, and 1950 (NTAC 1968[1]). However, fecal coliform has since been shown to be a poor indicator of the presence of pathogens and human health risk. As early as 1972, a Committee formed by the National Academy of Science-National Academy of Engineers noted the deficiencies in the study design and data used to establish the recreational fecal coliform criteria, and stated that it could not recommend a recreational water criterion because of a paucity of valid epidemiological data.[2] Studies initiated in 1972 by USEPA found that fecal coliform densities showed "little or no

[1] Water Quality Criteria, a Report of the National Technical Advisory Committee to the Secretary of the Interior, Federal Water Pollution Control Administration: Washington, D.C. April 1, 1968, at p. 8 and p. 12.
[2] Committee on Water Quality Criteria. National Academy of Sciences-National Academy of Engineering. Water Quality Criteria. USEPA R3-73-033, Washington, D.C., 1972.

correlation" to gastrointestinal illness rates in swimmers.[3] Based upon these studies, EPA in 1986 proposed section 304(a) criteria for full body contact recreation based upon *E. coli* and/or enterococci.[4]

Although the Regional Board adopted criteria for *E. coli* consistent with USEPA's recommendations in 2001, fecal coliform criteria remained in the Basin Plan following that amendment. The current proposed Basin Plan Amendment to remove fecal coliform is consistent with USEPA's directives and consistent with scientific studies showing the fecal coliform is at best a poor indicator of human health risk. For this reason, we support the proposed Basin Plan amendment.

Request to consider "controllable water quality sources" language as a CEQA alternative. However, the best available science indicates that *E. coli* are far from a perfect indicator of human health risk. *E. coli* originate from multiple sources, including birds and wildlife, and can regrow in sediments and biofilms. Further, recent epidemiological work in southern California indicates that, when human sources of indicator bacteria have been minimized or eliminated, indicator bacteria are uncorrelated with human health risk. An extensive cohort epidemiological study of Mission Bay[5], where extensive efforts were made to eliminate human sources of bacteria, found that "[t]he risk of illness was uncorrelated with levels of traditional water quality indicators. Of particular note, the state water quality thresholds [including those for *E. coli*] were not predictive of swimming-related illnesses. Similarly, no correlation was found between increased risk of illness and increased levels of most non-traditional water quality indicators."

We are now fortunate to have detailed data on *E. coli* and on a human-specific bacteria (bacteroidales) from six dry weather sampling events in the Los Angeles River, which were collected as part of the CREST sampling effort.[6] As shown in **Figure 7-26** of the CREST study (at p. 7-59, and reproduced below), only about 10-50% of the bacteria measured in Reach 2 of the Los Angeles River during six dry weather sampling events originated from storm drains and tributaries. This indicates that elimination of inflows, or elimination of bacteria in inflows, to this reach would not eliminate the exceedances of the water quality objectives for *E. coli*.

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[3] Dufour, A.P. Health Effects Criteria for Fresh Recreational Waters. USEPA 600/1-84-004, August 1984.
[4] Ambient Water Quality Criteria for Bacteria – 1986, USEPA 440/5-84-002, January 1986.
[5] Colford, J.M. Jr, T.J. Wade, K.C. Schiff, C. Wright, J.F. Griffith, S.K. Sandhu, S.B. Weisberg. Recreational water contact and illness in Mission Bay, California. 2005. Technical Report 449. Southern California Coastal Water Research Project. Westminster, CA
[6] CREST (2008). Los Angeles River Bacteria Source Identification Study: Final Report. November.

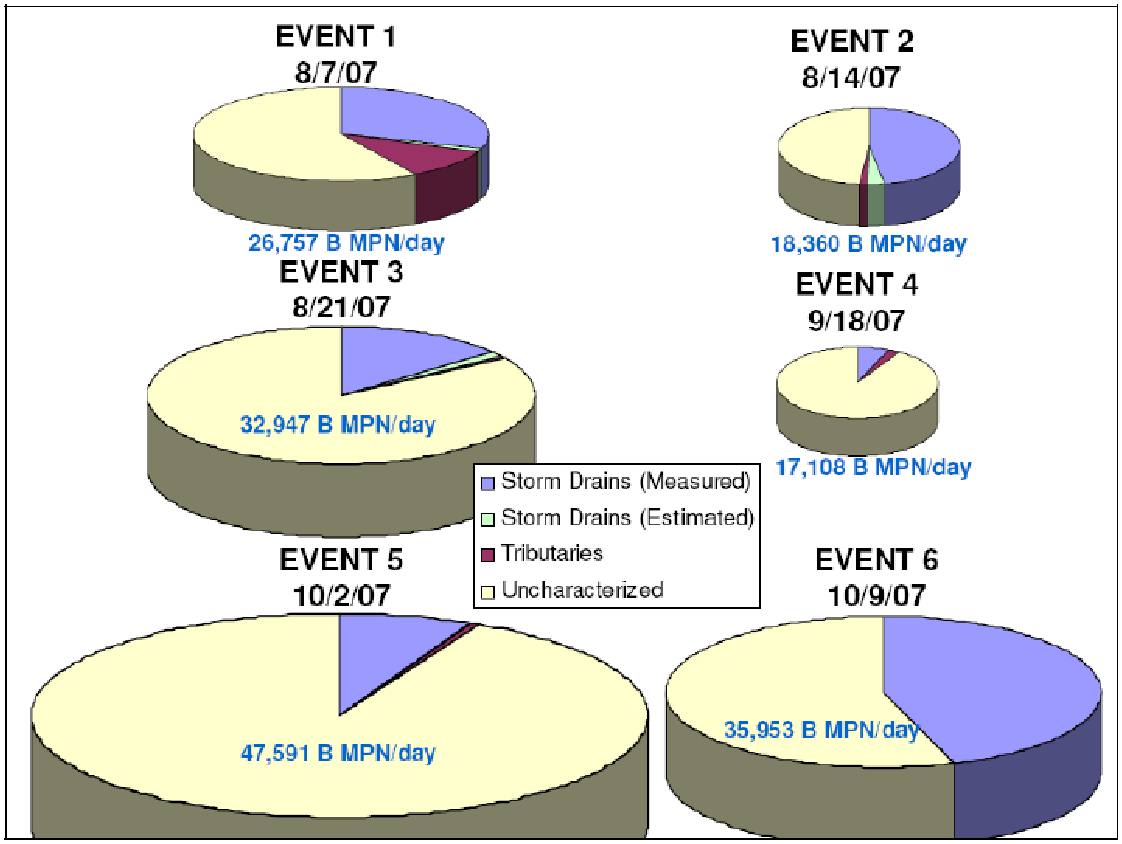

Figure 7-26. Reach 2 Event-by-Event *E. coli* Mass Balance

This figure is a graphical representation of **Table 7-24**. The diameter of the pie charts is proportional to the upstream-downstream loading increase measured along the LA River reach (i.e., the net loading from all sources), which is also detailed with text. The scale is unique to Reach 2 monitoring events (i.e., the figure for Reach 4 uses a different scale). The calculated vs. measured loading difference in **Table 7-24** is represented by "uncharacterized".

Additional information is provided by reviewing **Figures 6-3** and **6-12** of the CREST report (at p. 6-11 and 6-25, respectively, and reproduced below), which show measured concentrations of *E.coli* and human bacteriodales from six dry weather sampling events along the length of the river. As shown in **Figure 6-3**, concentrations of *E. coli* fall to levels mostly below water quality objectives for E. coli downstream of sewage treatment plants. Highly purified wastewater enters the Los Angeles River between river miles 5 and 8, and between river miles 14 and 26. However, downstream of those locations, *E. coli* concentrations rise again. Note in particular the rise in *E. coli* concentrations between 6th St. and Slauson Ave.

Figure 6-12 presents concentrations of human bacteroidales, measured in the same samples from which the *E. coli* measurements (shown in Figure 6-3) were obtained. Note the concentrations of human bacteroidales increase only slightly in Reach 2 of the river between 6th Street and Slauson Ave. The increase in *E. coli* concentrations in this river segment is far greater (more than one order of magnitude) than the corresponding increase in bacteroidales, indicating that the *E. coli* in this segment is from non-human sources. These data indicate that non-human sources (which may include wildlife and birds, or regrowth in sediments) are likely responsible for the exceedances of water quality criteria in this river segment.

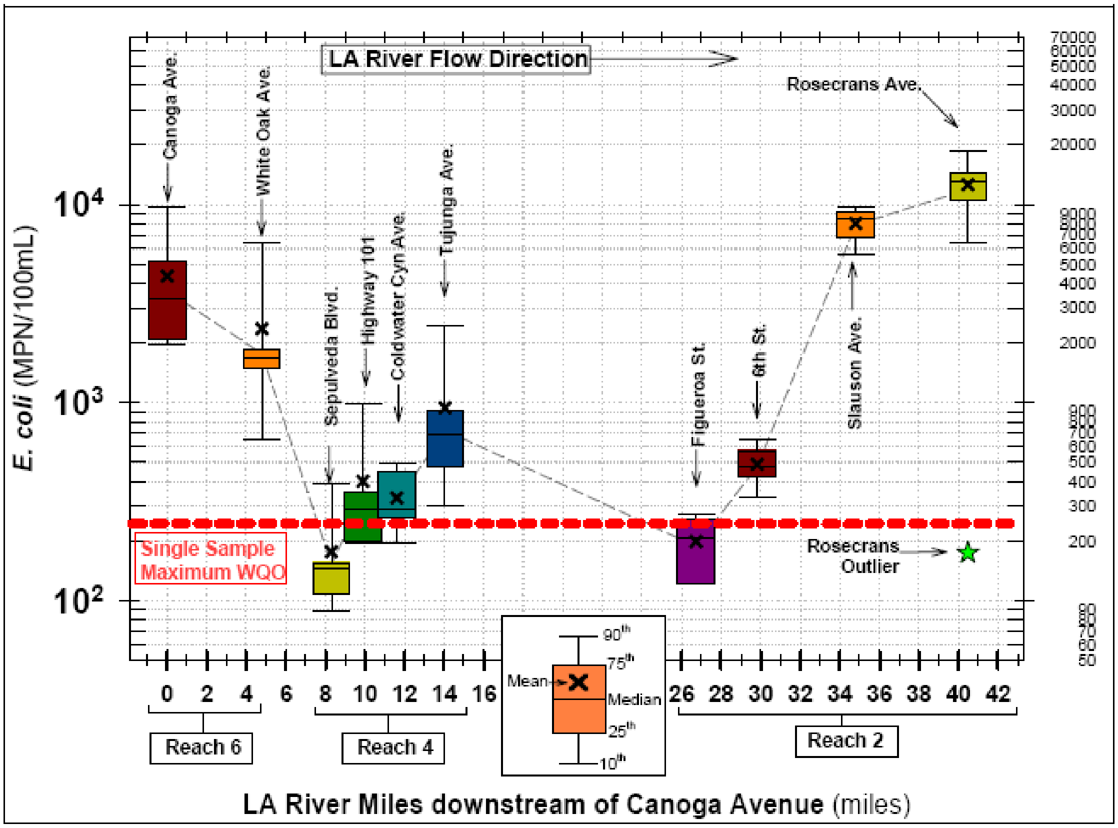

Figure 6-3. Measured *E. coli* Concentrations along the LA River

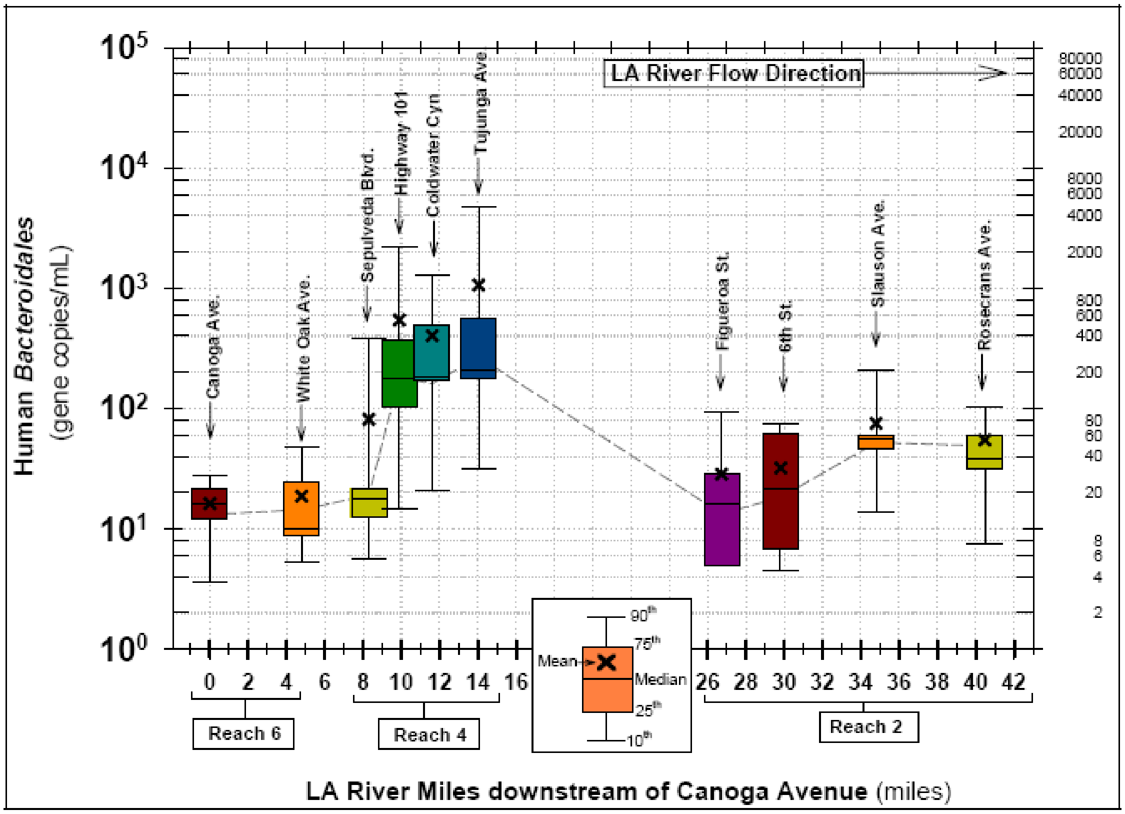

Figure 6-12. Measured Human-specific *Bacteroidales* Concentrations along the LA River

In the past, the Los Angeles Regional Board has used a "reference" or "natural" watershed approach to try to address natural sources. Under this approach, an "allowable exceedance frequency" is determined using monitoring data for indicator bacteria in an undeveloped watershed; the subject watershed is then allowed to exceed standards at the same frequency as the natural watershed. However, this approach is problematic for several reasons. For example, dry weather flows in urban watersheds come from many sources, including POTW effluent, overland flows, and flows through storm drains (including NPDES-permitted flows), while dry weather flows in natural watersheds are often comprised mainly of groundwater inflow. Thus, there is less opportunity for the dry weather flows in natural watersheds to be exposed to natural sources of bacteria. Data from the CREST study process[7] indicate exceedance rates for *E. coli* of between 7% (for single samples) and 16% (for geomeans) for all dry weather data from a natural watersheds study completed by SCCWRP. When two of the undeveloped watersheds in the SCCWRP study were excluded from the analysis because they were "minimally impacted" (i.e., had higher rates of exceedances and were nearer to urban development), exceedance rates fell to <2%. However, as shown in **Figures 6-3** and **6-12**, it appears that non-human sources were responsible for increases in *E. coli* concentrations between 6th St. and Slauson Avenue for 100% (6 of 6) dry weather sampling events. Thus, it

[7] CREST Consulting Team, Freshwater Reference Site Conditions, Calculation of Allowable Exceedance Days, and Consideration Points for the LA River Bacteria TMDL. December 2008.

appears that a reference or natural watershed approach would be ineffective for at least certain reaches of the Los Angeles River.

Because of bacteria regrowth in streams, compliance with water quality objectives in-stream may not be achievable, even when extensive treatment measures are implemented to minimize bacteria concentrations in inflows. For example, Orange County recently studied the efficacy of several BMPs for reducing bacteria concentrations in Aliso Creek, Orange County, California. Results of this study were summarized by the County of Orange (2005)[8]. The BMPs that were evaluated included a multimedia filtration and UV sterilization system. The study, which was conducted during dry weather, found that these BMPs greatly reduced concentrations of indicator bacteria, but that bacteria levels rebounded within a short distance downstream of the BMPs. For the filtration/sterilization BMP, the geometric mean concentration of fecal coliform increased from 317 cfu/100mL at the outlet of the BMP to 2575 cfu/100mL (i.e., in excess of water quality objectives) in a natural channel at a distance of 35 feet downstream of the BMP.

The draft implementation plan prepared by the CREST consulting team[9] includes several options for the "first iteration" of implementation. (The CREST work product was developed assuming that E. coli would be the only targeted bacteria [i.e., the proposed alternative in the subject proposed Basin Plan amendment], and considering implementation measures for dry weather compliance only.) One of the concepts evaluated would focus on meeting TMDL waste load allocations (WLAs) by diverting and/or treating dry weather flows from storm drains and tributaries to the mainstem of the Los Angeles River. The cost estimate for this approach, assuming 3% escalation of costs per year, is $ 1.112 billion for dry weather flows only. Expenditures of this magnitude will undoubtedly impact other municipal services, potentially including health and safety services, environmental restoration measures, and a wide range of other public services. In addition, the construction of diversions to the sewer system will have environmental impacts at the point of diversion, and increasing flows to POTWs will impact their capacity and treatment and energy costs. Treatment at the point flows enter the mainstem of the river will also potentially have significant environmental impacts, including construction impacts, noise, and energy use. The energy requirements of multiple treatment systems could potentially impact public utilities and energy consumption, and could result in increased regional CO_2 emissions. Finally, it is reasonably foreseeable the strict compliance with the *E. coli* objectives could require control and/or elimination of wildlife and associated habitat, as wildlife is a significant source of bacteria to receiving waters.

For these reasons, we request that the Board consider as a CEQA alternative amending the objectives for indicator bacteria such that they require compliance with *E.*

[8] Final Report, Agreement: 01-227-550-0, Aliso Beach Clean Beaches Initiative. J01P28 Interim Water Quality Improvement Package Plant Best Management Practices. County of Orange, February 2005.
[9] DRAFT Los Angeles River Watershed Bacteria TMDL Technical Report Section 7: Dry Weather Implementation Plan. Prepared for CREST by the CREST consulting team. February 2010.

coli concentrations "as a result of controllable water quality factors." Under this concept, if it were demonstrated, using appropriate scientific techniques, that bacteria in excess of criteria were from "uncontrollable" factors (such as wildlife), the presence of those bacteria would not be considered a violation of water quality objectives. It is likely that this alternative would have a less significant environmental impact than the proposed alternative (i.e., removal of fecal coliform from the water quality objectives) alone. Most importantly, the CEQA alternative proposed for consideration here would allow the presence of wildlife and associated habitat without considering those wildlife and habitat to cause or contribute to an exceedance of water quality standards. Further, we believe that this proposed CEQA alternative would be protective of water quality and human health and would meet the objectives of the proposed CEQA project.

Project timing. Because of the potentially large expenditures of public resources associated with the proposed project, we urge the Regional Board to delay the adoption of bacteria TMDLs until the standards for indicator bacteria are further reconsidered, as detailed above.

Thank you for the opportunity to provide comments. Please contact me if you have any questions.

Sincerely,

Susan C. Paulsen

Susan C. Paulsen, Ph.D., P.E.
Vice President and Senior Scientist

Attachment B

Minutes of SWRCB's SQO Scientific Steering Committee Meeting with Environmental Caucus, April 6, 2005

Sediment Quality Objectives

Environmental Caucus Meeting With SSC, April 6, 2005

These notes summarize discussion during the meeting held between representatives of the Environmental Protection caucus of the Advisory Committee and members of the Scientific Steering Committee. This meeting was originally scheduled for February 25 and had been agreed to by all members of the Advisory Committee. Its purpose was to allow members of this constituency group to explore science-based questions related to the Multiple Lines of Evidence (MLOE) approach in more depth. As agreed with all members of the Advisory Committee, detailed notes of the meeting are being provided to the entire Committee. There were no materials (e.g., agenda, PowerPoint presentations, documents) prepared for the meeting. Attendees at the meeting are listed at the end of the meeting summary.

In order to provide other Advisory Committee members with the most complete picture possible of the discussion, the following notes identify the speaker and track the the detailed content of the discussion to the greatest extent possible. Speakers identified as follows:

- BB: Brock Bernstein, Advisory Committee Facilitator
- EK: Ed Kimura, Sierra Club, Advisory Committee member
- EL: Ed Long, ERL Environmental, Scientific Steering Committee member
- GS: Gabriel Solmer, San Diego Baykeeper, Advisory Committee member
- SB: Steve Bay, SCCWRP, project science team
- SW: Steve Weisberg, SCCWRP, project science team
- TB: Todd Bridges, U.S. Army Corps of Engineers, Scientific Steering Committee member.

BB: this meeting grew out of a letter the enviornmental caucus of the Advisory Committee sent me late last year, outlining their concerns with the MLOE approach. Some of those concerns have been addressed to some extent in subsequent Advisory Committee meetings, but there are two remaining issues that are of primary concern. These are:

- Better understanding the basis of the SSC's conclusion that a single line of evidence approach to sediment quality objectives (SQO) is not scientifically appropriate and the SSC's support for a MLOE approach
- Determining whether the details (both technical and policy) of developing and implementing a MLOE approach can be resolved in a practical way.

[agreement from EK and GS that these are two key issues]

I suggested that it would be useful for the Caucus members to discuss these questions with one or members of the SSC and the remainder of the Advisory Committee agreed to such a meeting with the conditions that the meeting focus on technical issues, that notes and materials from the meeting be provided to the entire Committee, and that the regulated community members of the Committee have the option for a similar meeting if they so desire.

TB: there are just so many examples where the actual data show that using a single line of evidence would have led to an erroneous conclusion. There are lots of examples I'm familiar with from dredging. We have lots of experience with the uncertainty in interpreting data from single lines of evidence and the only way to deal with that is by using more than one line of evidence. For example, the Contaminated Sediments Task Force led to striking results when DDT was involved, showing that it had little explanatory value. And metals in sediments in San Francisco Bay have little explanatory value in terms of explaining impacts.
SW: other examples. In one wetland study, lead and antimony were very high in the sediments but there was no biological problem detected. The high chemistry was due to lead shot but it was not bioavailable. Without data from toxicity tests, we would have drawn the wrong conclusion based on the chemistry alone. In other examples, the benthos has been all dead and test organisms die in toxicity tests, but the the source of the mortality is not on the list of standard chemical analyses so would not have been identified without the biological effects information.
EK: there was an example of a waste treatment plant causing high toxicity but with no chemical signal and it was due to a surfactant that was not being measured.
GS: is the goal of the SQO effort to identify chemistry problems?
SB: yes, the focus of the legislation and of the project is specifically on contaminated sediments.
EL: SQO will become law. But sediment objectives are not the same as water quality criteria. Water quality criteria are based on laboratory tests and exposure, done chemical by chemical, for both acute and chronic exposures, and we have a lot of this kind of data from tests done over a number of years. We can't do that for sediment. We can spike sediments with specific chemicals, but there is no agreement on how to actually spike sediments. This is because sediments are so much more complex than water. The physical and biogeochemical characteristics of the sediment determine the responses of animals and there is such a large range of conditions and variables that it is incredibly complex. So, if we develop something in the lab and try to apply it to the field, there would be huge errors.
TB: EPA finally decided that there is too much uncertainty involved to be able to develop numeric criteria for sediments
EK: then why do they support a pore water approach? Aren't there problems with that as well?
TB: it does simplify things but also introduces lots of other artifacts. For example, organisms can digest sediment and so on.

EL: this has all followed a progression since the 1970s. We went to the chemists back then and asked them to tell us what was in the sediments, but it was very hard to interpret the toxicological relevence of the sediment chemistry results. So, we went to using toxicity tests as an assessment tool to help interpret the chemistry. But, then we had to ask what the toxicity data actually meant and began to look for changes in the resident benthos to provide context for the toxicity data. The status quo is the use the Triad approach but to keep the legs separate for interpretation. The new step here is to put the three legs together.

[discussed that the goal of the project's MLOE approach is to try to get a numeric score for a site]

EK: I have a question about defining a reference as the basis of comparison
GS: and we're also concerned about what the SQO will be used for. We want a law that will force a cleanup and to have that done to a certain level. Will the SQO help define what level should clean up to?
EK: the MLOE approach seems to be missing the goal
BB: members of the Advisory Committee have been grappling with the need for a target, for some way of knowing when we're done and have gotten where we want to be
EL: that's a common problem, identifying the level of a chemical that's unacceptable. We've done lab tests to show the relationship between chemicals in the sediment and toxicity and how these influence the response. And we've combined multiple chemicals into an index but each of them has its own ditribution and history. We've done site-specific chemical guidelines to get at this problem.
TB: New York state has no statewide cleanup level for mercury. Cleanup values (targets) are inherently site-specific.
EL: nickel, chromium, and mercury in San Francisco Bay are coming out of the Delta and "reference" areas are toxic, even though the chemicals are coming from natural sources

[discussion of how SQOs could be used in conjunction with monitoring data to track cleanup success and see how close are getting to a desirable level of sediment quality]

TB: it's easier to set a goal when you have a single comtaminant. But when there are mixtures that differ in their mode of action and toxicity, this gets very complex
BB: the big question for the Advisory Committee is where the "line" will be on the SQO scoring scale
SB: the state will probably set one score for the state which will define which level of SQO is protective
EL: that's a policy decision whether you have a basic binary decision point to separate good from bad sediment conditions or a gradient. But at some point you have to draw a bright line to say whether it's good or bad
SW: this is an ongoing discussion with the SSC. At the moment, we have identified several categories for a site:

- Unimpacted
- Likely unimpacted
- Possible impacted
- Likely impacted
- Clearly impacted

We would identify a series of thresholds for the three lines of evidence that would be merged to get the site score. Then would make an assessment about that site and the state needs to set the line(s) separating the degrees of impact and the Advisory Committee should be deeply involved in that process. This would be the process for a single site, but decisions are rarely made on the basis of a single site. Most often we're concerned about a waterbody with many sites. The scientists want nothing to do with the policy of how to make decisions about an area or a waterbody containing multiple sites.
EK: we have a concern with how to define an area, especially sediment management zones
SW: first, have to ask is there a problem? Second, then have to ask what the nature of the problem is and how much cleanup to do.
TB: I think that you would want an approach that would help you set priorities. It's relatively trivial to say that a site is good or bad. It's more important and useful to have information that would enable the state to allocate resources, since the fact is that there's not enough money or time to address every single problem of every size. Would want to know how big the problem is, whether it involves human health or merely a couple of missing amphipod species, what contaminants are involved, etc.
GS: not sold on drawing a single line. There could be different decision pathways for different points on the scale (i.e., the categories listed above) and each kind of result would lead to different sorts of actions.
BB: also have talked about the importance of considering the context, what the condition is at all sites and how the SQO would help to compare conditions across sites
EK: and it would be important to include the possibility that something could be more bioavailable in the future even though it's not a problem now
TB: when you start asking "what do I do now?" you're going well beyond the SQO itself and into policy decisions
EL: and you need to collect much more evidence to help with that kind of decision, site-specific information and details
SW: the evaluation we appear to have here is that we are moving away from a single bright line and that a gradation (i.e., categories above) is more useful and the stakeholders have to have input about the categories themselves and the thresholds that separate them
TB: I understand the utility of a single line as a basis for action. But the state needs to provide more detail on how the SQOs will be used. It's difficult to discuss this or provide context-free advice
BB: the Advisory Committee is writing drafts of application guidance, but what we need now is more detailed information on the biological, chemical, and toxicological

relationships and their association with the different SQO categories and how the state intends to use these
EK: bioaccumulation is important
SW: yes, but the science is not there yet to develop quantitative-based objectives and the best we can do at this point is the detailed case studies of San Francisco and Newport Bays to move it along
EL: some SSC members have argued for adding a fourth leg for bioaccumulation to the direct effects approach, for example, mussel watch
TB: we have more ability to work with the benthos but fish advisories get much more attention. However, noboby knows how to link sediments and fish tissue and the SQO approach has to spell out how to address such issues if they're going to be included in the objectives.
SW: we will have narrative objectives for human health and guidance on how to do site-specific assessments. We can't be as presciptive as we can be with the benthos.
EK: can you extrapolate from benthic tissue and ecology up the feedweb?
TB: we've been measuring chemical toxicity and bioaccumulation in the same tests. But this doesn't tell you what the residues mean and therefore can't use them to develop objectives or criteria. We've been working on bioaccumulation criteria for New York dredged material, but this is inherently site-specific because of the dependence on details of sediment characteristics. The overall approach could be transferred but the details would have to be site-specific. This is very contentious and has not been done the same way twice.
SW: in response to Ed's earlier question about sublethal toxicity tests, I think it's smart to separate the narrative objectives themselves from the tools used to develop the data to implement the objectives. For example, for each line of evidence, there will be thresholds to determine:

- Reference
- Marginal deviation from reference
- Moderate effects
- Severe effects

And, as new toxicity tests and other toosl come along, their results can be fitted into this framework without having to redo the entire objectives.
TB: you want to have flexibility to adapt the approaches, because the objectives themselves will probably be around for a long time
EL: state of WA made their approach to SQOs rigid and they can't be adapted readily
SW: this is a good question for Chris Beegan – how can the underlying indices and tests be changed as science improves?
GS: and that will influence how hard we decide to fight now to get something included
TB: you can at least frame what approach could be used. But you have to be careful of overprescribing, because the framework will be set for many years. But on the other hand, you have to be specific enough to have a basis for action.

GS: this all has to happen in the real world with budget constraints. Wonder whether we want a phased approach that would allow a choice between cleanup or more study, depending on the situation
SW: the SSC has already said that we should consider a phased approach and that's an implementation question. We will do the whole MLOE approach first and then see how it could be scaled based on the size, severity, etc. of a particular situation
GS: and we will need science guidance about what data to use in that process
TB: there will be important issues such as defining the boundaries of a cleanup, etc.
GS: on a slightly different topic, we're concerned about whether the same objectives will apply to the whole state, and about how the site-specific aspect that is being mentioned will be dealt with
SB: the emphasis is that the objectives will be most valuable if they are as general as possible. We're asking whether and where they need to be regional. We have lots of data for San Francisco Bay and southern California, but relatively little data elsewhere. The first question is whether to combine San Francisco and southern California or not. The second question is whether there are subhabitats or mixtures of contaminants that need to be considered separately. There are big data limitations when we start subdividing the state and we want to avoid that as much as possible. For the benthos, there are habitat groupings we're starting to identify and we are striving for comparability. So, we may end up with one benthic index for the whole state or two or three regional indices with translations so that we end with comparable results for the whole state
GS: however, for water quality objectives, there is one number that's the same across the entire state
SW: toxicity tests are a good example of what we're talking about. We wouldn't want to use the same toxicity test for salt and fresh water, because using freshwater test organisms in salt water would provide a wrong answer, and vice versa. What we're working toward, using the toxicity test example, is a set of comparable tests that provide comparable answers about conditions in different environments
EL: chemistry objectives are based on associations with toxicity and toxicity objectives are based on associations with chemistry, but benthos is tricky because there are inherent differences between habitats, but indices will be scales or calibrated so that we get the same answer from different regions
SW: asking at what point benthic communities are different enough to need different indicators or different formulations of the index. But different indices will be calibrated against each other
EL: in Puget Sound, the number of species in benthic cores went down with increasing chemistry, but there were sites where the abundance went up. Indices of benthic response aren't necessarily linear

[discussion of the BRI benthic index has been scaled in terms of loss of community structure along a pollution impact gradient. The BRI is not sensitive to non-indigenous species, but reflects pollution tolerance and intolerance. In southern California, invasive species tend to increase habitat diversity and this leads to increased abundance and diversity of native species. The scientists agree that the index is not thrown off by the presence of non-indigenous species.]

TB: people have an interest in the state being consistent in terms of goals, definition of impact. Achieving this kind of consistency will require modifications to how the underlying tools work. If we don't allow for underlying flexibility then we won't achieve consistency at the higher level. For example, one benthic index might track with sediment chemistry better in one place and another index track better in another place. Requiring the same index to be used in both places would result in an inconsistent measure of impact due to contamination. Just like the fresh and salt water toxicity tests described earlier.
EK: will we have an opportunity to provide feedback on the workplans?
SB: there's still an opportunity for that. There has been no feedback from the Advisory Committee since the bulk of the workplans were released last October. These are always a work in progress and we're receptive to feedback at any time.
EK: I had some similar questions as the SSC and some confusion about the review process
SW: we wanted the SSC to formally review the workplans as drafts
EK: I have no objection to the Triad but I had some concerns about the details and how they will work out
SD: we're open to comment and suggestions
EL: but the workplans have to be finalized at some point
SW: there's a difference between the workplans and the work. We will not produce new versions of the workplans again. There was just the single round of revision in response to the SSC comments on the drafts. The Advisory Committee did not see the first drafts, because we wanted to give the SSC first crack at commenting. We will adjust the work as we go, based on what we learn and on additional comments, but we are not going to produce a whole new series of workplans.
EK: so, the October workplans are not cast in concrete in terms of our input to the work and the reports?
SB/SW: absolutely not; there is always the opportunity for comment
BB: the Advisory Committee is concerned about the window for input into the products and about the overall schedule for developing the objectives and the documents
SW: the schedule still has to be confirmed by the State Board, but what we're working toward at this point is that by July we will have the methods for tying the legs of the MLOE together and that will be vetted with the Advisory Committee. We will have selected the specific indicators for the MLOE (e.g., which benthic index, which toxicity tests). However, we will not have selected thresholds that define levels of effect for each indicator. That is not required by the court and the August deliverable will be a set of narrative objectives. After July, we will work with the Advisory Committee to identify the thresholds and scoring. We will present scientific results to help with those decisions, but the thresholds will not be decided by the science team. After July, the Advisory Committee will also need to work on how the objectives would be used in different

applications. In the October / November timeframe, we will go back to the SSC for a review of the whole package.
GS: what is the final SSC review, given that many of the decisions (e.g., about thresholds) will be policy decisions?
SW: a combination of science and policy, for example, have the uncertainties been identified and dealt with properly, from a scientific standpoint?
EL: will there be a written report for each workplan?
SB: we expect that there will be reports with analysis results, recommendations. These will be technical reports
BB: Chris Beegan and the State Board will be preparing the actual state document on the objectives
GS: why will the SSC see the policy and guidance for review?
SW: that's something you should ask Chris Beegan. But the policy does use science and the SSC should double-check to ensure that the science has been used properly
TB: I believe in an iterative approach because science and policy are inherently interrelated
GS: but you need a wall between the two because don't want the science tweaked to achieve a certain preconceived regulatory or policy goal
SW: this is a good question for Chris Beegan – whether the policy aspects should be reviewed by the Agency Coordination Committee, the State Board, etc.
GS: this is a really good question. You have to know what the decision options are.
TB: we still don't know exactly what the State Board plans to do with the SQO. You have to know what the objectives are going to be used for in order to select the proper tools. Different applications require different approaches
EK: my questions were about the tools, about whether the site was impacted or not and coming up with tools that are more definitive than what we have now
GS: my concern is how to define good cleanup levels
EL: have to realize that this has never been done. All sediment guidelines in the US and Canada and elsewhere are silent on how they should be used in this regard except for the open water disposal guidelines in the Netherlands. The Washington guidelines are totally silent on that (i.e., cleanup levels).
BB: it seems that the TMDL process is the mechanism for that
TB: it's hard to even define in a consistent way what you mean by cleanup. If at a Superfund site, then you have a set of tools for that, but in a TMDL in Newport Bay, for example, cleanup may mean cleaning up sources in the watershed, not contaminated sediment in the Bay itself
SB: the tools in the SQO will enable us to evaluate condition at a station and then the SQO result gets used in other management and regulatory programs
SW: but you do get one thing. Something concrete enough to force action. If the sediment fails and needs to be fixed, then the specific fix is more program and site specific
BB: the Advisory Committee is working now on developing that kind of application guidance

GS: I'm concerned that the tools will be applicable to and consistent with programs used in other instances, especially when we don't have all three legs. The 303d listing guidance says, for example, that a listing can be based on toxicity data alone, but the SQO approach says that we need more than one leg
EK: but if there was a cleanup effort implemented based on the toxicity data and the 303d listing, then it would of course use the full Triad of data
GS: what does the SSC think should be done with just one leg?
EL: I would use that information to perhaps flag that site but I would not move very far forward without additional information
EK: Basin Plans would have to be updated if we moved more toward a Triad approach
TB: we are trying to establish some level of confidence that we are right in our judgment about a site. The vast majority of sites are not ones where extreme levels of chemistry, toxicity, or benthic change make the conclusion obvious. The majority are ones where there is a large amount of uncertainty associated with making a decision based on one leg alone
SB: the good news is that we don't have that many really extreme sites; that's the dilemma of environmental progress
SW: if you have a site with one leg that's bad, then you could put that in the bin of presumed bad sites and if no more data are collected, then it gets judged bad. This is the burden-shifting approach the Advisory Committee has talked about
TB: the SSC said we didn't like that approach because it's not science based

[all participants agree that such a burden-shifting approach is a policy tool]

BB: it's clearly a mechanism to resolve uncertainty. At the October Advisory Committee meeting, one port representative said that in a situation like that they would want to go and gather more information to find out what was going on
EL: of the estuaries around the country, only a very few are clean or really bad; the majority are somewhere in the middle
SW / EL: if we only had chemistry, we could predict aquatic life condition in many cases but there are enough where we couldn't that there is substantial uncertainty. In terms of the burden shifting mechanism where only one leg was available, that could be framed as saying that the preponderance of evidence says there is some effect and more data are needed to resolve that
GS: I guess the analogy would be that if you saw someone standing over a dead body you could presume they had committed a murder but they are innocent until proven guilty and you wouldn't convict them without more evidence linking them directly to the crime
BB: it's also an issue of drawing conclusions at the population level vs. the individual. We can say that there is a quantifiable risk of getting lung cancer if you smoke and can predict how many people a year will get cancer, but we can't predict with certainty whether any specific individual will get cancer
GS: I would like science advice on what to do when all three legs are not available

SW: that’s both a science and a policy question. Science can say that here is the level of uncertainty associated with that situation and then it’s a science-informed policy decision what to do in that case
GS: if you could describe the uncertainty associated with decision making with one or two legs, that would be helpful
TB: it’s hard to provide context-free advice. The more consequential the decision, the greater the impact of missing data. In cleanups, there is generally little doubt that the central area needs cleanup, but a huge amount of effort goes to where the boundaries should be drawn, as the degree of impact declines spatially, and all three legs are useful in those decisions
EL: if we only had toxicity data, without chemistry, we could not be sure that the toxicity response wasn’t due to ammonia, for example. Or the benthos could be dead due to grainsize, not chemistry.
GS: in a vacuum, with one leg, would you say that more data were needed?
EL / **TB**: yes, absolutely
TB: and one leg could provide some sense of urgency, but you couldn’t make a specific decision about taking action because you wouldn’t know what’s going on. You need to know what’ going on, what the causes are, before deciding what action to take
EL: weight of evidence approaches are used in other environmental arenas, for example, fish tissue, liver function, and histopathological lesions in impacts on fish. For water issues, we often use aquatic chemistry, toxicity, and the plankton community

Attachment C

Opinion of SWRCB's SQO Scientific Steering Committee on the Need for Using Multiple Lines of Evidence in Assessing Sediment Quality

The SSC's perspective on the MLOE approach:

It is the consensus opinion of the SSC that classification of sediment quality with an approach that follows multiple lines of evidence (MLOE) is superior to a single line of evidence (SLOE) approach. Therefore, we encourage the science team to pursue some form of a MLOE approach in establishment of state sediment quality objectives. Because there are various sources of uncertainty with any single approach, the step of combining the different lines of evidence tends to increase the certainty in correctly classifying the quality of sediments. This step also recognizes the need for data analyses that can link measures of exposure and response (effect).

Thus far, there is no precedent for establishing sediment quality criteria, standards, or objectives based on a MLOE approach. Various MLOE approaches have been used to describe and classify sediment quality, but none thus far establish criteria, standards, or objectives. US EPA developed national sediment benchmarks with one line of evidence, using an equilibrium partitioning approach. The guidelines derived for NOAA, Florida, Manitoba, and British Columbia were derived by statistical analyses of chemistry data and either toxicity or benthic measures. The mid-western sediment quality guidelines calculated by USGS and MESL were established with toxicity data associated with chemistry. Although the Washington standards were based on chemistry data related to both toxicity and benthic measures, the data from these lines of evidence are not added or combined into an overall index or score. In most cases, the measure of effect in the data used to derive such guidelines was acute mortality in a laboratory test with little or no information on the ecological relevance or predictive ability of the toxicity test.

This information would suggest that a SLOE approach would be in line with what has been done previously and therefore acceptable for California. However, given the Legislative mandate and the degree of uncertainty associated with each of the individual lines of evidence, the SSC recommends the pursuit of some form of a MLOE approach and views this approach as a significant step forward in the science of contaminated sediments management.

The scientific community has had considerable experience with characterizing and classifying sediments using data from multiple lines of evidence. The US EPA bioeffects manuals describe the virtues and uses of all lines of evidence that SCCWRP and the State Board have in their MLOE plan. The State of Washington uses a combination of chemistry, toxicity and benthic information to classify their sediments in Puget Sound, but not as a combined index or score. Although the current set of national benchmarks issued by US EPA relies on one line of evidence, users of these guidelines are encouraged to apply them with other sediment assessment tools in making management decisions (e.g., http://www.epa.gov/nheerl/publications/; see the third paragraph of Foreword in any of the ESBs). The triad concept first applied by Long and Chapman in Puget Sound and Chapman and Long in San Francisco Bay relies on a weight of evidence from three kinds of complimentary data. Virtually all of the estuarine ambient monitoring programs in this country rely on some form of the triad to classify sediment quality. Such programs include the two largest nationwide estuarine programs; EMAP operated by US EPA, and NSTP operated by NOAA and many regional programs, including those for the Great

Lakes, Puget Sound, San Francisco Bay, Chesapeake Bay, Southern California Bight, Tampa Bay, and NY/NJ harbor. The triad concept has been used and published in, at least, the USA, Canada, Australia, UK, France, The Netherlands, and Brazil. Most regulatory programs, including those that control open water disposal of dredged material, require tests of sediment chemistry, toxicity, and bioaccumulation. Comprehensive ecological risk assessments invariably use a weight of evidence from multiple kinds of assays and tests to estimate and manage risks at waste sites.

The use of any single line of evidence in isolation is problematic. For example, there are several reasons to avoid classifying sediment quality based on the chemical information alone. If only the sediment chemistry line of evidence were used to classify California sediments, mis-classifications of sediments could occur as a result of un-measured toxicants in the sediments, measured toxicants or mixtures for which no objectives were derived, or the presence of substances that would preclude or inhibit the bioavailability of toxicants. Although the predictive abilities of chemical objectives could be determined as an estimate of their reliability, the only way to be sure that the toxicants in the sediments are bioavailable and toxic or not is to subject them to actual testing. Tests of acute mortality and/or sublethal effects are not good surrogates of tests for uptake and bioaccumulation and vice versa. Empirical data are necessary for both lines of evidence.

Similarly, there are several reasons to avoid classification of sediment quality with only the toxicity line of evidence. The SSC is not aware of any monitoring or regulatory program in this country in which the quality of sediments is classified with only toxicity data. It is noteworthy, however, that Washington programs allow biological information to override chemical information; thus, recognizing that the biological line of evidence can have heavier weight than the chemical data. Without the chemistry data, the environmental factors associated with observations of toxicity would be unknown. Spurious results of toxicity tests could be attributable to the presence of natural factors such as ammonia, hydrogen sulfide or physical abrasion or alternatively, the result of un-measured contaminants. Regulatory agencies cannot control toxicity as they would the discharge of specific toxicants or toxicant groups. That is, the regulatory process is inevitably chemical-based, not toxicity-based, so it is necessary to establish a chemistry-toxicity relationship to implement regulatory controls. Toxicity tests performed in the laboratory can be effective measures of the relative bioavailability of toxicity of sediment-bound toxicants, but the ecological relevance of each test can differ considerably among tests. The only accurate way to determine if the toxicity observed in the laboratory is also apparent in the field is to analyze the composition of the resident benthic assemblage at the site to determine whether or not it is impaired.

The use of benthic community condition as the sole measure of sediment quality also is problematic. The composition, diversity and abundance of the benthos can be affected or controlled by a large, complex battery of anthropogenic and natural factors that can work together or in combinations to impair the communities. Without the chemistry and toxicity data, it is impossible to determine if the benthos appears to be adversely altered at a site as a result of natural factors or man-made factors that are subject to regulation. The benthic communities are the resources most at risk from sediment contamination and are the target biological resources for which the sediment quality objectives are intended to protect. Many of the laboratory tests of toxicity are performed with species that are not particularly important components or indicators of the health of the resident biota. The laboratory test species were selected for other virtues. Therefore, to determine if toxicity observed in the laboratory is indicative of actual losses of biological resources, it is necessary to analyze the local benthos to establish that line of evidence.

Sediments classified based on only the tissue uptake/bioaccumulation line of evidence would not account for acute toxicants that do not tend to bioaccumulate in tissues of biota. Most trace metals and polynuclear aromatic hydrocarbons (PAHs) do not bioaccumulate in tissues, so their presence and toxicity would not be accounted for in such an approach. In addition, like the PAHs, all other chemicals that are readily biotransformed would not be appropriately addressed.

Despite our support of the use of a MLOE approach to classify sediments, the SSC members share several concerns regarding the method that might be used to combine SLOE scores into an overall site score. The work plans thus far are purposefully vague on how the individual scores would be calculated and, more importantly, how they would be combined. The MLOE work plan proposes working with stakeholders and scientific advisors to develop an acceptable method. The SSC members believe that a combined scoring method must account for the varying kinds of data that might be generated among sites, account for incomplete data, and identify a numerical score with one line of evidence as different from the same score resulting from a different line of evidence. For example, a chemistry hit in one site should not be scored the same as a benthic hit in another site. However, such accounting of data for individual sites would be impossibly cumbersome in any state-wide or large regional assessment. Necessarily, the way the SLOE scores are combined may be a function of the purpose or intent of the sediment classification and the management questions being addressed. Finally, it will be challenging to communicate or address the uncertainties in the underlying data, especially if the sources of uncertainty differ among the SLOEs among sites or regions of the state.

One perspective on this issue is that the more lines of evidence used in a sediment assessment, the smaller the likelihood of incorrectly designating a site as unimpacted as compared to a single line of evidence situation. That is, with a full compliment of triad data, the sediment analyst can be most assured that a clean site is not contaminated, not toxic, and supports a healthy benthos. On the opposite end of the scale, the analyst can be most assured of classifying a degraded site correctly when the data indicate it is contaminated, the chemicals are bioavailable, the sediments are toxic, and the benthos are adversely impaired. Therefore, the use of a MLOE approach increases the likelihood of the accurate and correct classification of sediments.

Attachment D

Final Report, Independent Advisory Committee Convened by National Water Research Institute, Assessment of TMDL Targets for Organochlorine Compounds for Newport Bay, August 4, 2009

NATIONAL WATER RESEARCH INSTITUTE

Final Report

of the April 7-8, 2009, Meeting of the

Independent Advisory Panel

for the

Assessment of TMDL Targets for Organochlorine Compounds for the Newport Bay

August 4, 2009
Fountain Valley, California

Disclaimer

This report was prepared by an NWRI Independent Advisory Panel, which is administered by the National Water Research Institute (NWRI). Any opinions, findings, conclusions, or recommendations expressed in this report were prepared by the Panel. This report was published for informational purposes.

Assessment of TMDL Targets for
Organochlorine Compounds for the Newport Bay

Purpose and History of the Panel

In 2009, the County of Orange (County) requested that the National Water Research Institute (NWRI) of Fountain Valley, California, form an Independent Advisory Panel (Panel) to review the methods and underlying data used to develop total maximum daily loads (TMDLs) for organochlorine compounds for the Newport Bay Watershed, located in central Orange County, California. TMDLs are the maximum amount of a pollutant that a water body can receive and still attain water quality standards.

The Newport Bay Watershed constitutes 154 square miles (98,500 acres) in central Orange County, California. The major features of the watershed include Newport Bay (Upper and Lower), San Diego Creek, Santa Ana Delhi Channel, and other small tributary drainages. Lower Newport Bay is considered to be that portion of the Bay south of the Pacific Coast Highway Bridge (Highway 1). The Lower Bay harbor is important for recreational use and supports nearly 10,000 pleasure boats, as well as many residential and commercial facilities. Upper Newport Bay (north of the Pacific Coast Highway Bridge) includes a 752-acre estuary and ecological reserve and is home to 78 species of fish and six imperiled species of birds, such as the light-footed clapper rail. The threatened and endangered bird species are a primary concern. Organochlorine pollutants are toxicants that can bioaccumulate in plants and the fatty tissues of fish, birds, and mammals, and biomagnify in the food chain. Examples of organochlorines include chlordane, dichlorodiphenyltrichloroethane (DDT), dieldrin, toxaphene, and polychlorinated biphenyls (PCBs).

The charge to the Panel was to consider the following:

1. Are the methods and underlying data used to develop the targets for the organochlorine TMDLs in the Newport Bay Watershed, as well as the targets proposed by the stakeholders, based on the best available science?

2. Are the numeric targets in the organochlorine TMDLs, as well as the targets proposed by the stakeholders, protective of beneficial uses?

3. Are there alternative targets, or methods to develop targets that have not yet been considered, that are both scientifically defensible and protective of beneficial uses?

4. Is the analysis indicating a declining trend in organochlorines concentrations robust? If the analysis is robust and there is strong evidence of a declining trend, should this trend be reflected in defining targets and, if so, how?

5. What are the recommended next steps to resolve any deficiencies, conflicts, or data gaps from questions 1 through 4?

The Panel members include:

- *Panel Chair:* Brock B. Bernstein, Ph.D., Independent Consultant (Ojai, CA)
- Michael Fry, Ph.D., American Bird Conservancy (Washington, D.C.)

- Lynn S. McCarty, Ph.D., L.S. McCarty Scientific Research & Consulting (Ontario, Canada)
- James Meador, Ph.D., NOAA National Marine Fisheries Service (Seattle, WA)
- Charles A. Menzie, Ph.D., Exponent (Alexandria, VA)
- Daniel Schlenk, Ph.D., University of California, Riverside (Riverside, CA)

A short biography on each Panel member is included in Appendix A.

Introduction

A 2-day meeting of the Panel for the Assessment of TMDL Targets for Organochlorine Compounds in Newport Bay was held April 7-8, 2009, at the Holiday Inn Costa Mesa in Costa Mesa, California.

Representatives from the County, Santa Ana Regional Water Quality Control Board, and stakeholders Dr. Jim Byard and Dr. Susan Paulsen gave presentations during this meeting on the following topics:

- Panel charge.
- Overview of the Newport Bay Watershed.
- Organochlorine compounds TMDLs for the Newport Bay Watershed.
- A critical review of the TMDL targets and impacts of organochlorines in the Newport Bay Watershed.
- Risk assessment case study of DDT in Newport Bay.
- Existing DDT levels in forage fish in Upper Newport Bay.
- Sediment chemistry and toxicity – Sediment quality objectives.

A tour of the watershed, specifically of Newport Bay, was also included as part of the Panel meeting.

The meeting agenda is included in Appendix B. A complete list of Panel meeting attendees is included in Appendix C.

Findings and Recommendations

The findings and recommendations that resulted from the April 2009 Panel meeting are presented below. However, before addressing the individual questions in its charge, the Panel has highlighted a number of more general issues.

1. General Comments

The Panel was impressed by the willingness of all parties to engage in the rigorous and open-ended discussion held at the April meeting. The presentations were thorough, each presenter offered their comments in a clear and concise manner, and all responded directly to the Panel's numerous comments and questions. In combination with the multiyear workplan the parties are developing, the Panel believes this overall effort is an excellent model of how such complex issues should be approached in a regulatory setting.

The Panel also appreciated clarification on the details of its charge since this helped provide the basis for more direct answers to the key concerns that prompted the Panel's involvement.

Based on material presented at the meeting and in follow-up discussions with participants, the Panel understands the Regional Water Quality Control Board's (Regional Board) first priority to be the protection of beneficial uses related to wildlife, particularly the threatened and endangered bird species in the watershed, with a second priority being the protection of human health related to consumption of sportfish caught in Newport Bay. The Regional Board's primary management tool for addressing organochlorine contamination is the TMDL process, with its focus on reducing organochlorine loads to the Newport Bay from the watershed. The Panel thus understands that the Regional Board is focusing primarily on sportfish that acquire the bulk of their organochlorine tissue contamination from in-Bay sources, because the TMDL would not address sources of contamination outside Newport Bay and its watershed. Finally, the Panel understands that the Regional Board recognizes that toxicity to benthic invertebrates, stemming from direct exposure to contaminated sediments (in laboratory tests), is unlikely to be related to the organochlorines for which TMDLs have been developed. The focus of the organochlorine TMDLs is, therefore, the bioaccumulation of these chemicals from water and/or sediment, with subsequent transfer through the foodchain to humans (via consumption of sportfish) and wildlife species (through consumption of fish and invertebrates).

While the Panel recommends additional data gathering, data analysis, and modeling, it also understands that there are limitations on the applicability of historical data, as well as constraints on the ability to gather additional data that would be ideally suited to the questions it poses. For example, obtaining direct data on conditions (e.g., contaminant levels in tissues, sublethal reproductive effects) in threatened and endangered species is subject to severe constraints. In addition, the Panel recognizes that descriptions of many processes in a complex and highly variable system, such as Newport Bay, will always be somewhat uncertain.

The Panel's findings and, particularly, recommendations are based on a core judgment that the challenge of setting management thresholds for bioaccumulative compounds such as organochlorines should be approached through a structured risk assessment process (see Recommendations for Questions 2 and 3). Thus, the Panel strongly supports the Regional Board's phased approach to the organochlorine TMDLs, the extended implementation schedule that allows for additional studies to be performed, and the Regional Board's stated willingness to modify the TMDLs as new information becomes available.

2. Question 1

Are the methods and underlying data used to develop the targets for the organochlorine TMDLs in the Newport Bay Watershed, as well as the targets proposed by the stakeholders, based on the best available science?

Findings

The Panel finds that neither the targets used in the TMDLs nor the targets proposed by the stakeholders are based on the best available science. Each target is discussed in turn.

The Regional Board's sediment target is based on Threshold Effects Levels (TELs) for DDT and Effects Range Median (ERM) levels for chlordane. The Panel noted two limitations regarding the use of these values. The first is that TELs and ERMs do not relate to the impairments for which the TMDLs are being derived; instead, they are screening values for direct toxicant effects on exposed benthic invertebrates. The Panel notes that TELs and ERMs are used in the organochlorine TMDLs as a practical estimate of contaminant levels that might lead to the bioaccumulation of sediment-borne contaminants in higher trophic levels. However, no functional relationship exists between contaminant levels associated with toxicity to benthic organisms due to direct exposure to contaminated sediments and those associated with bioaccumulation. Guidance, such as that developed at the 2002 Pellston workshop on sediment quality guidelines (Moore et al., 2005), specifically refers to the inappropriateness of using such sediment quality guidelines for interpreting the risk of bioaccumulated toxicants. Secondly, the Panel concludes that the derivation of these screening values is subject to considerable scientific uncertainty. Both TELs and ERMs are derived from statistical estimates of the level of contaminants in sediment at which effects to sediment organisms are observed in toxicity tests, using data aggregated from numerous separate studies. Dr. Byard pointed out at the April 2009 Panel meeting that the TEL database has numerous undocumented inconsistencies and apparent flaws. Though individual studies from which the TEL database extracted data have been peer reviewed, the data screening and aggregation process and related quality assurance procedures on which the database itself was built have not been thoroughly reviewed and vetted. The Panel believes that this lack of transparency and documented quality control seriously undermines confidence in the applicability of the derived TELs even for purposes related to direct sediment toxicity.

The Regional Board's use of Screening Values from CalEPA's Office of Environmental Health and Hazard Assessment (OEHHA) to set fish tissue targets for human consumption is an inappropriate use of these values. OEHHA makes it clear in its publications that Screening Values were developed for OEHHA's internal use as a practical threshold for identifying situations that deserve additional attention and where detailed risk assessment might be called for. Only in cases where such risk assessment suggests a human health risk would consumption advisories then be implemented. The Panel recognizes that the Regional Board's use of OEHHA's Screening Values is not uncommon and that these Screening Values were included as a potential set of guidelines in the Functional Equivalent Document (FED) (SWRCB, 2004) prepared to support the development of the State's 303(d) listing policy. However, this application of the Screening Values is not scientifically justified since they were not developed for this purpose. OEHHA has developed new thresholds that are more suited to the Regional Board's current purpose (see paragraph below on OEHHA's newer results, and Question 3).

The Regional Board used the National Academy of Sciences' (NAS) 1972 guidelines[1] for setting wildlife tissue thresholds for total DDT. The Panel does not believe this is the best currently available science. Much additional data has been gathered and the understanding of contaminant effects has improved greatly since the early 1970s. In addition, the use of standard numbers, such as the NAS guidelines, does not allow for the use of local information that reflects site-specific processes that may affect bioaccumulation processes and contaminant effects. The Panel also noted that the NAS report includes significantly different thresholds for DDT in marine and freshwater systems, a reflection of the fact that different expert panels derived the marine and freshwater thresholds. The fact that two expert panels arrived at such significantly different results using essentially the same datasets further undermined the Panel's confidence in the applicability of the NAS guidance to Newport Bay.

The stakeholders proposed a fish tissue target for DDTs for human consumption of 520 parts per billion (ppb), based on the value in Table 2 of Klasing and Brodberg (2008). This Advisory Tissue Level (ATL) of 520 ppb allows for the consumption of three servings of fish per week.

[1] National Academy of Sciences. 1972. Water Quality Criteria 1972. A Report of the Committee on Water Quality Criteria, Environmental Studies Board. Washington, D.C. EPA-R3-73-033.

However, the ATL is not necessarily directly applicable to use in setting targets in the context of the Organochlorine TMDLs. As Klasing and Brodberg (2008) say (p. 60):

> The ATLs described in this report should not be misinterpreted as static “bright lines” that others can use to duplicate state fish consumption advisories. As noted, ATLs are but one component of a complex process of data evaluation and interpretation used by OEHHA in the assessment and communication of fish consumption risks.

Dr. Brodberg of OEHHA has clarified that ATLs are developed by OEHHA for its own purposes and not for use as broader regulatory guidelines. ATLs are based on the relatively high 10^{-4} cancer risk level to allow for the health benefits of consuming fish; at this risk level, given current contaminant levels in fish tissue, non-cancer risks are larger than cancer risks for most consumption categories. Thus, the tissue level of 520 ppb of DDT cited by Dr. Byard is based on non-cancer risk factors. OEHHA is aware that agencies such as U.S. Environmental Protection Agency (U.S. EPA) and the Regional Board typically set TMDL targets and other criteria on the basis of risk alone, and do not balance benefits as OEHHA attempts to do. To accommodate the needs of other such agencies, OEHHA has also produced Fish Contaminant Guidelines (FCGs), which are based strictly on risk and use a more conservative cancer risk factor of 10^{-6}. These values, presented in Table 1 of Klasing and Brodberg (2008), are quite different from the ATLs. For example, the FCG for DDT, for one serving per week, is 21 ppb, markedly lower than the ATL even for three servings per week (520 ppb). The Panel concludes that the stakeholders’ proposed DDT fish tissue target of 520 ppb is based on a different risk/benefit framework than the older Screening Value of 100 ppb used by the Regional Board, as well as on more current science, but that it is not necessarily the most applicable target in this instance. The same is true of PCBs, with an ATL of 21 ppb (for three servings per week) and a FCG of 3.6 ppb (for one serving per week), and toxaphene with an ATL of 200 ppb (for three servings per week) and a FCG of 6.1 ppb (for one serving per week).

In their critique of the Regional Board’s DDT fish tissue target for human consumption, the stakeholders also noted that, “There is no fish consumption advisory for Newport Bay because fish concentrations are too low” and that there is “no health advisory for PCB in sportfish from Newport Bay.” The Panel believes, based on discussions with OEHHA staff, that this is a misinterpretation of the absence of consumption advisories for sportfish in Newport Bay. OEHHA notes that data requirements for developing consumption advisories are demanding and that sufficient data do not exist for Newport Bay. In addition, OEHHA’s main priority in its recent reevaluation of consumption advisories in Southern California was open coastal locations for which adequate, consistently collected, and analyzed data were available. They noted that the absence of consumptions advisories for Newport Bay should not be interpreted in any way as a reflection of OEHHA’s judgment about the relative safety of consuming fish from the Bay.

The stakeholders suggested a DDT fish tissue target of 150 ppb for the protection of bird species, based on extrapolations of data in a study by Anderson et al. (1975) of reproductive effects in brown pelicans. The Panel believes this tissue level is not directly applicable as a fish tissue target in Newport Bay for several reasons. While brown pelicans are the most sensitive bird for eggshell thinning effects, these may not necessarily be the endpoint of concern for all targeted bird species in Newport Bay. Other endpoints related to survival, growth, or reproduction may well have different thresholds. Nor does the Panel believe that the estimation of brown pelican egg tissue residues, based on a presumed one-to-one relationship between declines in fish tissue and declines in pelican egg tissue, is supported by other data on the behavior of such relationships, particularly when the relationship is based primarily on data from one point in time when DDT concentrations in the Southern California Bight were changing dramatically. As the Regional Board pointed out in its response #8 to the Flow Science report on DDT, another equally arbitrary comparison (DDT levels in pelican eggs to levels in pelican diet in 1969) results in a biomagnification factor of 18, which results in higher estimates of egg tissue levels using the 1974 fish tissue level of 150 ppb. The Panel believes that selecting individual comparisons from single points in time is not an appropriate approach for setting TMDL targets, which should be based on a review of all available evidence. The stakeholders use a different approach with data from ospreys to arrive at the same fish tissue target of 150 ppb. The Panel believes that the biomagnification factor used in this calculation (10) is unrealistically low. Finally, the stakeholders' suggested tissue target of 150 ppb does not include a safety factor, which is often used to compensate for data gaps, uncertainties, and differences between species and sensitive life stages.

Recommendations

Sediment, water, and tissue targets should be derived as part of an integrated modeling approach that incorporates specific endpoints and information about the entire foodweb. The modeling approach discussed by Ben Greenfield at the Panel meeting and described in more detail in the Newport Bay case study in Greenfield et al. (2007) is the type of approach the Panel believes is appropriate for developing targets that can be used to protect endpoints of interest (or species of concern) (see Recommendations for Question 3). This approach may require gathering additional data about contaminant levels in specific categories of prey items in portions of the foodwebs in the Newport Bay (building on, for example, Allen et al., 2008). The results of this effort should be compared to the sediment targets proposed in the comment letter from the Fish and Wildlife Service and based on a similar back calculation approach.

The Regional Board should review OEHHA's fish tissue targets related to human health and decide which of these is most appropriate for use in the organochlorine TMDLs. Given that one of OEHHA's main responsibilities is to develop such information for other state agencies, the Regional Board should carefully evaluate OEHHA's targets before considering any others. The primary issue for the Regional Board is to determine whether to base its human health related targets on the approach that balances health risks and benefits (i.e., ATLs) or the approach that focuses only on risk (i.e., FCGs). The Panel believes that both approaches are legitimate, have a strong conceptual and analytical foundation, and are based on current scientific knowledge. In addition, both fall within the range of risk levels recommended by the U.S. EPA (10^{-4} to 10^{-6}). However, conceptually, the ATLs represent a different approach, since they attempt to incorporate information about the benefits of seafood consumption that was not available when the risk-based approach was developed.

Setting targets to protect wildlife health is more complex than setting sediment, water, or human health related targets. Human health related targets have been established by OEHHA. Sediment and water targets can be derived by back calculation once appropriate targets for sportfish and prey tissue are set. However, there are no similarly well-developed targets that are directly applicable to all wildlife species of concern in Newport Bay. The Panel, therefore, recommends that the Regional Board build on the efforts underway by the Biological Technical Assistance Group (BTAG). This is a workgroup initiated by U.S. EPA Region IX and staffed by scientific representatives of state and federal agencies with the goal of establishing a formal process for developing and refining toxicity reference values (TRVs) based on the best available current science. Board staff should undertake a thorough review of the literature on contaminant effects, thresholds, and screening values relevant to bird species of concern in Newport Bay.

This information should be organized and applied as described in the Recommendations for Question 3.

Toxaphene was identified as a chemical of concern in the Newport Bay Watershed. Toxaphene is toxic to fish in laboratory assays, with concentrations around 500 nanograms per gram (ng/g) affecting reproduction and growth, while concentrations in the low parts per million (ppm) range are lethal. In addition, OEHHA has identified toxaphene as a chemical of concern for human consumption of sportfish. However, the Panel believes current science does not yet permit setting reliable targets for toxaphene to the extent possible for other contaminants. Toxaphene is a complex mixture of an unknown number of congeners (250 to >670) (ATSDR, 1996), and the octanol-water partition coefficients will differ for each chlorinated compound, with estimated partitioning coefficients varying from 3.3 to 6.44. In addition, the toxaphene source, degree of weathering, and extent of biological dechlorination may all affect the partitioning coefficient. Since all 600+ chemicals will have different partitioning coefficients and different toxicities, it is not possible to determine a "correct" partitioning coefficient, and a conservative approach is appropriate, since it is not possible to identify which component is responsible for toxicity. It is likely that bioaccumulation is a greater concern than direct toxicity, and there are no data to suggest that water toxicity results from the same components that bioconcentrate. The more lipophylic components are the most likely to bioconcentrate, while more water-soluble components are more likely to be responsible for aquatic toxicity. The Panel suggests that toxaphene, while a chemical of concern, is generally less problematic than DDT. However, it is more challenging with regard to the development of site-specific media and organism target levels for regulatory monitoring programs. In the case of Newport Bay, rather than developing specific guidance for toxaphene, it is likely that any sediment control measures used to address DDT issues would also be effective for toxaphene. The continuation of a modest sediment and fish tissue monitoring effort to track toxaphene trends should be sufficient.

3. Question 2

Are the numeric targets in the organochlorine TMDLs, as well as the targets proposed by the stakeholders, protective of beneficial uses?

Findings

The Panel finds that this question is not amenable to a strict yes/no answer. The real issue is whether targets are appropriately protective, or protective enough to achieve management goals.

Determining whether the proposed targets are protective enough to meet management goals is to some extent a matter of both professional judgment and policy decisions. However, such judgment must be based on the best available current science applied in a consistent risk assessment framework. Based on its findings for Question 1, the Panel concludes that, without the type of assessment described in the following recommendations, it is not possible to rigorously evaluate whether the targets are appropriately protective of beneficial uses.

Recommendations

The Regional Board should develop numeric targets using a structured risk assessment modeling approach as described in the Recommendations for Question 3. This process should consider a wide range of endpoints, surrogate species, toxicity reference values, and past studies to identify suitable inputs to a modeling approach such as described in Greenfield et al. (2007).

More specifically, the Panel recommends that protective prey tissue levels (targets) be selected and/or calculated for three species of wildlife bird species: the clapper rail, least tern, and osprey. Each feeds on different components of the foodweb within the Newport Bay ecosystem. Clapper rails feed on invertebrates and small fish in exposed or shallow intertidal areas, and tissue values will thus need to be derived for the invertebrate and small fish prey base supporting this species. Least terns and ospreys feed primarily on fish, but their primary prey species differ somewhat in size and bioaccumulative potential and may be associated with different parts of the prey base within the Newport Bay ecosystem.

The selection and/or calculation of target tissue levels for the various prey species should be guided by several considerations, including:

a. ***Species Relevance* –** If surrogate species must be used to compensate for the lack of data on species within the Newport Bay system, they should mimic the species of concern with respect to taxa, size, and food habits.

b. ***Endpoint Relevance* –** Assessing the sustainability of the species in the Newport Bay system with respect to exposures to organochlorines requires considering the toxicological endpoints relevant to sustainability. These include a variety of reproduction, growth, and survival endpoints, and one of these will often emerge as the most important with respect to establishing protective tissue levels. These endpoints should be kept separate from one another (i.e., data sets should not be merged for statistical purposes).

c. ***Reliability* –** The studies or values used should be based on work that has been peer reviewed and/or has a traceable history that allows for transparent review of methods, data, and conclusions.

d. ***Utility of Data* –** Explicit consideration should be given to the value of negative and positive information in the study, and preference should be given to studies with multiple doses that will support probabilistic assessments. The use of no-observed-effect levels (NOELs) and lowest-observed-effect levels (LOELs) should be carefully considered, since the low statistical power associated with most toxicity tests means that many NOELs are statistical artifacts. NOELs should be used only in conjunction with LOELs or, alternatively, LOELs may be used with safety factors, an approach that often has fewer statistical shortcomings.

e. ***Metrics* –** Attention should be given to ensuring that the metrics for exposure match those for effects (e.g., milligrams per kilogram per day [mg/kg/day] or mg/kg tissue etc.).

f. ***Safety Factor* –** The use of an appropriate uncertainty or safety factor should be explicitly considered with regard to different wildlife species and life stages. The U.S. EPA generally uses a 3X, 5X, or 10X safety factor for each of these considerations. Additionally, safety factors may be used as a policy decision related to the level of uncertainty in the analysis and the extent to which that uncertainty may compromise the degree of protection, as well as to the potential for interactions among mixtures of toxicants.

4. Question 3

Are there alternative targets, or methods to develop targets that have not yet been considered, that are both scientifically defensible and protective of beneficial uses?

Findings

The Panel believes there are both alternative targets, as well as risk assessment methods, that are directly applicable to the Newport Bay ecosystem and that have not been considered by either the Regional Board or the stakeholders.

In addition to the NAS (1972) guidelines, there are similar but more recent guidelines published by Environment Canada. In addition, both the Fish and Wildlife Service (FWS) comment letter and the Greenfield et al. (2007) case study of Newport Bay suggest a number of alternative targets that could be considered for application to Newport Bay, and the BTAG mentioned in the Recommendations for Question 1 provides a mechanism for considering targets more appropriate for Newport Bay. Beyond these specific numbers, the U.S. EPA has recently recommended the use of site-specific risk-based approaches (similar to those applied in both the FWS comment letter and Greenfield et al. [2007]) in cases such as this. The Panel believes that the combination of existing data and information with additional studies, such as the work being planned by the Toxicity Reduction Investigation Program (TRIP), would provide an opportunity to effectively apply this approach.

Recommendations

The Panel recommends a site-specific, risk-based approach that would allow for explicit consideration of local species, as well as uncertainty, safety factors, and precaution. Precaution is needed to ensure that unique modes of action are not overlooked and that assumptions of trends do not curtail management actions. Because the Newport Bay system is not at equilibrium (see Question 4 below), it is important to include direct and indirect exposure and uptake pathways from all sources (i.e., water, sediment, prey tissue). This approach should be designed to link this full range of inputs to fish/invertebrate tissues and associated exposures to wildlife species of concern (i.e., the three bird species suggested above). This effort can be accomplished using well-accepted and peer-reviewed bioaccumulation and food chain models, such as the Gobas-based model presented by Ben Greenfield at the Panel meeting. In the simplest terms, this approach would involve the following four steps:

1. Identify a Toxicity Reference Value (TRV) for birds for the compound of concern (e.g., ng DDT/g bird/day), derived from data on concentrations considered protective in the bird (e.g., egg, liver, plasma). TRVs are available in the literature and from programs such as the Department of Defense's Health Effects Research Program (HERP)[2], or can be calculated from a combination of local and published data. TRVs may be validated through monitoring, although it may be difficult, if not impossible, to gather the data directly on threatened and endangered species in the Newport Bay Watershed.

2. Back calculate to a tissue target or threshold for birds' prey items, using biomagnification factors, assimilation efficiency, rates of ingestion, and body weight, and accounting for both sediment and water column pathways for transfer of toxicants.

2 http://chppm-www.apgea.army.mil/tox/HERP.aspx. Health Effects Research Program.

3. Estimate the observed ratio of fish concentrations to sediment and water concentrations in the site of interest (i.e., bioaccumulation factors).

4. Use the estimate (3) to back calculate sediment and water targets from the fish tissue target (2).

In reality, this approach – elements of which were implemented in a streamlined fashion in the FWS comment letter and in more detail in Greenfield et al. (2007) – depends on developing a site conceptual model that identifies the receptor of concern (e.g., endangered bird species), relevant endpoint(s) necessary to focus the assessment (e.g., growth, reproduction), and exposure and effects assessments (see the Recommendations for Question 2 for a more detailed list of issues to be considered in this approach). A final risk characterization step would estimate risk and uncertainty, as well as identify data gaps.

Utilization of a site-specific risk-based process has been recently proposed by a Science Advisory Panel of the U.S. EPA's Office of Water to evaluate potential changes in the Aquatic Life Criteria for Contaminants of Emerging Concern (U.S. EPA, 2008). For example, recent studies have indicated that the impact of some contaminants would be underestimated using the current aquatic life criteria guidelines. In addition, thorough site-specific conceptual models can help address impairment that might be overlooked due to unique modes of action (e.g., endocrine disruption), an element included in U.S. EPA's recent recommendation for a site-specific and tissue-based approach for assessing the ecological risk of hydrophobic pesticides with high LogP values (U.S. EPA, 2009). This approach would parallel guidelines already utilized by U.S. EPA's Office of Water for selenium (U.S. EPA, 2005). Major steps in the overall context of TMDL development and implementation are shown in Figure 1.

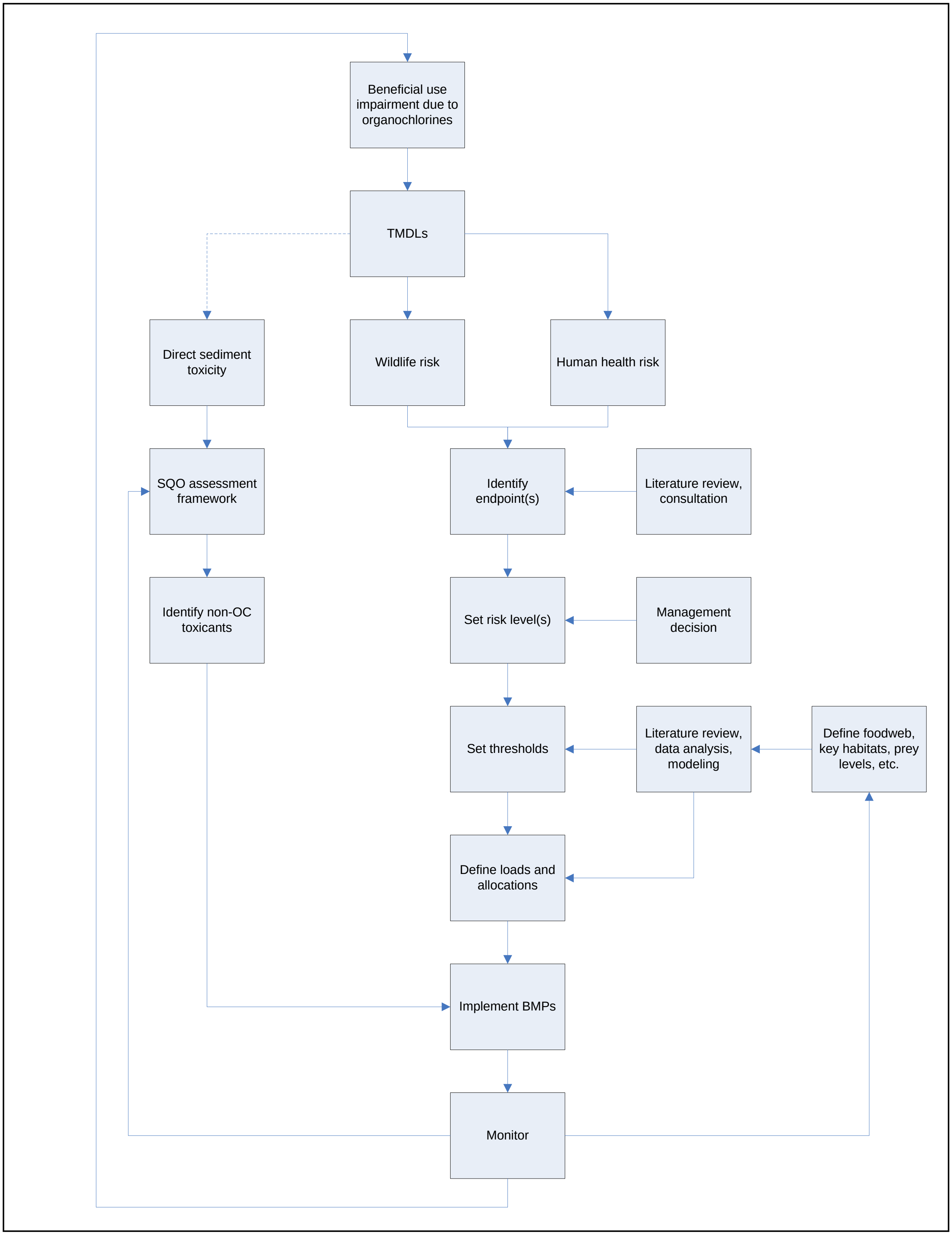

Figure 1. Major steps in the overall context of TMDL development and implementation.

5. Question 4

Is the analysis indicating a declining trend in organochlorines concentrations robust? If the analysis is robust and there is strong evidence of a declining trend, should this trend be reflected in defining targets and, if so, how?

Findings

The Panel finds that the declining trend of organochlorine concentrations in red shiner tissue is statistically robust for the period 1980 to 1996, although the strength of the regression relationship declines when the analysis is performed with all data, including outliers. However, data since 1996 fluctuate with no apparent trend, and the regression relationship for the later period (1993–2002) in the split is substantially weaker than that for the earlier time period, although short-term (<10 years) trends in organochlorines with long half lives may be difficult to identify. Furthermore, the relevance of this specific trend to conditions within the Newport Bay is somewhat uncertain because red shiner is a freshwater species and would not likely occur in estuarine conditions in Newport Bay itself. In general, however, declining trends in the red shiner data to about 1990 are supported by data on mussels and less detailed data on tissue levels in striped mullet, which have declined from more than 5000 ppb in the 1970s (Allen et al., 2004) to about 1000 ppb currently (Allen et al., 2008).

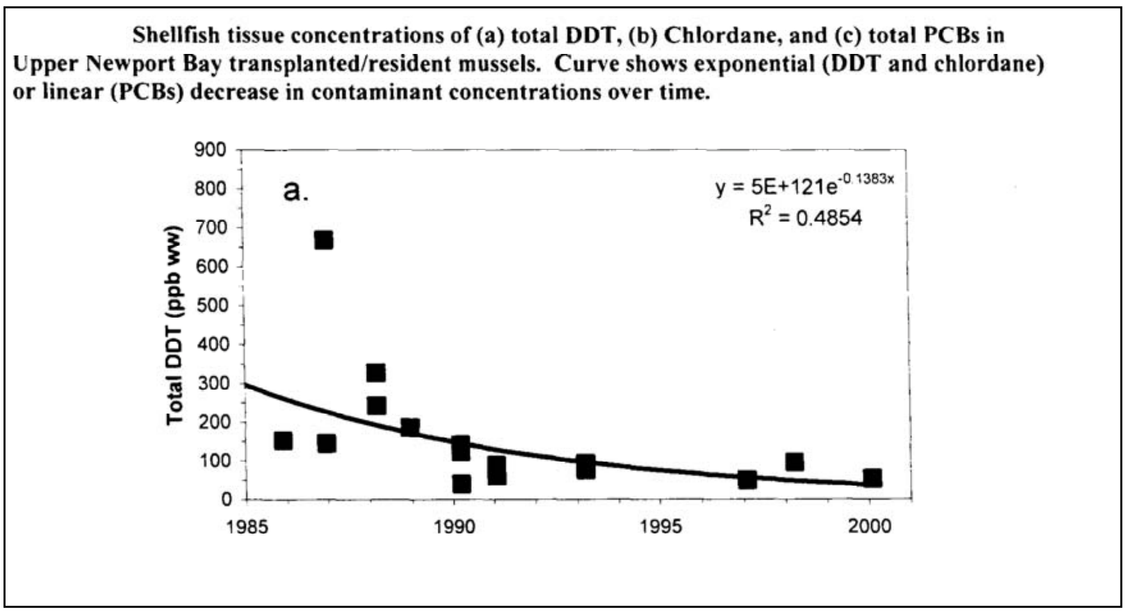

Figure 2. Figure from initial TMDL document (SARWQCB, 2006).

The lack of detailed trend data for marine and estuarine fish inhabiting the Newport Bay makes it impossible to determine if tissue concentrations in these species have declined at the same rate as tissue concentrations in red shiners and mussels. In fact, DDT concentrations in the same resident fish species in 2002 and 2005-2006 were not significantly different (Figures 3 to 5).

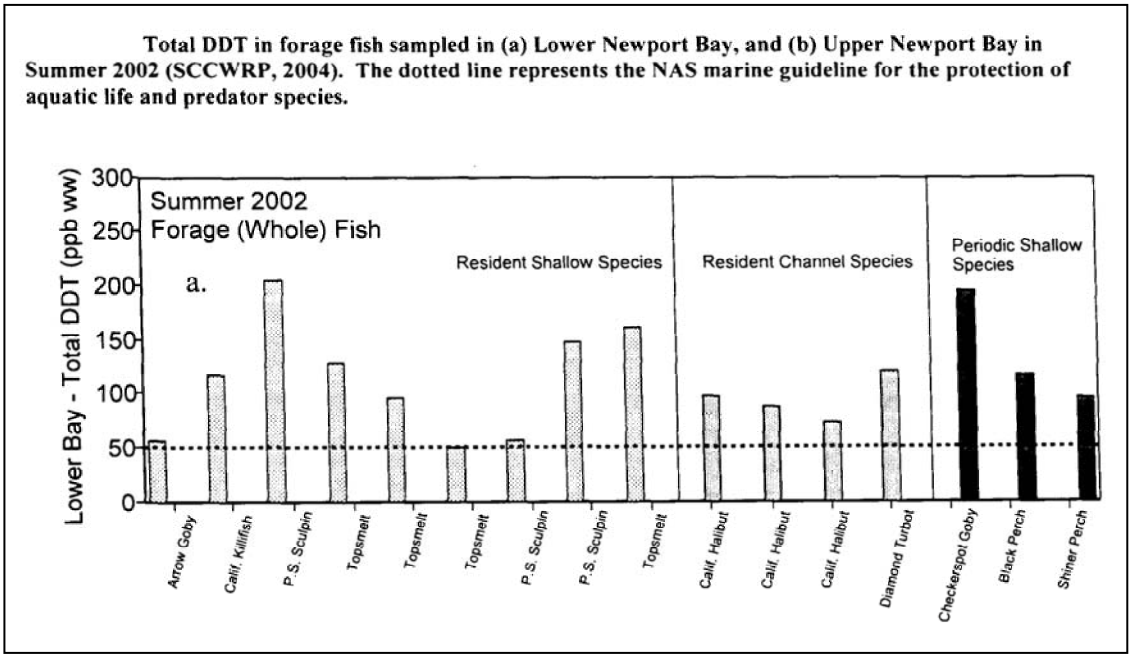

Figure 3. Figure from initial TMDL document (SARWQCB, 2006).

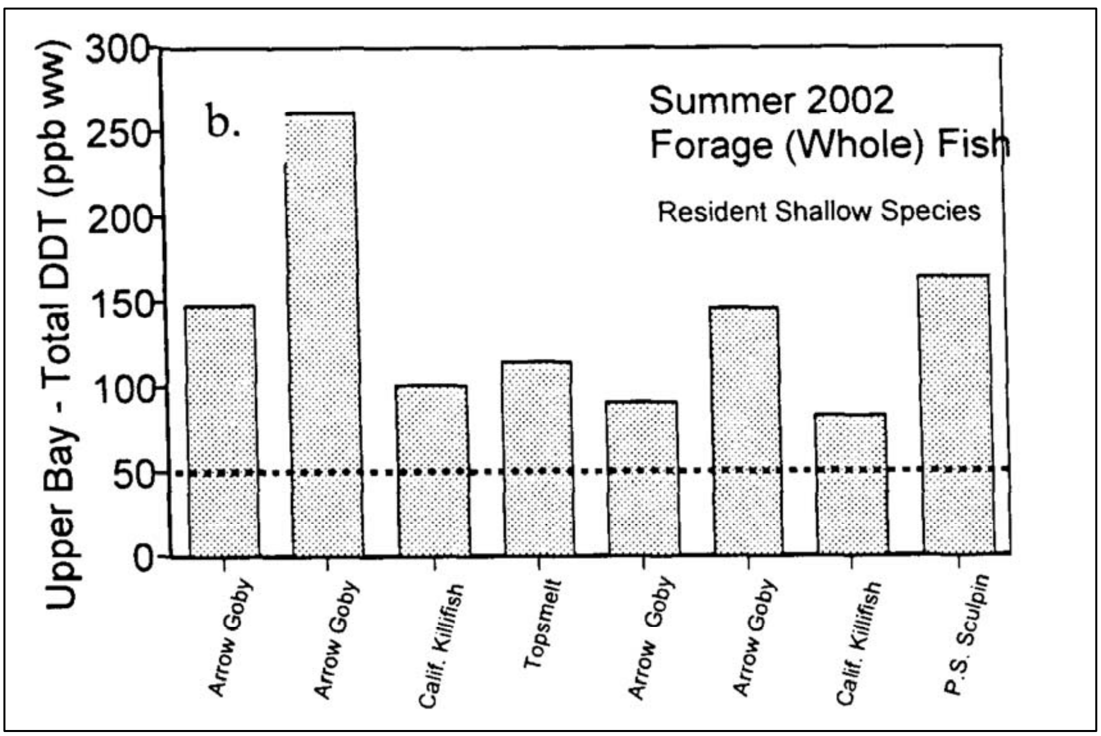

Figure 4. DDT concentrations of fish collected
in the summer of 2002 from Upper Newport Bay (Allen et al., 2004).

Sample Description	No. Composites	Total DDT (ug/kg ww) Min	Max	Wildlife SV = 14 ug/kg ww Mean	SD	CV%	Std Length Range (mm)
topsmelt	18	41.2	185.6	92.0	34.4	37	18-81
California killifish	11	78.8	220.6	156.2	45.8	29	21-71
cheekspot goby	1	23.6	23.6	23.6	--	--	18-30
shadow goby	1	36.8	36.8	36.8	--	--	20-33
California halibut	3	19.6	94.4	63.9	39.2	61	73-119

Figure 5. Concentrations of DDT in fish species collected in 2005–2006 from Upper Newport Bay (Allen et al., 2008).

The Panel agrees with the stakeholders' conclusion (Byard et al. [2006], pp. 15-16) that sediment data are not suited to the evaluation of systemwide organochlorine trends. In addition to the factors discussed by the stakeholders, the Panel notes that detection limits have improved dramatically over time, which would produce an apparent declining trend simply as an artifact of changing detection limits.

Despite the robustness of past trends in fish and mussel tissue data, the Panel has concerns about the stakeholders' assertion on Slide #32 of Dr. Paulsen's presentation that, "Trends in time will continue." The Panel believes that the natural attenuation of organochlorine contaminant concentrations in Newport Bay to vanishing levels may not be a viable assumption. In watersheds where key source inputs have been substantially decreased or removed, contaminant declines are expected for several reasons, such as degradation, sediment burial, or sequestration, and export. While declines in such situations often initially appear to be first-order (i.e., can be described by a half-life rate constant), they eventually change in rate, depending on the system character and circumstances. For example, reduction in the rate of decline of PCBs in Lake Ontario biota are thought to be related to a substantial reduction in PCB loadings to the point where the atmospheric contribution dominates the total loading and further declines are expected to be largely dependent on decreases in regional atmospheric PCB levels (Gobas et al., 1995).

Also, many contaminants exhibit half lives on the order of decades or longer when associated with anaerobic soils or sediments and, therefore, are reticent to degradation. This is important because pockets of such contaminants within the watershed or in buried sediments may be released when disturbed by storm events or human activity, adding a spike of "new" contaminant to the system and resetting to some degree the trend of decline. As another example, studies have found in some cases that a large percentage of the total contaminant load within a system exists in the biota and is recycled within the food chain. Because these contaminants may not interact with water, they would not be subject to the usual degradation processes that lead to declines and, thus, would not follow the first-order decay curve described by the stakeholders. Such cycling processes have been observed for PCBs in Puget Sound, Washington (biotic recycling) (O'Neill, 2009, personal communication) and for tributyltin associated with anaerobic sediment (Dowson et al., 1996).

While the Panel agrees with the stakeholders that continued conversion of agricultural lands is likely, the degree to which such conversions will reduce organochlorine input is not clear, and land use conversion may temporarily increase organochlorine inputs, especially during construction events followed by runoff. In addition, land use conversion may not affect all organochlorines equally, complicating the task of predicting future trends in organochlorine loadings. The extent to which agricultural soils will be disturbed in the future, the degree to which best management practices (BMPs) succeed in controlling solids, and the efficacy of sediment control mechanisms in the watershed are all sources of significant uncertainty.

Interannual variation in rainfall and sediment loading add an important episodic aspect to the delivery of organochlorines to the Newport Bay.

Thus, the Panel believes it is not appropriate or scientifically sound to extrapolate trends such as that observed in Newport Bay into the future, especially to an endpoint of complete elimination. At some point in the decline, one or more factors (such as internal system recycling, airborne input from outside the watershed, or input via biological transport of contaminated organisms) will decrease the rate of decline, and may cause a long-term phase of little or no decline. Episodic events may disrupt the trend by increasing inputs to the system, as existing data suggests has happened in the past. Without a detailed mass balance model for each contaminant of concern in Newport Bay, it is not possible to begin to estimate future contaminant levels in the Newport Bay. However, it is highly unlikely that the simple first-order decline present in the earlier part of the time period will continue indefinitely.

Recommendations

Given the uncertainty about the nature of any future trends in contaminant concentrations, the Panel does not believe that explicit expectations about future trends should be included in the TMDL targets based on currently available information. The Panel noted the high degree of instability in the system from dredging events and large storm-driven sediment inputs, as well as the potential that nonlinear cycling pathways could become increasingly important as levels decline from their historically highs. To better understand how information on trends over time could be used in the TMDLs, the Panel recommends the following:

1. Board staff should examine available trend data to determine if they can be interpreted equally well from different perspectives. For example, Figure 6 (taken from the stakeholders' presentation) suggests event-related increases in DDT levels in the late 1980s and again in the late 1990s. These could be associated with periodic increased loads from agricultural lands associated with stormwater or other disturbances, such as construction and changes in land use. Comparison with rainfall and sediment loading records would be useful in testing these possibilities. Such information would provide important insights that are missed by making simplifying assumptions about decay rates.

2. The Regional Board should include the development of mass balance models for each contaminant in its TMDL implementation workplan. These models should include major compartments in the system and be used to help evaluate the potential for the types of cycling described above. In addition, the Regional Board should investigate the potential that currently unidentified sources could become important as contaminant levels decline. For example, Blais et al. (2005) document the effects of migratory birds on DDT levels in Arctic lakes. This might be an important source of contaminant input as migratory birds and mammals feeding on the Palos Verdes Shelf (one of the most contaminated sites for DDT on the Pacific coast) could be depositing lipophylic residues into Newport Bay through spawning, defecation, or mortality, as observed in the Arctic.

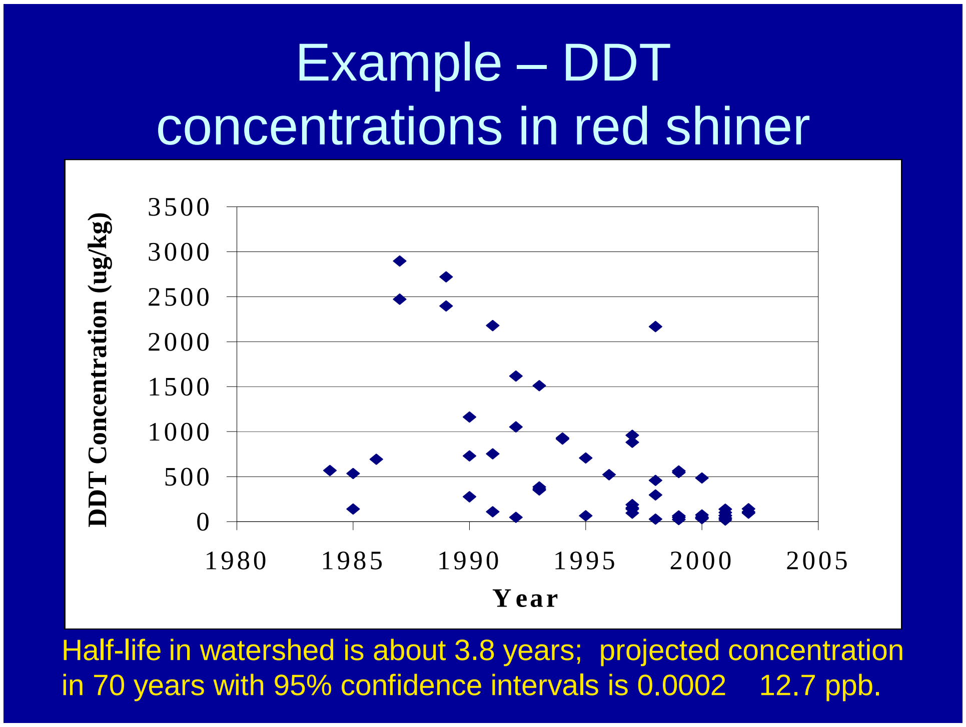

Figure 6. DDT concentrations in red shiner collected from San Diego Creek (Source: Stakeholder presentation at April 7, 2009, Panel meeting).

3. The Regional Board should expand tracking of trends by including one or more representative resident marine or estuarine fish in routine monitoring programs. If birds are the receptor of interest, then forage fish would be an appropriate target species for monitoring. This information should be combined with outputs from the mass balance models to improve understanding of how changes in contaminant inputs to the system, and contaminant cycling within the system, are reflected in tissue levels. As this understanding improves, it should be incorporated into the adaptive aspects of the TMDLs, which should allow targets to be periodically reevaluated as information and understanding improve.

6. Question 5

What are the recommended next steps to resolve any deficiencies, conflicts, or data gaps from questions 1 through 4?

Findings

The Panel's findings in response to questions 1 through 4 are that neither the TMDL targets nor the alternative targets proposed by stakeholders are consistently based on the most current science. While determining the appropriate level of protection of beneficial uses is, in part, a management decision, the Panel found that such decisions must be based on the best available science. Thus, the current targets are most likely not adequately protective, though determining whether they are over- or under-protective depends on applying the most current science to this question.

The Panel also found that there are alternative targets and methods available for use in the Newport Bay Watershed from a variety of federal, state, and academic research sources. Applying these to the Newport Bay Watershed will be challenging because of the non-equilibrium nature of this system, which is subject to a variety of sources of disturbance. As a result, the declining trends in tissue levels highlighted by the stakeholders cannot reliably be projected into the future.

Recommendations

The Panel has made a number of specific recommendations to address specific issues related to each of the four preceding questions. The Panel recommended an overall site-specific, risk-based approach that explicitly considers uncertainty, and safety factors. The Panel also recommended that this approach be designed to link water and sediment exposures to fish/invertebrate tissues and associated exposures to wildlife species of concern, and that it use well-accepted and peer-reviewed bioaccumulation and food chain modeling tools.

The Panel recommended specific data gathering and analysis efforts to develop the necessary inputs to the modeling approach. These efforts include additional monitoring studies within the Newport Bay system, as well as the review and application of data available from other sources. In addition to a better understanding of foodweb structure and bioaccumulation processes, data gathering and analysis should also focus on improving the understanding of historical trends and what factors might influence future levels of contaminants in sediments, water, and tissues.

More specifically, the Panel also recommended that the Regional Board consider its approach to human health risk assessment and make a management decision about whether to incorporate the benefits of fish consumption into its selection of sportfish tissue targets. While there is detailed guidance available from both OEHHA and U.S. EPA, current state policy provides the Regional Water Boards with substantial flexibility in their choice of overall approach to this issue.

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APPENDIX A: Panel Biographies

BROCK B. BERNSTEIN, PH.D. (Panel Chair)
Independent Consultant (Ojai, CA)

Brock Bernstein is an environmental scientist and consultant with broad experience in designing and evaluating environmental programs, structuring management and research initiatives, and developing policy. He has field research experience in a range of coastal and oceanic environments, and has also worked on a wide variety of management and policy issues, including the redesign of core compliance monitoring programs for major regional management efforts, the evaluation and/or development of regional assessment programs, and methods to improve fisheries management. In addition, he has served on numerous technical advisory and review committees, including several National Academy of Sciences panels on issues such as improving marine monitoring nationwide and improving the governance and management systems used to manage coastal and ocean resources.

MICHAEL FRY, PH.D.
Director, Conservation Advocacy
American Bird Conservancy (Washington, DC)

Michael Fry is an avian toxicologist whose research interests are in the effects of pollutants and pesticides on ecosystems, with a focus on wild birds. He received his doctorate at the University of California, Davis, where he then went on to become a research physiologist in the Department of Avian/Animal Sciences for 23 years before joining Stratus Consulting in 2003. Michael has been a panel member for the National Academy of Sciences on hormone active chemicals in the environment and has participated in toxicology reviews and international symposia for the Organization for Economic Cooperation and Development (OECD) and for the United Nations University in Japan. He has also served as a committee member for EPA and OECD in revising avian toxicity test methods and was a member of the U.S. EPA Ecological Committee for Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Risk Assessment Methods (ECOFRAM).

LYNN S. MCCARTY, PH.D.
Ecotoxicologist
L.S. McCarty Scientific Research & Consulting (Markham, Ontario, Canada)

Lynn McCarty is an ecotoxicologist with extensive experience in the area of risk assessment. An example of projects he has recently worked on include: the review of a risk assessment for a U.S. EPA new pesticide registration application for Valent USA Corporation; preparation of public comments on the EPA's draft “Considerations for Developing Alternative Health Risk Assessment Approaches for Addressing Multiple Chemical, Exposures, and Effects” for the American Chemistry Council; and an external review of Application/Uncertainty/Assessment Factor Proposals for Environment Canada. He has also served as an expert panelist for the

Strategic Projects Triage Selection Panel for Healthy Environments and Ecosystems (held by the Natural Sciences and Engineering Research Council of Canada) and Aquatic Life Criteria Consultative Panel (held by the EPA). In addition, from 1995 to 2003, he served as the Research Manager/Advisor to the Canadian Chlorine Chemistry Council, managing a research program with 38 projects and granting in excess of $2 million. McCarty received his Ph.D. in Biology from the University of Waterloo.

JAMES MEADOR, PH.D.
Fisheries Research Biologist
Ecotoxicology and Environmental Fish Health Program
NOAA National Marine Fisheries Service (Seattle, WA)

Since 1990, Jim Meador has served as a Fisheries Research Biologist of the National Marine Fisheries Service, a branch of the National Oceanic and Atmospheric Administration (NOAA). As an aquatic toxicologist, he studies the relationship between exposure to chemicals in the environment and the biological responses elicited. His interests range from environmental chemistry to the mechanisms of toxicant action. Meador has considerable experience studying aquatic organisms and has held positions at the Scripps Institution of Oceanography, Naval Ocean Systems Center, and Envirosphere Company. Among his honors, he received a NOAA Fisheries Bronze Metal in 2006 for innovative work with an interdisciplinary team on a complex Biological Opinion for ESA-listed salmonids and Paper of the Year for 2006 from the *Journal of Human and Ecological Risk Assessment* for the category of ecological risk assessment. He also serves as a review editor for the journals *Aquatic Biology* and *Marine Ecology Progress Series*. Meador received a B.A. in Zoology from Humboldt State University, M.S. in Biology/ Physiology from San Diego State University, and a Ph.D. in Aquatic Toxicology from the University of Washington.

CHARLES A. MENZIE, PH.D.
Principal Scientist and Director, EcoSciences
Exponent (Alexandria, VA)

Charles Menzie's primary area of expertise is the environmental fate and effects of physical, biological, and chemical stressors on terrestrial and aquatic systems. His expertise in chemical transport and fate includes organochlorine compounds, PAHs, benzene and other light aromatic hydrocarbons, chlorinated volatile compounds, phthalate esters, petroleum hydrocarbons, metals and cyanide compounds. Menzie has worked at more than 100 sites and has been involved in approximately a dozen natural Resource Damage Assessment (NRDA) related cases. He is recognized as one of the leaders in the field of risk assessment and was awarded the Risk Practitioner Award by the Society for Risk Analysis. Menzie has taken the lead in developing guidance documents for industry and government, and helped draft the ASTM Standard for risk-based corrective action (RBCA) for chemical release sites. In addition to his work on chemical risk-related matters, Menzie has developed and applied methods for identifying third parties who have contributed to contamination in aquatic and terrestrial environments.

DANIEL SCHLENK, PH.D.
Professor of Aquatic Ecotoxicology
University of California, Riverside (Riverside, CA)

Daniel Schlenk is Professor of Aquatic Ecotoxicology in the Department of Environmental Sciences at the University of California, Riverside. He has taught courses at both undergraduate and graduate levels, including *Fundamentals of Toxicology* and *Biotransformation of Organic Chemicals*. His research focuses on understanding the biochemical factors that influence susceptibility to environmental and natural chemicals. One example of his current research involves the identification of environmental estrogens and other endocrine disrupting compounds in reclaimed water, wastewater, and sediments, using bioassays. In addition, Schlenk serves as Co-editor in Chief of *Aquatic Toxicology*, which publishes original scientific papers dealing with the mechanisms of toxicity in aquatic environments and the understanding of responses to toxic agents at community, species, tissue, cellular and subcellular levels. Schlenk received his B.S. from Northeast Louisiana University, and his Ph.D. from Oregon State University.

APPENDIX B: Meeting Agenda

NATIONAL WATER RESEARCH INSTITUTE

Independent Advisory Panel Meeting
County of Orange's Implementation of
Organochlorine Compounds TMDLs to Newport Bay

REVISED Final Meeting Agenda
April 7-8, 2009

Meeting Location	On-Site Contact:
Holiday Inn Costa Mesa	**Jeff Mosher (NWRI)**
3131 Bristol Street	Cell: (714) 705-3722
Costa Mesa, CA 92626	
Phone: 714-557-3000	

Meeting Objectives:

1. Review the overall charge to the Panel regarding the Organochlorine Compounds TMDLs process.
2. Review the Panel Scope and the specific questions posed to the Panel for review.
3. Present a range of information and comments on the data, assumptions, and methodology for the numeric criteria in the TMDL process.
4. Develop a set of findings and recommendations for the Panel's review of the alternative approaches in setting numeric targets.

Tuesday – April 7, 2009

8:30 am	Welcome and Introductions - Jeff Mosher (NWRI) - Brock Bernstein (Panel Chair)	
8:40 am	Panel Charge	Maryanne Skorpanich (County of Orange)
8:50 am	Overview of Watershed	Stuart Goong (County of Orange)
9:10 am	Organochlorines Compounds TMDLs for the Newport Bay Watershed	Terri Reeder (Santa Ana RWQCB)
10:30 am	**BREAK**	
10:45 am	A Critical Review of the TMDL Targets and Impacts of Organochlorines in the Newport Bay Watershed	Dr. Susan Paulsen (Flow Sciences) and/or Dr. Jim Byard (Consultant)

11:30 am	Risk Assessment Case Study of DDT in Newport Bay	Ben Greenfield (San Francisco Estuary Institute)
12:00 noon	**WORKING LUNCH (Panel members and attendees)**	
12:30 pm	Existing DDT Levels in Forage Fish in Upper Newport Bay	Jack Skinner (Back Bay Environmental Advocate)
1:00 pm	Sediment Chemistry and Toxicity - Sediment Quality Objectives	Steve Bay (SCCWRP)
1:45 pm	Panel Q&A	Brock Bernstein (Panel Chair)
3:00 pm	**BREAK**	
3:15 pm	Panel Deliberations – Closed Session	
5:00 pm	**Adjourn Open Session**	

Wednesday – April 8, 2009

8:30 am	Watershed Tour	
10:30 am	Panel Deliberations – Closed Session	Brock Bernstein (Chair)
12:00 noon	**Panel Working Lunch**	
2:00 pm	**Adjourn**	

APPENDIX C – April 7-8, 2009 Meeting Attendees

Panel:

- *Panel Chair:* Brock B. Bernstein, Ph.D., Independent Consultant (Ojai, CA)
- Michael Fry, Ph.D., American Bird Conservancy (Washington, D.C.)
- Lynn S. McCarty, Ph.D., L.S. McCarty Scientific Research & Consulting (Ontario, Canada)
- James Meador, Ph.D., NOAA National Marine Fisheries Service (Seattle, WA)
- Charles A. Menzie, Ph.D., Exponent (Alexandria, VA)
- Daniel Schlenk, Ph.D., University of California, Riverside (Riverside, CA)

NWRI:

- Jeff Mosher, Executive Director
- Gina Melin Vartanian, Outreach and Communications Manager

County of Orange:

- Amanda Carr
- Chris Crompton
- Stuart Goong
- Jian Peng
- MaryAnne Skorpanich

Irvine Company Consultants:

- James L. Byard, Ph.D., DABT, Consultant
- Susan C. Paulsen, Ph.D., PE, Flow Science

Southern California Coastal Water Research Project:

- Steve Bay

California Regional Water Quality Control Board:

- Wanda Cross
- Terri Reeder

State Water Resources Control Board:

- Chris Beegan

San Francisco Estuary Institute:

- Ben Greenfield

Back Bay Environmental Advocate:

- Jack Skinner, MD

RBF Consulting

- Larry McKenney

PBS&J/OC Great Park:

- Rosanna Lacarra

University of California Cooperative Extension:

- John Kabashima

City of Orange

- Gene Estrada

Newport Bay Naturalists & Friends

- Roger Mallett

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