10/25/06 BdMtg Item 10
303(d) List
Deadline: 10/20/06 5pm

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Heal the Bay

SANTA MONICA BAYKEEPER

NRDC
THE EARTH'S BEST DEFENSE

October 20, 2006

Chairwoman Doduc and Board Members
State Water Resources Control Board
1001 I Street
Sacramento, CA 95814

VIA EMAIL: commentletters@waterboards.ca.gov

Re: Comments on the September 2006 Draft "Revisions of California's Clean Water Act Section 303(d) List of Water Quality Limited Segments"

Dear Chairwomen Doduc and Board Members:

On behalf of Heal the Bay, Natural Resources Defense Council and Santa Monica Baykeeper we submit the following comments on the State Water Resources Control Board's ("State Board's") proposed update to the California Clean Water Act Section 303(d) List of Water Quality Limited Segments dated September 15, 2006 ("303(d) List" or "List"). We appreciate the opportunity to provide comments.

We strongly support many of the changes that were made to the 303(d) List in response to our January 31, 2006 comment letter and data submittal. Specifically, we support the State Board's decision to move 30 Santa Monica Bay beaches originally proposed for de-listing to the "Being Addressed" 303(d) List for indicator bacteria impairments. Clearly, readily available data that are routinely collected by local health departments strongly support this listing decision. Also, we are very supportive of the new trash impairment listings, especially for Compton Creek. Compton Creek Watershed is arguably the most visibly polluted watershed in Los Angeles County, if not the entire State. Further, multiple lines of evidence support this listing such as Los Angeles County Public Works and Heal the Bay trash collection data. In addition, we support the State Board's recommendation to maintain listings for Dominguez Channel, Dominguez Channel Estuary and Los Angeles River Estuary for DDT and Los Angeles/Long Beach Outer Harbor for PCBs. In addition to readily available data that indicate impairment, historical information clearly suggests that these areas are highly contaminated.

However, we have significant remaining legal and technical concerns with the State's failure to list a number of impaired waterbodies. For instance, the failure to list 45 statewide beaches as impaired by bacteria indicators is an egregious mistake. This concern and others are outlined below and discussed in more detail in our January 31, 2006 comment letter ("comment letter"), which is incorporated herein by reference and is included in Appendix A of this letter. Also as discussed in our previous comment letter, we have many overarching concerns with State Board staff's interpretation of the Water Quality Control Policy for

Developing California's Clean Water Act Section 303(d) List ("Listing Policy"). Several of our main concerns are revisited below, as the State's Response to Comments in Volume VI of the Staff Report ("Response to Comments") provided either no response or an inadequate response.

I. GENERAL APPLICATION OF LISTING POLICY

A. The State Board Should Consider All Readily Available Information.

We submitted multiple water quality datasets to the State Board in our comment letter, including extensive statewide beach indicator bacteria exceedance data, exotic species data and information for the Malibu Creek Watershed, Index of Biological Integrity data for Region 4, and several other datasets. However, the State Board apparently has not fully considered all of these data, as there are no fact sheets in the Staff Report based on any of the datasets specified above. The State Board provides a blanket remark in the Response to Comments for the majority of data submittals:

> "These comments address new data and information that was not readily available to State Water Board staff before the draft recommendations were released or focus on previous listings where data and information are not yet summarized. The completion of fact sheets for these data and information are being delayed until the next listing cycle to avoid further delay in the completion of the 2006 section 303(d) list and to avoid using data and information that may be only a subset of all data (I.e., to avoid bias). All the data and information provided was reviewed; however, priorities for using the data to prepare new fact sheets were established on the data sets that were already summarized in fact sheets." Response to Comments at 177.

From this generic response, it is impossible to distinguish among datasets that were reviewed by State Board staff and those given a lower "priority" and to interpret the reasoning behind these decisions. Regardless most, if not all, of these data were readily available to the State Board well in advance of our letter. For instance, statewide beach indicator bacteria data are collected by local health agencies and are readily available. In fact, Heal the Bay receives these statewide data on a weekly basis to support our Beach Report Card. Also State Board has this information in-house as part of the routine beach monitoring database that is maintained, in part, to meet reporting requirements of the U.S. EPA. In fact, State Board staff routinely rely on the Heal the Bay beach water quality database and their own database to make Clean Beach Initiative eligibility and funding decisions. Clearly, State Board staff failed to fully consider all readily available information.

The body of regulations and guidance that bear on 303(d) listing are unambiguous about the information that should be considered in making listing decisions: *all of it*. TMDL regulations state clearly that "[e]ach State shall assemble and evaluate all existing and readily available water quality-related data and information to develop the [303(d)] list."[1] Recognizing these principles, the Listing Policy clearly states that "all readily available data and information shall be evaluated." Listing Policy at § 6. The result of the failure to review

[1] 40 C.F.R.§ 130.7(b)(5).

all readily available data is that the List may, or may not, actually set forth the full extent of impaired waters. Moreover, in many instances staff proposes to delist or not list well-studied waters such as the statewide beaches Campbell Cove in San Mateo and Stillwater Cove in Monterey notwithstanding the availability of high quality data. The State Board should direct staff to adequately respond to all data submittals and evaluate data that were indeed readily available. (see January 31, 2006 comment letter for a detailed analysis of this issue.)

B. Narrative Standards Must Be Evaluated.

Staff is proposing to de-list several nuisance conditions, including excess algal growth, odor, taste, and foam, which are all covered under various narrative standards in the Basin Plans, on the basis that they are conditions, not pollutants. For instance, State Board staff is justifying the de-listing of several reaches on Arroyo Seco for excess algal growth by concluding that "...excess algal growth [is] considered a condition and not a pollutant, and it is uncertain if the growth data are backed by pollutant data...." Response to Comments at 48. Further, staff comments that "[t]he use of guidelines to interpret narrative standards is a precautionary approach. Evaluation guidelines are being used as a transparent surrogate for the narrative water quality objective to be used on in the listing process." Response to Comments at 14. This reasoning is inconsistent with both the CWA and Porter-Cologne Act, as well as the express terms of the Listing Policy, and is by no means "precautionary" on the side of water quality.

One of the main objectives of the CWA is to restore water quality so that all of the Nation's waterbodies are fishable and swimmable. 33 U.S.C. § 101(a). The narrative standards at issue are necessary to attain this important goal. Moreover, federal regulations explicitly state that narrative water quality standards should be assessed for the purpose of listing waters under Section 303(d). 40 CFR § 130.7(b)(3). The Porter-Cologne Act similarly acknowledges both narrative and numeric water quality objectives; the State and regional boards are charged with enforcing these objectives. Cal. Water Code § 13241.

Staff's proposed rationale for not listing nuisances because they are conditions rather than pollutants is erroneous. First, the State Board is contradicting themselves, as there are numerous examples of impairments based on narrative objectives that are included on the 303(d) List such as exotic species listings on the Cosummes River and the San Joaquin River. Also using staff's own terminology, the narrative water quality standards themselves describe a condition, not a pollutant. Presumably, these narrative standards exist because it is difficult to pinpoint one specific pollutant that causes these conditions under all circumstances. For instance, odor could be caused by algae or by petroleum or trash or a combination of factors including water temperature and flow. Regardless of the cause, it is a nuisance. Under staff's proposed approach, however, a segment would not be listed even though specific narrative standards are not attained whenever a pollutant(s) causing the problem cannot be precisely identified during the listing process. Plainly, nuisance conditions must be considered for listing on the 303(d) List. Thus, the State Board should evaluate narrative standards when making de-listing and listing decisions. (see January 31, 2006 comment letter for a detailed analysis of this issue.)

C. The Lack of Acceptable Evaluation Guidelines Should Not Be a Reason for De-listing and "Do Not List" Decisions.

Staff has made numerous de-listing or "do not list" decisions based on the assertion that there is no existing and/or acceptable evaluation guideline under the provisions of the new Listing Policy. For instance, the September 2005 draft 303(d) List proposed that Malibu Creek be added to the List as impaired by aluminum. However in the September 2006 draft 303(d) List, this decision was reversed, and the State Board offers the justification that "[t]here are 20 samples available but there is no applicable water quality standard available with which to assess them." Staff Report at 348. This general rationale is improper as these decisions are based solely on a "guess" that there is no impairment.

As an overarching premise, the Section 303(d) listing process should err on the side of protecting water quality and beneficial uses. These decisions to de-list or list because no guideline is available are not precautionary, as there is no scientific evidence or data indicating that water quality standards, including beneficial uses, are being attained. Given the nature of some of the chemicals with no apparent guideline – like DDT, a highly toxic, persistent and bioaccumulative compound – this proposed approach is not justified. Thus, the State Board should *not* de-list these waterbodies until such time as substantial information is gathered to indicate that water quality standards are being met. The TMDL development process offers numerous opportunities to assess appropriate load allocations and compliance schedules providing the flexibility to address constituents without guidelines. Also a situation-specific weight of evidence approach, outlined in Sections 3.11 and 4.11 of the Listing Policy, should be employed to evaluate potential listings and de-listings when there is no available guideline. (see January 31, 2006 comment letter for a detailed analysis of this issue.)

D. Situation-Specific Weight of Evidence Listing/De-listing Factors Must Be Considered.

The Situation-Specific Weight-of- Evidence Approach set forth in Sections 3.11 and 4.11 of the Listing Policy was included to cure well-understood legal and technical inadequacies in a the State Board's draft binomial-only listing policy. Board Members required that a weight of evidence approach complement the specified listing and delisting factors, acting as a "safety net" to ensure that all impaired waterbodies are included on the 303(d) List.

Apparently State Board staff is misinterpreting this language to mean that the weight of evidence approach does not have to be employed as a "check" when delisting appears appropriate under the specified delisting factors but would not be appropriate when all evidence is considered. In the Response to Comments, State Board staff remark that "[t]he situation-specific weight of evidence factors are not a 'safety net' but rather a separate factor to be used when data and information are available that cannot be evaluated clearly under the other listing or delisting factors." Response to Comments at 11.

Properly applying Sections 3.11 and 4.11 to listing and de-listing decisions is critical. Both of these sections of the Listing Policy require an evaluation of all available evidence under the situation-specific weight of the evidence process whenever there is any information that indicates non-attainment of standards. Together, these sections provide flexibility to allow the State to use its best professional judgment in listing and de-listing decisions so that it can meet Section 303(d) standards and submit impaired waters lists that EPA can approve. The need for this flexibility and judgment is highlighted by the fact that some well-known and obviously polluted waterbodies may not meet the specific requirements of the Listing Policy's other de-listing or listing factors. Similarly, the binomial table approach does not work in the absence of any quantitative data, yet there may be other information indicating impairment.

State and regional board staff thus need clear direction from the State Board that they are **required** to apply Sections 3.11 and 4.11 whenever there is any information indicating impairment regardless of the other factors, consistent with both the language of the Listing Policy and the intent of the State Board in including these sections. (see January 31, 2006 comment letter for a detailed analysis of this issue.)

E. <u>Sediment Chemistry Data Should be Evaluated under Situation-Specific Weight of Evidence</u>

Staff recommends *not* listing numerous water segment- pollutant combinations despite the fact that a sufficient number of samples exceeded the sediment quality guidelines. For instance, Army Corps of Engineer sediment data for zinc, copper, benzo(a)anthracene, and dibenzo-a,h-anthracene in Ballona Creek indicate an impairment exists. The number of exceedances for each of these constituents necessitates listing as required under Table 3.1 of the Listing Policy, and the sediment quality guidelines are exceeded by several orders of magnitude in some cases. However, State Board staff cites Section 3.6 of the Listing Policy for the decision to not list these waterbody-pollutant combinations. This line of reasoning is inappropriate, as sediment quality data are sufficient for listing decisions on their own merit.

Pollutants in sediment must be evaluated using a situation-specific weight of evidence approach under Section 3.11 of the Listing Policy. The magnitude of the SQG exceedance may also be considered in conducting this situation-specific weight of evidence analysis. The State Board therefore should require its staff and the regional boards to evaluate available sediment quality data using the Section 3.11 situation-specific weight of evidence approach, regardless of the availability of overall sediment toxicity data. (see January 31, 2006 comment letter for a detailed analysis of this issue.)

F. <u>The State Board Should Determine if Media Should be Specified on the 303(d) List.</u>

We outlined a case for listing Dominguez Channel for DDT in fish tissue in our comment letter. In Response, the State Board remarked that "[t] he Listing Policy does not support listing pollutants multiple times for different media." Response to Comments at 53. This comment is confusing, as there are numerous examples throughout the 303(d) List where impairments in one or more media are specified. For instance, Colorado Lagoon is listed as impaired for chlordane in tissue *and* sediment. Region 4 303(d) List at 10.

The inconsistency with respect to specifying media on the List could lead to problems in the TMDL development process. If only one medium is specified, some may infer that no other media are impaired for a specific waterbody-pollutant combination. Presumably, all pollution problems would be uncovered during TMDL development and this would not be an issue. However this inconsistency could lead to some confusion and misinterpretation of the actual impairment. Thus, the State Board should list all of the media known to be impaired.

II. BEACHES

A. Santa Monica Bay Beaches Bacteria Impairments

- **Pico Kenter Drain and Ashland Avenue Drain Should NOT be De-Listed.**

Although State Board staff correctly maintained the majority of Santa Monica Bay beaches on the "Being Addressed" 303(d) List for indicator bacteria impairments, there are two Santa Monica Bay beaches that are inappropriately proposed for de-listing: Pico Kenter Drain and Ashland Avenue Drain. In State Board's Staff Report, staff contends that "Pico Kenter Drain is an enclosed stormwater conveyance. Enclosed stormwater conveyance drains do not have designated beneficial uses in the Basin Plan, and therefore, no criteria apply to waters within the drain itself as such, should be listed as impaired." Staff Report at 413. The Staff Report provides an identical argument for the Ashland Avenue Drain. *Id* at 352. These statements are seriously flawed and demonstrate a general misunderstanding of these monitoring locations.

Indicator bacteria samples at these locations are collected at ankle-depth in the ocean wave wash, not within the storm drains themselves.[2] In fact the enclosed storm drain at Pico Kenter ends approximately 200 feet inland from the sample location (see photos and sample site description in Appendix B). The enclosed storm drain at Ashland Avenue terminates in the tidal zone. (see photos and sample site description in Appendix B). Clearly, the State Board has misconstrued the location of sampling. Moreover, readily available data collected in the wave wash exist that support retaining these two beaches on the 303(d) List as impaired by indicator bacteria. These data are attached in Appendix B. Thus, the State Board should maintain these listings for Pico Kenter Drain and Ashland Avenue Drain on the 303(d) List.

B. Statewide Beaches Bacteria Impairments

- **The State Board Should Add 45 Statewide Beaches to the 303(d) List.**
- **Ormond Beach (Oxnard Industrial Drain), San Buenaventura Beach (San Juan Drain), and Mission Bay Shoreline Should Remain on the 303(d) List.**

Readily available indicator bacteria data show that an additional 45 statewide beaches outside of Los Angeles County should be added to the 303(d) List and three beaches should *not* be de-listed. The data analysis was presented in Appendix 1-B of the comment letter submitted to the State Board in January. State Board staff responded to our data submittal by stating

[2] The word "drain" in the name of a sampling location does not mean that the sample is collected in the drain. This is simply a name that serves as a point of reference.

that "[a]ll of the data provided has been reviewed and fact sheets revised if the available data support keeping water body and pollutant on the list." Response to Comments at 169. However only four of the 49 beaches (Goleta Slough/Estuary, San Diego Bay Shoreline, Linda Mar and Huntington State Beach) have been added to the latest revision of the 303(d) List, and only one of the four beaches, Pacific Ocean Shoreline – Scripps HA, was maintained on the List. In fact it appears that these data were not even considered, as there are no fact sheets for these waterbody-pollutant combinations in the "Do Not List" section of the State Board's Staff Report. Fact sheets do exist for Ormond Beach and San Buenaventura Beach, but the evaluation only included data from 1999-2001.

The statewide beaches indicator bacteria data described above and presented in Tables 1 to 6 of Appendix 1-B of our previous comment letter demonstrate the need for numerous additional bacteria indicator listings and several maintained listings. For example, it is unconscionable to not list Swami's Beach in San Diego, an incredibly popular, yet still polluted beach. As these data were readily available to the State Board, as part of their routine beach monitoring database maintained by the State Board partially to meet reporting requirement of the U.S. EPA, and Heal the Bay provided an extensive data analysis to the State Board, these data should be included in the evaluation for the 2006 303(d) updates. As noted in Heal the Bay's *End of Summer Beach Report Card 2006*, water quality problems continue to exist at many of these statewide beaches. For instance, Stillwater Cove and almost half of the sampled locations on Mission Bay received failing grades (C,D, or F) based on data though September 30, 2006. Thus as highlighted in Appendix C, 45 statewide beaches should be added to the 2006 303(d) List as impaired by bacteria indicators, and the three beaches proposed for de-listing that are outlined above should be maintained.

III. OTHER POLLUTANTS

A. <u>Excess Algal Growth</u>

- **The State Board Should Maintain Excess Algal Growth Listings for the Waterbodies Outlined in Appendix D.**
- **The State Board Should Add Excess Algal Growth Impairment Listings for Calleguas Creek Reaches 7 and 12**

In our previous comments, we submitted data and other evidence in support of *not* de-listing fourteen water segments for excess algal growth impairments in the Los Angeles Region and adding two additional reaches to the List. However, none of these recommendations were endorsed by State Board staff in the latest version of the 303(d) List. Staff contend that "...excess algal growth is considered a condition and not a pollutant." Response to Comments at 58. Of note, State Board's response is inconsistent since certain algae listings are maintained. Many of the water segments proposed for the de-listing of algae do not have a nutrient listing such as Arroyo Seco Reaches 1 and 2 and Verdugo Wash Reaches 1 and 2. Thus, by removing the algae listings and not including nutrient listings, the State Board is in a sense ignoring a narrative water quality objective and a major water quality problem. Also as discussed above, the debate over whether or not algae is defined as a "pollutant" is a sidebar because narrative standards must be met through the 303(d) process regardless.

Anyone that has studied algae in riparian habitats will tell you that algal impairments can impact macroinvertebrate ecology and dissolved oxygen.

However, excess algal growth is, in fact, a pollutant. CWA Section 502(6) expressly defines "pollutant" to include "biological materials." 33 U.S.C. §1362(6). Courts also have held that biological materials, such as algae, can be considered a pollutant if they impair beneficial uses. *See Northwest Environmental Advocates v. U.S. EPA*, 2005 WL 756614 (N.D. Cal. 2005), see also *U.S. PIRG v. Atlantic Salmon of Maine* (D.Me., Aug. 2001) (citing *United States v. Hamel*, 551 F.2d 107 (6th Cir. 1977)) ("Courts have interpreted the definition of 'pollutant' expansively, stating that it 'encompasses[es] substances not specifically enumerated but subsumed under the broad generic terms' listed in Section 502(6)."). *U.S. PIRG v. Heritage Salmon Inc.*, Civil No. 00-150-B-C (D.Me. Aug. 28, 2001). Indeed, the definition of pollutant is 'meant to leave out very little.' " *Sierra Club, Lone Star Chapter v. Cedar Point Oil Co.*, 73 F.3d 546, 566-568 (5th Cir. 1996), *cert. denied*, 519 U.S. 811 (1996).

For those who have read the acclaimed *Los Angeles Times* 5-part series about the crisis in the world's oceans entitled "Altered Oceans," it would be difficult to conclude that excess algal growth is not a pollutant. (see Appendix E for attached articles). For these reasons and those outlined in our previous comment letter, the State Board should maintain the excess algal growth listings and include additional listings for Calleguas Creek Reaches 7 & 12. (see January 31, 2006 comment letter for detailed analysis of the proposed excess algal growth de-listings).

B. <u>Exotics Species</u>

- **The State Board Should List 18 Reaches within Malibu Creek Watershed as Impaired by Exotic Species.**

Heal the Bay presented the State Board with ample evidence as to the distribution of exotic invasive predator species and their impacts on the dwindling population of native aquatic species in the Santa Monica Mountains and Simi Hills. (see January 31, 2006 comment letter). Based on our analysis, we recommend that 21 water segments in the Malibu Creek Watershed be listed as impaired by exotic species. However, the State Board did not include any exotic species listings in Malibu Creek Watershed on the revised 303(d) List. In fact, State Board staff fails to address the exotic species data or analysis in the Response to Comments and Staff Report. Thus, it is unclear how the weight of evidence does not lead the State Board to propose these listings or if the State Board reviewed these data at all.

Of note subsequent to our January 31, 2006 comments, aquatic invertebrate surveys in the Malibu Creek watershed have confirmed the presence of the New Zealand mudsnail, an insidious exotic invasive species. Recent surveys conducted by Heal the Bay, the Santa Monica Bay Restoration Commission and UCLA have confirmed the presence of the mudsnail at 16 of 45 locations throughout the watershed. In particular, the mudsnail has been found in the following locations: Medea Creek, Las Virgenes Creek, Malibu Creek, Lindero Canyon Creek, and the Medea Creek outlet into Malibou Lake. The report released by Santa Monica Bay Restoration Commission and Heal the Bay entitled, " Santa Monica

Mountains New Zealand Mudsnail Survey" is attached in Appendix F. This is a potentially catastrophic invasion that has lead to CDFG and State Parks posting of warning signs at 40 locations in the Watershed. The presence of the mudsnail augments the already solid weight of evidence for including these waterbodies as impaired by exotic species. Mudsnails, a voracious algae eater and prolific breeder, out compete native macroinvertebrates for food and substrate, thereby greatly reducing biological integrity and threatening local fish and amphibians. Thus, the State Board has a legal and moral obligation to add the waterbodies outlined in Appendix F and those cited as impaired by the mudsnail to the 303(d) List as impaired by exotic species.

C. Biological Communities

- **The Index of Biotic Integrity ("IBI") Scores Should be Evaluated to Determine Biological Communities Impairment.**
- **IBI Scores Should be Used as an Additional Line of Evidence in the Listing/de-listing Process.**

Heal the Bay presented the State Board with Index of Biotic Integrity ("IBI") data compiled by California Department of Fish and Game, Los Angeles County, Ventura County and Heal the Bay, in Appendix 7 of the January 31, 2006 comment letter. These data show that biological communities in numerous waterbodies throughout Los Angeles and Ventura counties are severely impaired. In the Response to Comments, State Board staff indicated that "[i]n circumstances where bioassessment data and chemical data (with associated guidelines) were available, these data were reviewed under section 3.9 of the Listing Policy." Response to Comments at 57. However, State Board staff did not propose to add biological community impairments to the 303(d) List for any of the waterbodies outlined in the data submittal as having low IBI scores.

Water segments with IBI data in the poor and very poor ranges meet the listing factors in sections 3.9 and 3.11 of the Listing Policy. As an example, Malibu Creek is included on the 303(d) List for several impairments, including nutrients and sedimentation. This, along with 20 of 22 IBI scores from seven sites in the poor or very poor ranges is sufficient to indicate that Malibu Creek should be placed on the 303(d) List for biological impairment under Section 3.9. In addition, IBI scores can and should be evaluated using the situation-specific weight of evidence approach. Section 3.11 of the Listing Policy states that "if the weight of evidence indicates non-attainment [of water quality standards], the water segment shall be placed on the section 303(d) list." Listing Policy at 8. The IBI scores should be weighed heavily in conducting such an analysis. Biological integrity has been used for waterbody listing decisions at numerous locations across the nation for years. Thus, the State Board should evaluate IBI scores when making listing decisions and should add the water segments presented in Appendix G to the 303(d) List as biological communities impairment.

IV. CONCLUSION

Often regulatory agencies use the excuse of lack of "good science" as the rationale for certain environmental management decisions. In this case, we have provided the State Board with extensive, high quality datasets from reputable monitoring agencies, yet State

Board has ignored this information and regulatory requirements set forth in the Listing Policy. As a result there are numerous 303(d) listing decisions that are not protective of human health or aquatic life. These decisions call into question the objectivity of the listing/de-listing process itself and staff's decision making on which data to review and how to review the data.

We have provided more than enough high quality data to make listing decisions for fecal bacteria on beaches, algae in streams, invasive species, and biological integrity that will lead to the restoration of impaired beneficial uses. Heal the Bay, NRDC and Santa Monica Baykeeper urge the State Board to use this "good science" to make appropriate decisions to protect public health and aquatic life.

If you have any questions or would like to discuss any of these comments, please feel free to contact us. Thank you for your consideration of these comments.

Sincerely,

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January 31, 2006

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Re: Comments on September 2005 Draft "Revision of California's Clean Water Act Section 303(d) List of Water Quality Limited Segments"

Dear Mr. Wilson:

Heal the Bay, the Natural Resources Defense Council, and Santa Monica Baykeeper hereby submit the following comments regarding the State Water Resources Control Board's ("State Board's" or "Board's") proposed update to the CWA §303(d) list of impaired waters (the "2006 List" or "303(d) List") as presented in the Draft Staff Report Supporting the Recommended Revisions to the Clean Water Act Section 303(d) List ("Draft Revisions").

I. INTRODUCTION

Overall, we support the State Board's efforts in developing a more standardized and uniform approach for listing impaired waters in the State of California under CWA section 303(d). However, this approach must be fully consistent with the CWA and provide full protection of beneficial uses. In this regard, we have several technical and legal concerns with the State Board staff's proposed interpretation and application of the State Board's Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List ("Listing Policy" or "Policy") in developing this standardized approach for the 2006 List. These include numerous inconsistencies in the application of the Listing Policy, the failure to evaluate all readily available data and information, the improper reevaluation of prior listings for which TMDLs have already been adopted, an extremely narrow construction and use of the situation specific weight-of-the-evidence factors for listing and de-listing, and inadequate consideration of narrative standards. All of these concerns arise from an improper use or interpretation of the Listing Policy. As this is the State's first attempt at using and interpreting the new Listing Policy, these overall concerns can and should be resolved by the Board in issuing the final 2006 List.

With regard to Region 4 specifically, we support the proposed addition of 93 waterbody-pollutant segments in the Los Angeles Region (Region 4) to the 2006 List. However, we have numerous specific concerns regarding many of the 92 proposed de-listings in this region. Specifically, we are strongly opposed to an approach that allows de-listing waterbodies previously listed by the Los Angeles Regional Water Quality Control Board ("LA Regional Board") based on the rationale that (1) nuisances are not pollutants; (2)

adequate numeric guidelines do not exist; (3) an approved TMDL will result in the attainment of the standard; or (4) uncertainty associated with the original data (i.e. the data have been lost) without any showing at all of actual attainment with WQS. Notably, many of these problems can be remedied with an appropriate application of the situation specific weight of the evidence approach as intended by the Listing Policy.

Our comments are broken up into three sections. The first section addresses our general comments and concerns on the statewide interpretation and application of the Listing Policy. The second section addresses our specific concerns with numerous specific proposed de-listings for Region 4. The third section addresses a small number of additional listings that we believe should have been included in the Draft Revisions given the readily available data. Our specific recommendations are then summarized and set forth in a Conclusion section.

II. GENERAL APPLICATION OF LISTING POLICY

A. <u>The Proposed Retroactive Application of the Listing Policy Is Inappropriate and Improper</u>

The State Board should not apply the Listing Policy retroactively to reevaluate listings made prior to the adoption of the Policy, except in very limited circumstances. In its review, however, State Board staff appears to apply the Listing Policy retroactively in a much more wholesale manner using the new Listing Policy factors. Staff's proposed approach fails to recognize the substantial deference that must be given to prior administrative decisions and ignores the limited circumstances set forth in the Listing Policy for re-evaluating previous listings for de-listing.

1. <u>Failure to Give Substantial Deference to Prior Administrative Decisions</u>.

First of all, staff's summary review of prior administrative decision-making contravenes well-established legal principles, which require substantial deference and a presumption of correctness in reviewing previous agency decisions. *Fukuda v. City of Angels* (1999) 20 Cal.4th 805, 820-21 (agency decisions are presumed to be correct); *Santa Monica Chamber of Commerce v. City of Santa Monica* (2002) 101 Cal.App.4th 786, 739 (same); *see also Imperial Irrigation Dist. v. State Water Resources Control Bd.* (1990) 225 Cal.App.3d 548, 568 (holding that agency's interpretation of the Clean Water Act is due substantial deference.). Staff has failed to adhere to the legal presumption of correctness by ignoring the required standard of substantial deference and the corresponding high burden of evidence in evaluating the majority of the proposed de-listings.

The flaws in this approach are shown most acutely in staff's proposals to de-list waters for which TMDLs have already been developed and adopted. Given the necessarily summary nature of the State Board's review of the original listing decisions,[1] these

[1] Indeed, at the State Board hearing on the Listing Policy, the State Board's own counsel advised the Board that going back and second guessing previous decisions would be an extreme administrative burden on staff. SWRCB Hearing Transcript, Sept. 30, 2004.

proposals cannot be justified under basic administrative law principles. In the process of developing the TMDLs for these waters, the Regional Boards will have conducted a comprehensive re-evaluation of the water segments and the impairing pollutants and conditions in order to confirm the impairments and conduct source evaluations and pollutant targets. This re-evaluation would encompass all available information, including all new data and evidence regarding the waterbody. Indeed, during the TMDL development process, where the Regional Boards found a lack of data supporting an impairment caused by certain pollutants, they did not develop TMDLs for those pollutants in the waterbody. Given the comprehensive re-evaluation and analysis done during the TMDL process, it is not appropriate for the State Board to propose to de-list these same segments after performing only a summary re-evaluation of the original listing data as compared to the new factors. As described, the latter was a much less rigorous process. To the contrary, in order to reverse the administrative decision made by the Regional Board and approved by the State Board and USEPA, the State Board would have to meet a high burden of proof to show that the earlier decision was incorrect. The State Board has not done this here.

Staff is also proposing to de-list waterbodies if there are no approved guidelines under the new Listing Policy to evaluate the original data set, the original data was lost or anecdotal, or if the original data set does not meet all of the requirements of Sections 4.1 to 4.10 of the new Listing Policy. Again, the State Board must make a substantial showing in order to overcome the presumption of correctness that applies to the original regional board decision. Notably, staff has made certain express assumptions to avoid this recognized burden altogether. *See* Draft Revisions, Vol. I., Staff Report (hereinafter "Staff Report") at 11-12. This is a clear violation of the law. The State Board is required to provide substantial evidence in all cases to overturn prior agency decisions. Moreover, in most cases, the regional boards had sufficient evidence to place these water bodies on the 303(d) List when the original administrative decision was made. The regional boards are much more knowledgeable about their local waterbodies and local conditions than the State Board is or can be, particularly in the current process where State Board staff has been tasked with reviewing a huge amount of information for the entire state. Thus, it is not appropriate, or legal, for the State Board to propose to overturn these prior administrative decisions without providing substantial evidence to show that the earlier decision was not correct. This is a high burden, and in most cases, the State Board has not met it in the Draft Revisions.

Notably, during the process of adopting the Listing Policy, the State Board itself recognized this presumption of correctness and the regional boards' expertise in making prior listing decisions. Indeed, in adopting the Policy, the Board voiced its intent that *an affirmative showing of current attainment is required* before waters may be de-listed. SWRCB Hearing Transcript, Sept. 30, 2004. Specifically, Board Member Sutley clarified that it is not enough to simply state that the listing was made by mistake – the boards must affirmatively demonstrate a lack of **current** impairment. *Id.* ("If it's on the list…then you have to have some information that says that they [fish] are not dying now and that the waterbody is not currently impaired…."); *see also* discussion *infra* at section II.B. Again, this directive was not followed by staff in the proposed Draft Revisions.

2. The Listing Policy Allows Reevaluation of Prior Listings Only In Specified Situations.

The Draft Revisions also go well beyond the letter and intent of the Listing Policy. As discussed, staff has improperly engaged in a wholesale reconsideration of previous listings. This directly contravenes the letter and spirit of the State Board's own Listing Policy.

The Listing Policy is very clear on the issue of removing previously listed waters from the 303(d) List. Specifically, section 4 of the Listing Policy sets forth only three situations under which a listing may be reevaluated. Listing Policy at 11. The first is if the listing was based on faulty data, such as typographical errors, improper QA/QC or limitations in the analytical methods that would lead to improper conclusions as to the status of the waterbody, and the listing would not have occurred absent this data. *Id.* The second is if a water quality standard or objective has been revised. *Id.* The third situation is if any interested party requests a reevaluation of a particular listing. *Id.* The factors in 4.1 to 4.11 are to be used in such a reevaluation, but only if it is raised under one of these three specified circumstances. *Id.* By listing these specific situations, the Listing Policy prohibits any broader reconsideration of previous listings.

As stated above, the Listing Policy went through an intensive stakeholder and public process before it was finalized. As a result, a great deal of debate was involved in drafting each of its various provisions. Given this level of debate and participation, to read more into any provision than is expressly stated is a clear violation of the well-known canon of construction *expressio unius est exclusio alterius*—the expression of one thing ordinarily implies the exclusion of other things. *See In re J.W.* (2002) 29 Cal.4th 200, 209. Here, the specific situations were delineated in order to prevent a haphazard re-evaluation of prior listings with all of the attendant problems that have now in fact resulted from the application of the proposed wholesale approach. In an analogous situation, this maxim is applied where specific exemptions are set forth in a statute. In that situation, the canon forestalls a court from implying additional exemptions. *See Sierra Club v. State Bd. of Forestry* (1994) 7 Cal.4th 1215, 1230. That same maxim would apply similarly here – it forestalls the State Board from implying an authorization for a broader re-evaluation of prior listings based on its own initiative. The only time that a re-evaluation should be conducted is on a case by case basis pursuant to the three specific situations expressly set forth in the much discussed and debated Listing Policy. In the situation here, where the State Board is conducting this reevaluation *on its own initiative*, only the first situation applies (faulty data), as the Board has not proposed any de-listings due to revision of a water quality standard.

3. The Proposed De-Listing Approach Is Not Adequately Protective of Water Quality.

From an overall policy perspective, the proposed retroactive de-listing approach, in addition to being contrary to law, is not adequately protective of water quality for all of the same reasons set forth above. In addition, de-listing based on applying the new Policy retroactively provides a perverse incentive to **avoid** monitoring or collecting further data on currently listed segments where there is limited numerical data. California must provide incentives for additional monitoring, not dissuade it, if we are to fully characterize the condition of our waterways.

4. Conclusion.

Given all of the above, the Board should do the following:

(1) state that as a rule previous listings for which TMDLs have already been adopted should not be re-evaluated and overturned during the listing process and that this issue is more properly addressed as part of TMDL implementation;

(2) make clear that the Listing Policy should not be used retroactively to overturn prior listing decisions unless one of the three situations specified in the Policy exists and there is substantial evidence to demonstrate with a high degree of persuasion that the earlier decision was not correct (including an affirmative demonstration that the water is currently in attainment); and

(3) direct State Board staff to forego re-evaluating previous listings in this round and leave that task to the individual regional boards, who are more knowledgeable about their own local waterbodies and listing decisions, to implement during the next round of listing in 2008 in accordance with the above clarifications.

B. A Precautionary Approach Should Be Followed.

As an overarching premise, the Section 303(d) listing process should err on the side of protecting water quality and beneficial uses. The Precautionary Principle was endorsed at the United Nations Conference on Environment and Development in 1992 as an appropriate guideline in environmental decision-making.[2] This Principle encourages environmental managers to err on the side of caution, in order to ensure that neither human nor environmental health is compromised. *Id.* In implementing this approach, uncertainty should not be a valid rationale for inaction. *Id.*

In the 303(d) Program, the implications of a false negative (failing to list an impaired waterbody) are much worse than a false positive (listing a non-impaired waterbody), as the latter can be corrected early on in the TMDL development process, as indeed it has in many of the TMDLs completed to date. In contrast, a failure to list an impaired waterbody has potential impacts on human health and aquatic life. Where uncertainty exists, decisions should be made in favor of protecting water quality, as well as human health and the environment. Indeed, federal regulations and the Listing Policy itself favor listing of threatened waterbodies (those for which water quality is declining and for which water quality standards may not be maintained). 40 C.F.R. § 130.2(j); Listing

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[2] United Nations, Rio Declaration on Environment and Development, June 14, 1992, 31 ILM 874.

Policy at Sections 3.10 and 4.10. This is necessary to account for the antidegradation component of water quality standards. *Id.*

The State Board recognized the precautionary principle in adopting the Listing Policy in 2004. Significantly, the State Board intended that, as a rule, a strong evidentiary showing is required to remove waterbody/pollutant combinations from the 303(d) List. Again, this intent was also made clear during the final hearing adopting the Listing Policy where the Board voiced its intent that an affirmative showing of attainment is required before waters may be de-listed. SWRCB Hearing Transcript, Sept. 30, 2004. Specifically, Board Member Sutley suggested that it is not enough to simply state that the listing was made by mistake – the boards must affirmatively demonstrate a lack of **current** impairment. *Id.* Ms. Sutley further stated that she was "Okay with not adding [additional] language [to the Listing Policy] as long as we're all in agreement and that's the direction of the regional boards that you have to look at the current conditions as well [before de-listing]." *Id.*[3]

Yet, while staff appears to acknowledge this high burden in its Staff Report and in its Response to Comments on the Listing Policy,[4] it fails to apply it either in letter or in spirit throughout the proposed revisions. Staff Report at 12; State Water Resources Control Board, *Functional Equivalent Document: Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List* (2004) (hereinafter "FED") at B-158. To the contrary, the staff has applied a very lax standard, *i.e.* that a waterbody is clean until proven dirty, to proposed de-listing decisions (as well as listing decisions) in the Draft Revisions. No evidence that a waterbody is currently in attainment is provided to back up the majority of the proposed de-listings. The necessary burden is to demonstrate that the water quality standard is being met, not that there is insufficient information to show it is not being met.

For example, without any new evidence demonstrating attainment, the State proposes to de-list several waterbodies for pollutants or conditions that are not quantifiable or do not have numeric evaluation guidelines, or where original listings were based upon guidelines that are not approved under the new Listing Policy. Similarly, staff proposes to de-list segments for which there is some uncertainty regarding the original listing or the original data has been lost. This is inappropriate and improper. The Regional Board exercised its Best Professional Judgment in listing these segments originally. Notably,

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[3] At that point the Board discussed the fact, and staff agreed, that the situation-specific weight of the evidence factor must be considered in all listing and de-listing decisions, and the Board added new language to Sections 3.11 and 4.11 that says "providing any data or information <u>including current conditions</u> supporting the decision." *Id.*

[4] The State Board stated: "Using the balanced error approach, the delisting requirements are not more rigorous by design so the burden of proof is equivalent." FED at B-158. **The State Board did provide a higher burden for de-listing toxic pollutants** however: "The Policy has been modified to *require for toxicants that there be more certainty* when delisting because of the concerns about the expected impacts of these chemicals. The policy requires more data to remove a water body or pollutant from the list." *Id.* (emphasis added).

the use of BPJ is permitted under Sections 3.11 and 4.11 of the Listing Policy. There must be some affirmative proof that the waterbody is not impaired before de-listing on any of these bases.

Further, although there are no numeric standards or guidelines for some pollutants, narrative standards still apply. The State's Porter-Cologne Water Quality Control Act (Porter-Cologne") acknowledges both narrative and numeric water quality objectives. 40 C.F.R. § 131.3(b). Yet, in the majority of cases, staff has failed to present any data or information in the Draft Revisions to demonstrate that narrative standards are met in these water segments. The onus is on the State Board to demonstrate that these water segments are <u>no longer</u> impaired before removing them from the 303(d) List. Only where the State has affirmative and demonstrable knowledge that water quality standards are being attained and maintained should they remove a water segment from the list. The State Board must make this clear in reviewing the Draft Revisions and approving the 2006 List.

C. <u>Failures in Public Process.</u>

After more than two years of stakeholder negotiation, the Listing Policy calibrated a relationship between the State Board and regional boards designed to enable these agencies collectively to manage the workload involved in preparing the Section 303(d) list for a state as large as California. Just as important, the Listing Policy took into account the need to provide adequate public participation opportunities.

The Policy resolved these issues by providing for the regional boards to play a central role in the Section 303(d) process by (1) preparing the lists in the first instance, including the implementation of the Situation-Specific Weight of Evidence Listing Factor (Listing Policy at § 3.11); (2) holding public hearings; and (3) submitting proposed regional lists to the State Board for final review and approval. FED at B-167. One of the chief functions of the regional boards is to allow for detailed factual review of local water quality conditions; by contrast, the State Board role is as a final "check" on the entire process as well as to consider matters of statewide interest or significance. *Id.* ("the SWRCB approval process is the last stage of review.") This central role of the regional boards is conveyed not only by these provisions but also by the more than one hundred references to the regional boards in the FED and in the Listing Policy itself.

Nevertheless, in its first implementation of the Listing Policy, the State Board has turned these procedures on their head by eliminating regional board formulation and public consideration of lists, as well as the other basic structural steps carefully set forth in the Listing Policy. It is not difficult to connect this failure to follow the Listing Policy to the State Board's related failure to consider all readily available information, given the scope of this task in a state as large as California. Moreover, the related failure to implement a weight of the evidence analysis, as required under Section 4.11 of the Listing Policy, whenever evidence suggests non-attainment of standards, appears connected to the attenuated role played by the regional boards in making listing decisions in the first instance.

D. Failure to Consider All Readily Available Information.

1. General Legal Principles.

The body of regulations and guidance that bear on 303(d) listing are unambiguous about the information that should be considered in making listing decisions: all of it. TMDL regulations state clearly that "[e]ach State shall assemble and evaluate all existing and readily available water quality-related data and information to develop the [303(d)] list."[5] The regulations go on to mandate that local, state and federal agencies, members of the public, and academic institutions "should be actively solicited for research they may be conducting or reporting."[6] Furthermore, EPA's 2004 Integrated Guidance similarly states that "[a]ll existing and readily available data and information must be considered during the assessment process."

The regulations and guidance are even more explicit about not excluding data on the basis of age and sample size. The Integrated Guidance states clearly that "[d]ata should not be excluded from consideration solely on the basis of age,"[7] and "does not recommend the use of rigid, across the board, minimum sample size requirements in the assessment process."[8] EPA adds that "the methodology should provide decision rules for concluding nonattainment even in cases where target data quantity expectations are not met, but the available data and information indicate a reasonable likelihood of WQC exceedance."[9] As an illustration, EPA explains that "[w]hen considering small numbers of samples, it is important to consider not only the absolute number of samples, but also the percentage of total samples, with concentrations higher than those specific in the relevant WQC."[10] EPA applied these rules in its review of California's 2002 303(d) list, finding that "it is inconsistent with federal listing requirements for the State to dismiss a water from further consideration in the Section 303(d) listing process simply because a minimum sample size threshold was not met for a particular water body. This is particularly true . . . where the impairments are caused by toxic pollutants."[11]

2. Listing Policy Requirements

Recognizing these principles, the Listing Policy clearly states that "all readily available data and information shall be evaluated." Listing Policy at § 6. It further states that the "RWQCBs and SWRCB shall actively solicit, assemble, and consider all readily available data and information." *Id.* at § 6.1 (emphasis original); *see also* FED at B-142 ("If data and information is available, it is required that it be assessed.)"

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[5] 40 C.F.R.§ 130.7(b)(5).
[6] 40 C.F.R.§ 130.7(b)(5)(iii).
[7] 2004 Integrated Guidance at 23-24.
[8] *Id.* at 25.
[9] *Id.* at 26.
[10] *Id.* at 27. EPA refers the reader to Section D.6, page 47 last paragraph through page 50 of CALM for further discussion of this point.
[11] Letter from Alexis Strauss, U.S. EPA Region IX to Celeste Cantu, SWRCB (July 25, 2003).

Nevertheless, a review of the proposed List shows that the SWRCB has so far failed to implement these bedrock requirements. Board staff has admitted that perhaps as little as 25% of available data has, in fact, been reviewed. Moreover, staff circumscribed the set of data used to formulate the list by restricting it to a public solicitation that ended in June of 2004, eighteen months ago. *See* Staff Report at 4. The result of both of these actions is that the List may, or may not, actually set forth the full extent of impaired waters. Moreover, in many instances staff proposes to delist well-studied waters notwithstanding the availability of high quality data that contradicts staff's conclusions. Both of these results are at odds with applicable regulations, guidance, the Listing Policy—and the basic "safety net" policy rationale for Section 303(d).[12]

E. <u>The Listing Policy Is Not Being Applied as Intended.</u>

The State Board issued the Listing Policy in 2004 after a long public process. During the public process, almost every issue in the Listing Policy was subject to comment and debate by agencies, environmental groups and dischargers. Thus, the intent of the final Listing Policy was clear to all parties. Unfortunately, staff has not interpreted or applied certain aspects of the Listing Policy consistent with that intent. Notably, as most of these are concerns with regard to proposed de-listings, they can be resolved easily by the State Board declining to apply the Listing Policy retroactively.

1. <u>An Existing TMDL is Not A Valid Justification to De-list.</u>

Staff has used Section 2.2 of the Listing Policy improperly to de-list water quality segments where a TMDL has been adopted but compliance with water quality standards has not yet been established. Not only is this inconsistent with the CWA, which requires listing of all segments where water quality standards are not attained and does not contemplate de-listing waters at the time of TMDLs adoption, it was not the intent of Section 2.2. 33 U.S.C. § 1313(d); Listing Policy at § 2.2. Delisting must only occur when TMDL requirements are met and beneficial uses are attained.

Section 2.2 defines when a water quality segment should be <u>moved</u> from the Water Quality Limited Segments category to the Water Quality Limited Segments Being Addressed ("WQLSBA") category of the 303(d) List. Listing Policy at 3; FED at B-73 – B-74 . Nothing more. It was developed as an alternative to proposals either to de-list segments with a TMDL in place or to leave those segments on the main list until water quality standards are attained. As the CWA does not authorize the State to remove waters from the 303(d) List until water quality standards are attained,[13] the State chose to create a separate category on the list for these segments to distinguish them from segments still needing a TMDL. Listing Policy at 3. This is the sole purpose of Section

[12] Houck, Oliver A., *The Clean Water Act TMDL Program* 49 (Envtl. Law Inst. 1999).
[13] Section 303(d) of the CWA does not contemplate de-listing waters at the time that TMDLs are established. 33 U.S.C. §1313(d). Rather, Section 303(d) focuses solely on requiring TMDLs to result in the attainment and maintenance of beneficial uses. *Id.*

2.2, as confirmed by its placement in Section 2: *Structure of the CWA Section 303(d) List. Id.*

Staff, however, has taken Section 2.2 out of context and applied it in a way that essentially denigrates the entire purpose of that section. Basically, staff cites Section 2.2 to justify de-listing segments for which a TMDL has been adopted and approved by EPA but compliance with standards not yet attained, whenever a reevaluation of the data used for the original listing was insufficient to meet the new guidelines in the Listing Policy. This is wrong on many levels.

First of all, as discussed above, staff should not be reevaluating listing decisions for segments for which TMDLs have been adopted. Rather, for segments already listed, staff should focus solely on whether a TMDL has been approved by EPA for that segment. If so, the Listing Policy provides that it should be moved to the WQLSBA category. During the development of the Listing Policy, neither the State Board nor the public was contemplating using section 2.2 as a justification for de-listing segments for which a TMDL had been approved. Second, from a practical standpoint, it makes no sense to reanalyze the original information and decide that no listing, and thus no TMDL is required, when the State and EPA have obviously very recently re-analyzed all the information during the rigorous TMDL development process, and made a decision to develop and adopt a TMDL based on the fact that water quality standards were not being met.[14] The entire scenario belies logic.

Adding insult to injury, staff has based several of these erroneous de-listing proposals on the fact that there is *uncertainty* with regard to the original listing. *See e.g.*, Draft Revisions, Vol. II, Los Angeles Region 4 (hereinafter "Draft Rev. Reg. 4") at 206, 299. Obviously, the TMDLs that were developed by the Regional Boards and approved by the State and EPA have already addressed any uncertainty in reevaluating the data and including appropriate provisions in the TMDL to address any uncertainty.[15]

Again, the State Board should clearly state that if a TMDL has been adopted, but not yet fully implemented for a waterbody/pollutant, the original listing should not be reevaluated for de-listing during the 303(d) list update process. Instead, those segments should be moved to the WQLSBA category as directed by the Listing Policy.

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[14] It has been the state's practice to effectively de-list a pollutant by not establishing a TMDL if it discovers during the TMDL development process that the waterbody is no longer impaired for that pollutant. This certainly implies that the State believed that the waterbodies were impaired for those pollutants for which a TMDL was established during this process.

[15] In addition, basing a de-listing on a re-evaluation of the original data where a TMDL already exists for that segment will potentially weaken existing TMDLs by opening them up for argument that they should be reopened because the State has determined the segment is no longer impaired under the new Listing Policy.

2. Situation-Specific Weight of Evidence Listing/De-listing Factors Must Be Considered.

The Situation-Specific Weight-of-the-Evidence Approach set forth in Sections 3.11 and 4.11 of the Listing Policy was included to cure well-understood legal and technical inadequacies in a the SWRCB's draft binomial-only listing policy. *See* Environmental Caucus of the AB 982 Public Advisory Group Comments on SWRCB, "Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List" (2/18/04). Board Members required that a weight of evidence approach complement the specified listing and delisting factors, acting as a "safety net" to ensure that all impaired waterbodies are included on the 303(d) List. Both of these sections require an evaluation of all available evidence under the situation-specific weight of the evidence process whenever there is any information that indicates non-attainment of standards. Together, these sections provide flexibility to allow the State to use its best professional judgment in listing and de-listing decisions so that it can meet Section 303(d) standards and submit impaired waters lists that EPA can approve. For instance, Section 3.11 states

> When all other Listing Factors do not result in the listing of a water segment but information indicates non-attainment of standards, a water segment shall be evaluated to determine whether the weight of evidence demonstrates that a water quality standard is not attained. If the weight of evidence indicates non-attainment, the water segment shall be placed on the section 303(d) List.

Section 4.11 is, and was intended, to be a direct counterpart to Section 3.11. Thus, the Board inserted the exact same language in section 4.11 by simply substituting the terms de-listing and attainment for the terms listing and non-attainment.

> When all other Delisting Factors do not result in the delisting of a water segment but information indicates attainment of standards, a water segment shall be evaluated to determine whether the weight of evidence demonstrates that a water quality standard is attained. If the weight of evidence indicates attainment, the water segment shall be removed from the section 303(d) List. If warranted, a listing may be maintained if the weight of evidence indicates a water quality standard is not attained.

Listing Policy at 8. Unfortunately, SWRCB staff apparently is misinterpreting this language when it appears in Section 4 of the Policy to mean that the weight of evidence approach does not have to be employed as a "check" when delisting appears appropriate under the specified delisting factors but would not be appropriate when all evidence is considered.

Staff's interpretation is flawed. First, if the Listing Policy is faithfully implemented, staff's interpretation amounts to a distinction without a difference. Proceeding in a step-wise fashion through the biannual Section 303(d) process requires consideration of all readily available information as a fundament of the process. Even if staff believe (erroneously, as discussed immediately below) that delisting is appropriate without employing a weight of the evidence analysis under Section 4, the evidence available must in any case be considered under Section 3—it cannot be ignored without violating basic Section 303(d) principles. So, whether Staff employs the weight of the evidence approach under Section 4, or under Section 3, this analysis must be undertaken before a Section 303(d) list of impaired waters can be completed.[16]

Second, staff's interpretation of Section 4 is wrong, in any case. This interpretation would set a far less stringent standard for del-listing than to list waterbodies. This plainly was not the intent of the Board nor is it the standard set forth in the Listing Policy. *See e.g.,* Hearing Transcript, Sept. 30, 2004; FED at B-158 – B-159 (responding to the comment that "the burden of proof [for listing and delisting] is equivalent" by noting "this is true.") Second, if staff believes the language chosen in Section 4 of the Listing Policy fails to clearly reflect the underlying principle of the Listing Policy, staff need only read Section 4 along with Section 3 and in light of the well-documented intent of the State Water Board in approving the Listing Policy. *See e.g., Food and Drug Admin. v. Brown and Williamson Tobacco Co.* (2000) 529 U.S. 120, 133 ("the words of a statute must be read in their context and with a view to their place in the overall statutory scheme.") Notably, the SWRCB relies on the fact that the Policy employs adequate measures to assure that impaired waters are identified and placed on the Section 303(d) list in the first instance—and not improperly removed thereafter—as a basis of its approval and its related certification that "this policy will not have a significant adverse impact on the environment." Were staff to persist in contending that delisting is proper when evidence indicates impairment but specified listing factors are not triggered, these critical findings would have no basis and would be subject to challenge.

The need for this flexibility and judgment is highlighted by the fact that some well-known and obviously polluted waterbodies may not meet the specific requirements of the Listing Policy's other de-listing or listing factors. Similarly, the binomial table approach doesn't work in the absence of any quantitative data, yet there may be other information indicating impairment. Instead of acknowledging this flexibility, staff has improperly taken a very narrow and conservative interpretation of these sections to avoid utilizing them, even in situations where it is clearly warranted.[17] De-listings made in this manner

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[16] It would be far simpler for Staff to employ the weight of evidence approach before delisting under Section 4, but they could reach a provisional decision to delist under Section 4 and then analyze the same waterbody and the same information under Section 3 before completing the process. This would appear to be less efficient.

[17] An example demonstrates the point. Staff has proposed to de-list the Dominguez Channel and Estuary for DDT in sediment and tissue under Sections 4.5 and 4.6, based on the lack of an approved sediment quality guideline and fish tissue data from fish caught inside the Creek or the Estuary. This, despite the fact that (1) there are high levels of DDT in the sediment; (2) the Montrose Chemical Company, the former largest manufacturer of DDT in the world, was located in the upper Dominguez Creek watershed; (3) the Dominguez Channel is a known conduit and source for historical DDT contamination reaching the Los

would be clearly arbitrary and capricious in view of the totality of the information. State and regional board staff thus need clear direction from the State Board that they are **required** to apply Sections 3.11 and 4.11 whenever there is any information indicating impairment regardless of the other factors, consistent with both the language of the Listing Policy and the intent of the State Board in including these sections.

The State Board therefore should direct its staff and the regional boards on the appropriate application of section 4.11 of the Listing Policy to situations where any evidence exists to support retaining a listing even if the precise requirements of Sections 4.1 to 4.10 are not met or all of the required data sets do not exist. This is the only interpretation consistent with the Listing Policy as a whole and the recognized equal burden of proof applicable to both listing and de-listing decisions.

3. <u>Sediment Chemistry Data Should be Evaluated under Situation-Specific Weight of Evidence</u>

Staff recommends *not* listing numerous water segment- pollutant combinations despite the fact that a "sufficient number of samples exceeded the sediment quality guidelines." For instance, although six of twenty-four sediment samples in Los Angeles Harbor – Cabrillo Marina exceed the copper sediment quality guideline ("SQG"), which satisfies the required frequency for listing under the binomial distribution table, staff asserts that no listing should occur because there was no observed toxicity. Draft Rev. Reg. 4 at 371. Section 3.6 of the Listing Policy is cited as the basis for this decision. This line of reasoning is inappropriate.

Section 3.6 of the Listing Policy provides listing factors for water and sediment toxicity, but **not** for pollutants in sediment. In fact, there are no specific listing factors provided in Section 3 of the Listing Policy for pollutants in sediment. Listing Policy at 5-6. An exceedance of a SQG, in and of itself, is an indicator that water quality standards are not being attained. For example, ERMs are set at a chemical concentration above which adverse biological effects are frequently observed. Long, E.R., MacDonald, D.D., Smith, S.L., and F.D. Calder, Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments, *Environmental Management* at 19(1): 81-97 (1995). Thus, it is unfounded to require sediment *and* observed toxicity data before listing is considered.

Sediment quality data are sufficient for listing decisions on their own merit. As there is no specific section addressing this, pollutants in sediment must be evaluated using a

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Angeles Harbor; (4) this contamination has resulted in a Superfund Site directly offshore; (5) a fish consumption advisory exists for Los Angeles/Long Beach Harbor due to elevated DDT and PCBs; (6) other DDT listings are (rightly) retained for areas of the Los Angeles Harbor along with several new proposed DDT listings in the Harbor; and (7) there is existing fish tissue data from the Harbor with high levels of DDT. It is entirely unfounded to propose de-listing the Dominguez Channel and Estuary for this pollutant on the sole basis that no one has sampled any fish inside the Creek itself for DDT. Yet staff has made the erroneous interpretation that Section 4.5 overrides Section 4.11 and so its hands are bound and it must de-list. This is in direct contravention of both the language of the Listing Policy and the intent of the State Board in including Section 4.11.

situation-specific weight of evidence under Section 3.11 of the Listing Policy. The magnitude of the SQG exceedance may also be considered in conducting this situation-specific weight of evidence analysis. The State Board therefore should require its staff and the regional boards to evaluate available sediment quality data using the Section 3.11 situation-specific weight of evidence approach, regardless of the availability of overall sediment toxicity data.

Finally, staff has not interpreted or applied Section 3.6 of the Listing Policy consistently. For example, the Staff Report recommends to *not delist* the Los Angeles Harbor – Fish Harbor due to exceedances of the sediment quality guideline for PAHs in sediments, despite the fact that sediment toxicity has been determined to be "insignificant." State Board staff find that "it cannot be determined if applicable water quality standards are attained," so the listing is maintained. Draft Rev. Reg. 4 at 372. This analysis appropriately takes a more conservative approach to ensure water quality standards are attained. In another example, the Draft Revisions are very inconsistent with regard to sediment pollution in the Dominguez Channel Estuary. For instance, staff recommends listing pyrene, phenanthrene, chrysene, and benzo(a)pyrene given three lines of evidence: significant exceedance of SQGs, observed sediment toxicity, and observed impacted benthic community. However, staff recommends not listing other constituents such as copper and benzo[a]anthracene in the same estuary despite a significant number of exceedances of SQGs. The observed toxicity in the Dominguez Channel Estuary should be included as a line of evidence supporting listing for these latter pollutants. The State Board should ensure that it maintains consistency in its interpretation and application of the Listing Policy.

4. <u>Lost or Anecdotal Data</u>

Staff also has made express unilateral assumptions that go beyond the Listing Policy. For instance, on pages 11-12 of the Staff Report, staff provides a list of assumptions, *in addition* to those contained in the Listing Policy, which it used to evaluate potential de-listings. Staff Report at 11-12. These additional assumptions include de-listing previously listed segments if "data or information justifying the original listing was anecdotal" or "data or information to support the original listing simply does not exist." Staff's support for this is the following: "This approach was used to *avoid requiring a large burden of proof to delist* a water body pollutant combination if the original listing was found to be baseless in terms of Listing Policy procedures." *Id.* (emphasis added). Significantly, this approach also illegally avoids the Listing Policy's requirement to show that the segment would not have been listed absent the faulty or non-existent original data. *See supra* section II.A.2.

The application of these additional assumptions is plainly in direct contradiction to the Listing Policy. These additional assumptions go well beyond the intent of the Listing Policy, which requires a high burden of proof for de-listing. As staff acknowledges, these factors in fact **negate** that required burden. Given that the regional boards must have had a justification for listing the majority of these waterbodies in the first place, substantial deference must be given to the original listing. A high degree of persuasion is necessary to overturn this presumption of correctness.

The State Board should remove these additional assumptions from the process. They constitute revisions to the Listing Policy and thus must be undertaken as part of a separate process to revise the Policy. The State Board also should clarify that in the absence of any new data showing attainment of water quality standards, these listings should remain on the 2006 List. They may be reviewed again by the regional boards in the next round of listing using Section 4.11, the site-specific weight-of-the-evidence approach.

5. Narrative Standards Must Be Evaluated.

Staff is proposing to de-list several nuisance conditions, including excess algal growth, odor, taste, and foam, which are all covered under various narrative standards in the Basin Plans,[18] on the basis that they are conditions, not pollutants. *See e.g.,* Draft Rev. Reg. 4 at 316. This is inconsistent with both the CWA and Porter-Cologne Act, as well as the express terms of the Listing Policy.

One of the main objectives of the CWA is to restore water quality so that all of the Nation's waterbodies are fishable and swimmable. 33 U.S.C. § 101(a). The narrative standards at issue are necessary to attain this important goal. Moreover, federal regulations explicitly state that narrative water quality standards should be assessed for the purpose of listing waters under Section 303(d). 40 CFR § 130.7(b)(3). The Porter-Cologne Act similarly acknowledges both narrative and numeric water quality objectives; the State and regional boards are charged with enforcing these objectives. Cal. Water Code § 13241. Accordingly, the FED sets forth guidelines for interpreting narrative water quality standards, and the Listing Policy provides for such listings in Section 3.7. FED at 75-78, B-120; Listing Policy at 6. Indeed, in response to a specific comment requesting that assessments based on narrative standards or other qualitative assessments be excluded from the Listing Policy, the State Board responded "Federal regulation requires that narrative water quality standards be evaluated and that waters be placed on the section 303(d) list if these waters exceed these narrative standards." FED at B-74. Plainly, nuisance conditions must be considered for listing on the 303(d) List.

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[18] The Los Angeles Basin Plan, like most Basin Plans, contains only narrative objectives for nuisances, including:

> "Waters shall not contain biostimulatory substances in concentrations that promote aquatic growth to the extent that such growth causes nuisance or adversely affects beneficial uses."
>
> "Waters shall not contain floating materials, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses."
>
> "Waters shall be free of coloration that causes nuisance or adversely affects beneficial uses."

LA Basin Plan at 3-8 and 3-9.

Staff's proposed rationale for not listing nuisances because they are conditions rather than pollutants is erroneous. Using staff's own terminology, the narrative water quality standards themselves describe a condition, not a pollutant. Presumably, these narrative standards exist because it is difficult to pinpoint one specific pollutant that causes these conditions under all circumstances. For instance, odor could be caused by algae or by petroleum or trash or a combination of factors including water temperature and flow. Regardless of the cause, it is a nuisance. Under staff's proposed approach, however, a segment would not be listed even though specific narrative standards are not attained whenever a pollutant(s) causing the problem cannot be precisely identified during the listing process. This too is erroneous, as determining the source(s) of the non-attainment is generally done during the TMDL development process, which may include such factors as seasonality and a margin of safety.[19] From a more practical standpoint, if narrative listings cannot be made, there may be no incentive to address the problem and investigate the source. The logical and appropriate way to address this is to list waterbodies for the nuisance condition where a narrative nuisance standard is not being attained. This is exactly what Section 3.7 does. Section 3.7 contains no requirement to list for a specific pollutant instead of a nuisance condition. Nor can it under the CWA. To the contrary, the express terms of Section 3.7 allow a segment to be listed for several nuisance conditions, including excessive algae growth, odor, taste or foam. Listing Policy § 3.7; *see also* testimony of State Board Legal Counsel, SWRCB Hearing Transcript, Sept. 30, 2004 ("When you know the pollutant, list the pollutant, if you don't know it, it doesn't mean don't list it...In fact, EPA has consistently held that its own regs [sic] require listing for unknown toxicity, low dissolved oxygen and other conditions like nuisance conditions. So we have no choice but to list for those conditions."). Thus, staff's proposed rationale that only pollutants may be listed must be rejected and relevant listings reassessed.

Staff also asserts that quantitative data is necessary for a nuisance listing. Again, this is erroneous. Translators for assessing narrative conditions are not limited to numeric objectives and guidelines. As acknowledged in Sections 3.7.1 and 3.7.2 of the Listing Policy, there are scientifically-accepted approaches to evaluating compliance with narrative objectives aside from comparison to numeric guidelines. These include biological assessment approaches and the widely used and accepted reference system-based approach. Listing Policy at 6 ("Waters may **also** be placed on the section 303(d) list when a significant nuisance condition exists as compared to reference conditions...." (emphasis added)); *see also* FED at B-27. Further, with regard to nutrient-related conditions, section 3.7.1 expressly allows listing for nuisance conditions if "nutrient concentrations cause or contribute to excessive algal growth." *Id.* ("Waters may **also** be placed on the section 303(d) list ... when nutrient concentrations cause or contribute to excessive algal growth.") This is independent of any need to pinpoint whether the cause is nitrogen (N) or phosphorous (P) or some combination of the two, to list either N or P, or whether there are applicable numeric objectives for N or P. Therefore, consistent with

[19] In addition, the majority if not all of the TMDLs passed to date in California also include some amount of study and pollutant/source characterization as part of their implementation, with reopeners provided in case new information comes to light.

the very language of the Policy, the State Board should clarify that Sections 3.7 and 4.7 should not be interpreted as narrowly as staff has done in the proposed revisions.

Further, where there is no quantitative data, the State and regional boards must evaluate the nuisance condition under Sections 3.11 and 4.11 based on all available information. The State Board acknowledged in its Responses to Comments on the Listing Policy that even if a nuisance does not meet the quantitative requirements for listing, the Policy "was amended to include a situation-specific weight of evidence listing or de-listing process by which Regional Boards can list or de-list any water body-pollutant combination even if it does not meet the listing requirements of the Policy as long as the decision can be reasonably inferred from the data and information." FED at B.27. This situation-specific weight of the evidence process is provided for in Sections 3.11 and 4.11 of the Listing Policy and, as discussed in Section II.E.2., *supra*, must be used when the other factors fail whenever there is *any* evidence of non-attainment.

6. <u>Lack of Acceptable Evaluation Guidelines</u>

Staff is proposing numerous de-listings based on the assertion that there is no existing and/or acceptable evaluation guideline under the provisions of the new Listing Policy.[20] This is improper for two reasons. First, this rationale is not included in the list of three situations in which de-listing may be considered. Listing Policy at 11. Second, this line of reasoning is inappropriate in the absence of any evidence indicating that the segment is in attainment with water quality standards. Once the water is listed, the substantial deference standard applies and a high burden of proof is required for de-listing. The assertion of this line of reasoning by the State Board also ignores the regional boards' own best professional judgment and the precautionary principle.

In short, it is evident that these proposed de-listings are based solely on a "guess" that there is no impairment, with no scientific evidence or data indicating that water quality standards, including beneficial uses, are being attained. Staff admittedly made no attempt to obtain additional information or more recent data that would reveal whether or not the water segments are indeed in attainment. Given the nature of some of the chemicals affected – like DDT, a highly toxic, persistent and bioaccumulative compound – this proposed approach is not justified. As stated in the Federal regulations, "[The] State must demonstrate good cause for not including a water or waters on the list. Good cause includes…more recent or accurate data…" 40 C.F.R. §130.7. The burden of proof is squarely on the State to provide such data. It has not met that burden here.

The CWA and its implementing regulations cast a wide net to assure that water quality standards are met. This is apparent throughout Section 303(d) and its regulations, which require TMDLs to be established and also require a margin of safety where uncertainty is

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[20] Evaluation guidelines do exist for several of the pollutants said to have no guideline. For example, currently there is a National Academy of Science ("NAS") guideline for aldrin and dieldrin, an OEHHA guideline for chlordane, and an ERM guideline for DDT. It is unclear if these guidelines were used to re-evaluate the data.

present. 33 U.S.C. §1313(d). Given all the above, the State Board should direct staff to retain these listings as well until such time as substantial information is gathered to indicate that water quality standards are being met.

7. <u>De-Listings Should Not Be Made Based on New Standards for Evaluation Guidelines</u>

Finally, staff contends that several previous listings based upon Maximum Tissue Residue Levels (MTRLs) and Elevated Data Levels (EDLs) should be removed from the list because the new Listing Policy does not recognize these guidelines. This is another good example of how such staff's proposed retroactive application of the Listing Policy fails. Once again, this is not one of the three express situations in which previous listings may be re-evaluated under Section 4 of the Listing Policy. Moreover, staff has not provided any affirmative evidence that the waterbodies proposed for de-listing are not currently impaired under the situation-specific weight of the evidence standard or otherwise. Finally, the proposed approach again ignores the deference due to prior agency decisions.

Although MTRLs and EDLs are not permissible in data evaluations under Section 6.13 of the new Listing Policy, the Policy must be read as a whole. *See e.g., Food and Drug Admin. v. Brown and Williamson Tobacco Co.* (2000) 529 U.S. 120, 133 ("the words of a statute must be read in their context and with a view to their place in the overall statutory scheme.") It is another well-established canon of construction that courts must interpret a statute "'as a symmetrical and coherent regulatory scheme' [citation] and 'fit, if possible, all parts into an harmonious whole.'" *Id.* The same canon applies here, where the Listing Policy, a regulatory guidance document, is issued with an intent to provide regulatory guidance for consistent implementation of a section of the CWA. Following this principle in this case, it becomes clear that the regional boards are to consider the totality of the evidence using the situation-specific weight of the evidence factor in Section 4.11 before a waterbody may be de-listed for any reason. The State Board staff did not do this for proposed de-listings based on the previous use of MTRLs and EDLs. Thus, the de-listings proposed on this basis are inappropriate and improper.

Finally, the Precautionary Principle should be heeded where the constituents of concern have no other established guidelines, as is the case here. While previous guidelines may have associated uncertainties, they do indicate **potential** impairments in these water segments. For instance, EDLs are indicative of biological stress and impairment at the very minimum. Similarly, the Los Angeles Regional Board recognizes that "MTRLs have value as alert levels indicating water bodies with potential human health concerns." Los Angeles Regional Water Quality Control Board and U.S. Environmental Protection Agency, *Total Maximum Daily Load for Toxic Pollutants in Marina del Rey Harbor* (2005) at 13. As threatened waters must also be listed under Section 303(d), these waters should remain listed for this reason as well, particularly in the absence of affirmative evidence showing attainment of standards. Listing Policy at 7; 40 C.F.R. § 130.2(j).

In this vein, we also encourage the State Board to actively pursue efforts to develop new or revised guidelines. Once a new guideline is established, the water quality standard may be revised and the listing may be reevaluated properly. However, absent any new guideline or standard, and absent affirmative information to show that the water segment is not, in fact, impaired or threatened, it is inappropriate in the context of Section 303(d) to de-list previously listed segments based on staff's proposed rationale.

III. LOS ANGELES REGION 4

The following section describes in detail our concerns regarding the proposed de-listing of numerous waterbody-pollutant combinations in the Los Angeles Region (Region 4). For ease of reference, Table 1 provides a summary chart of the specific segments that should be retained on the list, along with the lines of evidence and the applicable sections of the Listing Policy.

REGION 4: DO NOT DE-LIST

Water Segment	Pollutant	Line(s) of Evidence	Listing Policy Section(s)
Arroyo Seco - Reach 1	Excess Algal Growth	1)Existing TMDL is not a valid justification; 2)Excess algal growth is eligible for listing	2.2; 4.11
Arroyo Seco - Reach 2	Excess Algal Growth	1)Existing TMDL is not a valid justification; 2)Excess algal growth is eligible for listing	2.2; 4.11
Ballona Creek	Cadmium (sediment)	Readily Available Data	4.6; 6.1.1
Ballona Creek	Silver (sediment)	Readily Available Data	4.6; 6.1.1
Burbank Western Channel	Excess Algal Growth	1)Existing TMDL is not a valid justification; 2)Excess algal growth is eligible for listing	2.2; 4.11
Calleguas Creek - all listed reaches	Excess Algal Growth	1)Existing TMDL is not a valid justification; 2)Excess algal growth is eligible for listing	2.2, 4.11
Calleguas Creek - Reach 4	Excess Algal Growth	IBI Data	4.11
Calleguas Creek - Reach 5	Excess Algal Growth	IBI Data	4.11
Calleguas Creek - Reach 9B	Excess Algal Growth	Readily Available Data	4.7; 4.11; 6.1.1
Calleguas Creek - Reach 10	Excess Algal Growth	Photographic Evidence	4.11
Calleguas Creek - Reach 13	Excess Algal Growth	Readily Available Data	4.7; 4.11; 6.1.1
Coyote Creek	Excess Algal Growth	1) Upcoming EPA Study; 2) Ammonia & Nitrate-Nitrogen listing may not address problem	2.2; 4.11
Dominguez Channel	DDT (sed&tissue)	1)SQG Exists; 2)Historical Knowledge	4.6; 4.11
Dominguez Channel Estuary	DDT (sed&tissue)	1)SQG Exists; 2)Tissue sample Exists; 3)Historical Knowledge	4.6; 4.8; 4.11
Los Angeles River - Reach 2	Nutrients (Algae)	1)Existing TMDL is not a valid justification; 2)Excess algal growth is eligible for listing	2.2; 4.11
Los Angeles River Estuary (Queensway Bay)	DDT (sediment)	1)SQG Exists; 2)Historical Knowledge	4.6; 4.11
Los Angeles/Long Beach Outer Harbor	PCBs (tissue)	1)Fish Consumption Advisory; 2)Historical Knowledge	4.8; 4.11
San Gabriel River - Reach 1	Algae	1)Upcoming EPA Study; 2)excess algae is a pollutant/condition eligible for listing	2.2; 4.11
San Jose Creek - Reach 1	Algae	1)Upcoming EPA Study; 2)excess algae is a pollutant/condition eligible for listing	2.2; 4.11
San Jose Creek - Reach 2	Algae	1)Upcoming EPA Study ; 2)excess algae is a pollutant/condition eligible for listing	2.2; 4.11
Verdugo Wash - Reach 1	Excess Algal Growth	1)Existing TMDL is not a valid justification; 2)Excess algal growth is eligible for listing	2.2; 4.11
Verdugo Wash - Reach 2	Excess Algal Growth	1)Existing TMDL is not a valid justification; 2)Excess algal growth is eligible for listing	2.2, 4.11
Abalone Cove, Bluff Cove, Hermosa, Malaga Cove, Malibu, Whites Point, Manhattan, Nicholas Canyon, Portuguese Bend, Puerco, Royal Palms, Carbon, Escondido, Inspiration, Las Tunas, Trancas, Venice, Topanga, Dockwiler, Will Rogers	Beach Closures/ Bacteria	1)Readily Available Data; 2)An existing TMDL is not valid justification to delist	2.2; 4.3; 6.1.1
La Costa, Lunada Bay, Point Dume, Sea Level, Flat Rock Point, Point Fermin, Point Vicente, Resort Point, Rocky Point, Torrance, Zuma	Beach Closures/ Bacteria	An existing TMDL is not a valid justification to delist	2.2, 4.11
Ormond, San Buenaventura	Bacteria Indicators	Readily Available Data	4.3; 6.1.1

Table 1: Water-segment/pollutant combinations that are proposed for de-listing but where the weight of evidence shows that they should remain on the 303(d) list.

A. Proposed De-Listings for Beach Closures

1. All of the Proposed Beach De-Listings in Region IV Should Be Rejected

- All Santa Monica Bay beaches should remain on the 303(d) List because they are covered under existing bacteria TMDLs.
- Readily available data indicate that the two Ventura County beaches proposed for de-listing should remain on the 303(d) List.

Staff proposes to de-list 31 Santa Monica Bay beaches that are currently listed for "beach closures." All 31 of these beaches are covered by existing Santa Monica Bay Bacteria TMDLs adopted in 2003-04, and thus it is not proper to reevaluate these listings as part of the 303(d) listing process. The State Board's proposal to de-list these beaches is not only inconsistent with the Listing Policy, it is just bad policy. Significantly, it adds unnecessary complexity to the TMDL implementation process, which is already addressing the issue of impairment and compliance for these beaches.

The Santa Monica Bay Beaches Bacteria TMDLs ("SMB TMDLs") explicitly address the issue of bacteria levels at each of the beaches proposed for de-listing, including provisions for monitoring of bacteria levels at these beaches and measuring compliance (*i.e.* attainment of water quality standards). Attainment of water quality standards therefore should be determined under the TMDL, which sets forth a procedure to accomplish this – not through the listing process. In addition, the first year of monitoring data under the TMDL has been compiled and does not indicate attainment. **The proper action in this case is to retain these beaches on the 2006 List until compliance is determined under the already adopted TMDLs.**

Notably, of these 31 beaches, only five are also listed for bacteria in addition to "beach closures;" the remaining 26 beaches would no longer be listed *at all* if staff's proposed changes are adopted. As all of these beaches are addressed in the SMB TMDLs, it is inappropriate to de-list them for this impairment. If the State Board is not comfortable with the term "Beach Closures" for these listings, it should simply replace this term with the term "Bacteria Indicators" on the List for the 26 beaches so affected. All 31 beaches then should be placed in the WQLSBA category as provided for in Section 2.2 of the Listing Policy.

Further, even though the 31 Santa Monica Bay beaches should not even be considered for de-listing in this process, as discussed above, readily available data exist to support retaining them under a bacteria listing in all cases except those few that are not currently monitored at all. Specifically, this data, summarized in detail in Appendix 1, Tables 1 and 2, show that bacteria standards are being exceeded pursuant to the requirements set forth in Table 4.3 of the Listing Policy. This is not new data, it is public data from 2000-2005. Thus, this is yet another line of evidence to retain these beaches on the 2006 List.

Finally, staff has proposed to de-list two Ventura County beaches for bacteria indicators. However, readily available data exist and are included in Appendix 1 of this letter, which support retaining both of these beaches on the 2006 List.

2. <u>The State Board Has Not Presented Valid Lines of Reasoning for De-Listing.</u>

Although all of the LA and Ventura County beaches proposed for de-listing should remain listed for the simple reasons set forth above, it bears mentioning that, in addition to ignoring existing TMDLs and available data, staff has applied its "proposed justifications" for de-listing inconsistently for the various beaches, causing a lot of confusion regarding what is supposed to be a transparent process. For example, staff sets forth three potential justifications for de-listing for "beach closures": (1) A TMDL has been developed and the implementation plan should result in attainment of the standard; (2) "It is not known if beach closure information is backed by coliform data;" and (3) "beach closures" should not be listed on the 303(d) List because "it is not a pollutant or toxicity." *See e.g.*, Draft Rev. Reg. 4 at 203. Depending on the particular beach, however, one, two or all three of these arguments are employed. The basis for this inconsistency is entirely unclear. Moreover, these proposed justifications, alone or together, are not valid lines of reasoning in these instances. Thus, the Draft Revisions do not provide any support for the proposed de-listings.

a. The Existence of a TMDL is Not a Valid "Line of Evidence" for De-listing.

In any case, the existence of an approved TMDL is not a valid "line of evidence" for de-listing segments under the Listing Policy. Further, staff's justification that "[a] TMDL has been developed and approved by USEPA and an approved implementation plan is expected to result in attainment of the standard," is flawed on its face. By the plain language of staff's statement, water quality standards will be met only upon *implementation* of the TMDL. This is not sufficient to de-list. Indeed, this is the exact reason that the State Board created the WQLSBA category in the Listing Policy.

It is also worth noting that the *only* "line of evidence" considered and weighed by staff in de-listing many of these beaches was the existence of the SMB TMDLs. The State has not provided any other evidence to demonstrate that these beaches are in compliance, only on an expectation of compliance at some date in the future. The implementation schedules under the SMB TMDLs range all the way up to 18 years for wet weather. Thus, water quality standards may not be achieved until this time. Section 2 of the Listing Policy makes clear that water quality limited segments that are being addressed by a TMDL should remain on the 303(d) List – in the portion of the list for WQLSBA. Water segments should be removed from this category only "if it is *demonstrated* in accordance with section 4 that water quality standards are attained." Listing Policy at 3 (emphasis added). This plainly does not include WQLS that "will attain water quality standards at some point in the future." Consistent with the Listing Policy and the CWA, the State Board must direct staff to retain the 31 beaches covered by the SMB TMDLs on the 2006 List until attainment is achieved.

b. Uncertainty in the Original Data or a Lack of Monitoring Data are not Viable Reasons for De-listing a Water Segment for Beach Closures.

While the 31 Santa Monica Bay beaches clearly should remain on the 2006 List for the reasons set forth above, we have additional concerns about the evaluation conducted by staff. For several beaches (again not consistently applied), staff maintains that, "[i]t is unknown if the beach closure information is backed by coliform data." Draft Rev. Reg. 4 at 203. This implies that the data or information that was originally used to support these listings is unknown or cannot be found. This should not be used as a basis for de-listing either.

Moreover, for the 31 beaches expressly covered by the SMB TMDLs, the LA Regional Board has already addressed this precise issue in developing the SMB TMDLs in 2002-03. For instance, the SMB TMDL Staff Report acknowledges that beach closures may result "from oil spills, vessel spills and in a few cases persistent elevated bacteria densities." LA Regional Board, *Total Maximum Daily Load to Reduce Bacterial Indicator Densities during Dry Weather at Santa Monica Bay Beaches* (2002) at 3. Further, the SMB TMDLs address monitoring and compliance measurement for these beaches. In contrast, the Staff Report provides no data to indicate the beaches are not impaired by bacteria, although beach bacteria data are readily available from numerous sources. Again, the de-listing process for segments covered by existing TMDLs should be done through the process set forth in the TMDL itself. This is consistent with the Listing Policy, the TMDLs, the CWA and the Precautionary Principle.

Another problem with this type of approach in general is that many beaches throughout the State are not monitored for bacteria in wet weather. Rainfall as a cause of high bacteria densities at beaches is well understood. In fact, AB411 even includes a wet weather health warning provision. However, instead of spending funds on monitoring, some county Health Departments simply post warnings at the beaches whenever there is rainfall above a certain amount. Thus, the use (water contact recreation) is impaired as the County is warning people to stay out of the water, but no bacteria data is being collected.[21] Given this, it may not always be possible to support the previous listings with quantitative bacteria data even though there is an impairment of uses. It is evident that the State Board either must place dry **and** wet weather monitoring information and programs at a much higher priority for funding if it is to adequately protect the health of the waters on which we all depend, or revise the Listing Policy guidelines for bacteria listings to take this into account.

[21] Under CWA, water quality standards consist of the designated uses of the navigable waters, the water quality criteria for such waters based upon such uses and an anti-degradation policy. 33 U.S.C. §1313(C); 40 C.F.R. Part 131; LA Basin Plan at 3-1. Therefore, an "impairment of a designated use" equates to the non-attainment of water quality standards.

c. De-listing on the Basis that the Term "Beach Closures" Is Not a Pollutant or Toxicity is Not Proper

The term Beach Closures was used to indicate an impairment of the beneficial use (water contact recreation) of the waterbody segments. If the State Board is not comfortable with this term, it should simply replace it with the term "Bacteria" or "Bacteria Indicators" on the 2006 List. As these beaches are all covered by existing Bacteria TMDLs, such a listing is justified. In addition, as shown above and in Appendix 1.A, there is data to support these listings as well.

B. <u>Excess Algae</u>

Staff proposes to de-list fifteen water segments in the Los Angeles Region which are currently listed for "excess algal growth," including several reaches covered under the already adopted Los Angeles River Nitrogen TMDL and Calleguas Creek Nitrogen TMDL. Staff proffers three arguments in support of these de-listings: (1) "excess algal growth" is not a pollutant; (2) qualitative information on excess algal growth is not sufficient to maintain these listings under section 3.7 of the Listing Policy; and, (3) in most cases, that a Nitrogen TMDL is in place for the segment. None of these proposed justifications are valid technically or under the Listing Policy. All of the water segments currently listed for excess algal growth should remain on the 2006 List.

1. <u>An Existing Nitrogen TMDL is Not a Valid Justification for De-listing Segments for Excess Algal Growth.</u>

In eleven of the sixteen proposed de-listings,[22] staff relies on just one line of evidence – that a nitrogen TMDL has been adopted for the water segment. As discussed above with regard to beach closures, an existing TMDL is *not* a valid line of evidence to de-list a segment under the Listing Policy. These 11 proposed de-listings should be rejected on this basis alone.

In addition, we are very concerned with staff's proposed reasoning that the LA River or Calleguas Creek Nitrogen TMDLs will adequately address excess algal growth in these segments. First, these two TMDLs, adopted in 2003, are still in the process of being implemented and water quality standards have not been attained. Second, the nitrogen targets in these two TMDLs are based on human health standards, not on levels necessary to prevent algal blooms and protect aquatic life, which are generally much lower. Third, many factors, such as sunlight, phosphate levels, pH, flow and others, can contribute to algal growth, not just nitrogen levels. Thus, addressing nitrogen alone is not likely to solve the algae problem. For all of these reasons as well, the existence of a TMDL for nitrogen is not sufficient to address excess algal growth in these segments. These concerns are discussed in more detail below.

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[22] These reaches are Arroyo Seco Reaches 1 and 2, LA River Reach 2, Verdugo Wash Reaches 1 and 2, and Calleguas Creek Reaches 4, 5, 9B, 10, 11, and 13.

a. Controlling Nitrogen May Mot Adequately Address Excess Algal Growth

Staff bases its proposed de-listings for excess algal growth in whole or in part on the erroneous assumption that future and existing nitrogen TMDLs will adequately address excess algal growth. This is incorrect for two reasons.

First, it is well established in the scientific literature that nitrogen is not the only factor contributing to algal growth. "Growth of algae in individual streams, or even reaches of streams, may be limited by N alone, P alone, N and P together, or some combination of other physical and chemical factors…." Busse, L., Cooper, S., Kamer, K., and Stein, E., Southern California Coastal Water Research Project, *A Survey of Algae and Nutrients in the Malibu Creek Watershed* (2003) at 412. In fact, the Technical Support Document prepared for the Calleguas Creek Nitrogen TMDL evaluates nitrogen and phosphorus data and concludes that "initial N:P calculations based on the CCCS data indicate phosphorus would be limiting over nitrogen in most of the watershed, if nutrients were the limiting factor." LA Regional Board, *Calleguas Creek Nutrient TMDLs* (2001). The Report also notes that "nutrients may not be the limiting factor in much of the watershed." *Id.* In short, the impacts of nutrients such as nitrogen and phosphorus on algal growth are complex and involve numerous factors, and often are waterbody or even reach specific.

This was demonstrated in Region 4 in a recent UCLA study which found that "the relationships between nutrients and algal or diatom cover differed in sunny versus shady sites. In shaded sites, algal cover was not significantly related to nutrient concentrations (*i.e.*, light appeared to be the limiting factor for algal growth), while diatom cover was positively associated with total phosphorus and negatively associated with total nitrogen. In contrast, in unshaded sites algal cover was significantly related to nutrient concentrations (positively with nitrogen, negatively with phosphorus), while diatoms were negatively associated with nitrogen only. Other variables associated with the abundance of algae or diatoms include nitrogen, temperature, pH, and conductivity." Ambrose, R.F., Lee, S.F., and S.P. Bergquist, *Environmental Monitoring and Bioassessment of Coastal Watersheds in Ventura and Los Angeles Counties* (2003).

Similarly, data collected in the Malibu Creek Watershed by Heal the Bay's Stream Team show that elevated phosphate concentrations contribute to excess algal growth. Stream Team data collected between the period of November 1998 and November 2004 are represented in Figures 1 and 2. As seen in Figure 1, algal cover in Malibu Creek consistently exceeds 30% when nitrate is <0.05 mg/l and phosphate is above 0.15 mg/l. While nitrate is the limiting nutrient in this case, it would be nearly impossible to get the nitrate level any lower. Thus, decreasing phosphate concentrations would be a more effective means to reduce algal cover. Graphical representation of Site 12 in Figure 1 illustrates a situation where elevated phosphate levels and low nitrate levels lead to excess algal growth in over 80% of the samples. In addition, as shown in Table 2, data collected at the Agoura Hills Reference Site and Las Virgenes Creek Reference Site show that conditions with low nitrates and higher phosphates produce excess algae. Given the complexity of the nutrient issue, it is more prudent to list a segment for excess algae than for nitrates or nitrates and phosphates. This will ensure that all potential factors are considered in the TMDL so that the algae pollution is cleaned up and narrative standards are attained.

Further, algal growth is often a better indicator of adverse effects on a waterbody than nitrogen concentrations, and is used as such by numerous environmental managers precisely because algal growth is sensitive to many environmental variables. For instance, the United States Geological Survey uses algae as an indicator in various studies due to the fact that "...as primary producers with rapid reproduction rates (days), attached algae would be expected to respond to physical and chemical changes in streams before macroinvertebrates or other fauna. Periphyton respond directly to many aspects of the stream environment that might be expected to change with land management practices including nutrients." U.S. Geological Survey, *USFS-USGS Algae Indicator Studies*, (retrieved November 21, 2005 from the World Wide Web: http://ca.water.usgs.gov/cgi-bin/influx/projectsapp.pl?preview=16). USEPA also recognizes algae as a biological indicator of watershed health. "By using algal data in association with macroinvertebrate and fish data, the strength of biological assessments is optimized." U.S. Environmental Protection Agency, *Biological Indicators of Watershed Health: Periphyton as Indicators*, (retrieved Nov. 21, 2005 from the World Wide Web: http://www.epa.gov/bioindicators/html/periphyton.html.)

In sum, staff is not scientifically justified in making a blanket assumption that a nitrogen TMDL will fully address excess algal growth in a water segment. The State Board should correct this in reviewing the Draft Revisions.

b. Nitrogen Targets in the LA River and Calleguas Creek in TMDLs Are Based on Human Health Standards and Thus Are Too High to Adequately Address Excess Algal Growth

In addition to the fact that addressing nitrogen alone is not sufficient to prevent excess algal growth, water quality targets established in the nitrogen TMDLs relied upon by staff are not protective of aquatic life uses. The target for total nitrogen in the LA River TMDL is 8 mg/l and in Calleguas Creek is 10 mg/l (nitrate plus nitrite). These levels are intended to address the drinking water standard of 8-10 mg/l nitrate plus nitrite, which is necessary to prevent toxicity to human infants (methemoglobinemia, also known as blue baby syndrome). They are not adequate to address aquatic life uses. This is illustrated by the current Nutrient TMDL for Malibu Creek, adopted by USEPA in 2003, which provides summer season water quality objectives of 1.0 mg/l total nitrogen and 0.1 mg/l total phosphorous. As seen in Table 3, data collected from Malibu Creek show that there are reaches with total N and total P concentrations below these targets that produce algal growth in excess of the nuisance limit of 30% coverage. Heal the Bay studied threshold values for nutrients and algal cover in Malibu Creek using an empirical reference site approach and found that "[p]eriphyton cover exceeded nuisance levels (*i.e.* 30% cover) whenever average nitrate concentration was greater than 0.1 mg/l or average phosphate concentration was greater than about 0.15 mg/l." S. Luce and M. Abramson, *Periphyton and Nutrients in Malibu Creek* (2004). Thus, even the low targets for nitrogen in that TMDL are inadequate to protect aquatic life. Other established nitrogen criteria for protection of aquatic life also are significantly lower. For instance, USEPA established CWA section 304(a) nutrient criteria specific to the Los Angles Region (Ecoregion III) of 0.38 mg/l total nitrogen and 0.022 mg/l total phosphorus for protection of aquatic life and recreation uses. USEPA, *Ambient Water Quality Criteria Recommendations: Rivers and Streams in Nutrient Ecoregion III* (2000) (EPA 822-B-00-016).

Clearly staff is not justified in relying on the existence of these Nitrogen TMDLs to address excess algal growth. The State Board should make a finding that this approach is not scientifically sound.

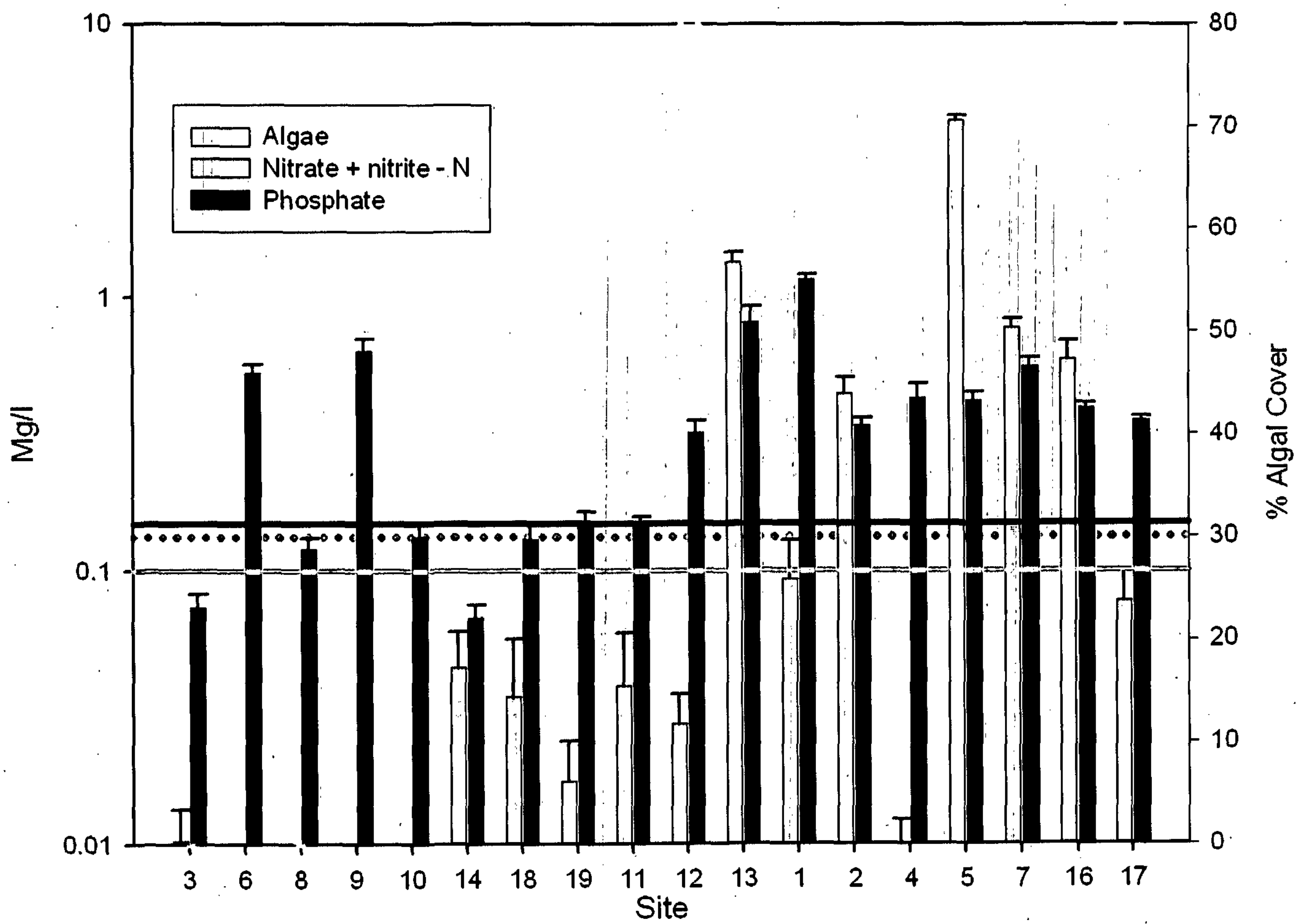

Figure 1: Malibu Creek dry weather nutrients and percentage of algae exceedances >30% coverage (11/98 – 11/04)

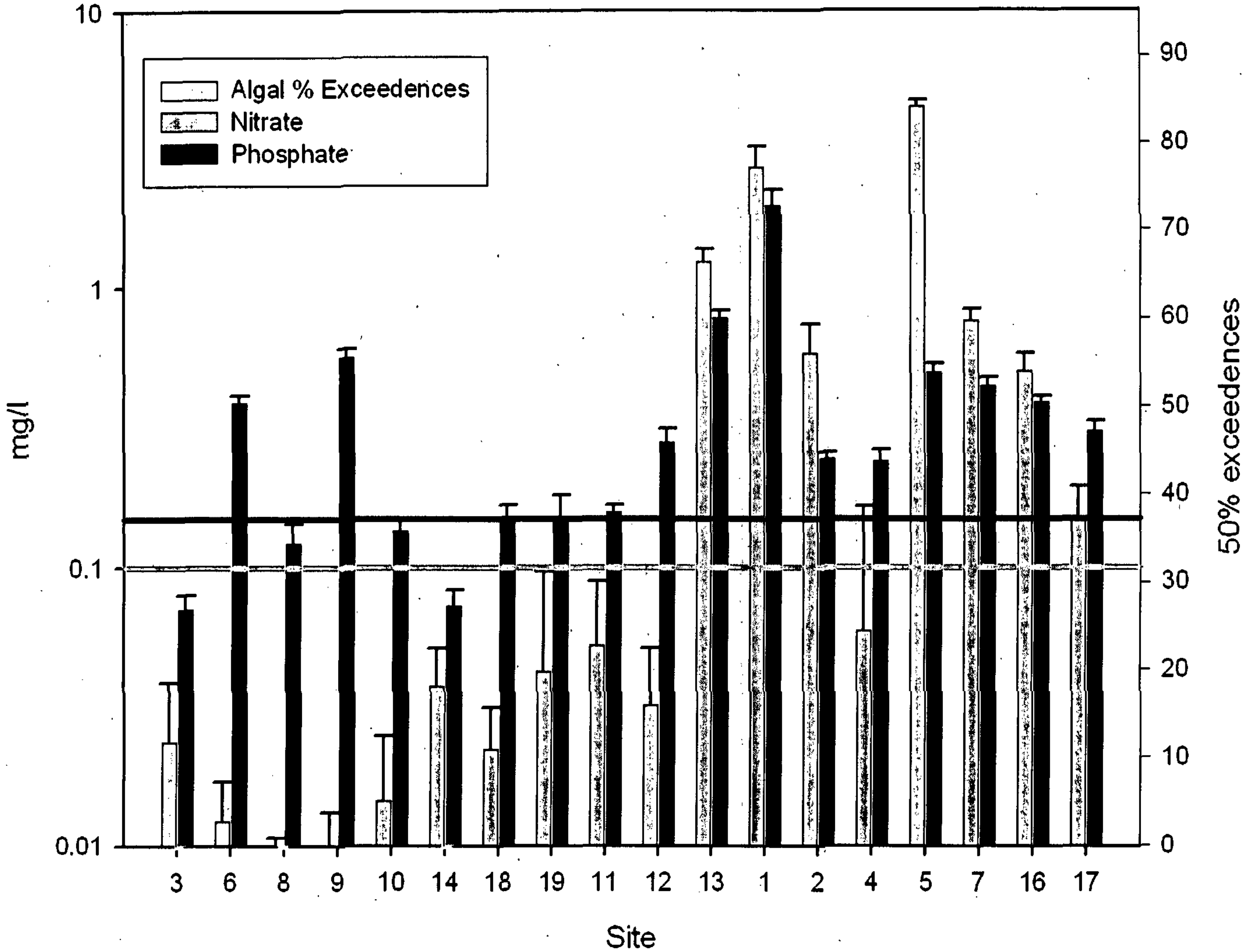

Figure 2: Malibu Creek average nutrients and percentage of algae exceedances >50% coverage (11/98 – 11/04)

	Agoura Hills (HtB - 6)			Las Virgenes Creek (HtB - 9)		
	4/7/2001	5/5/2001	4/6/2003	11/3/2001	1/5/2002	3/3/2002
NO_3+NO_2 (mg/l)	0.005	0.005	0.04	0.005	0.01	0.01
PO_4 (mg/l)	0.52	0.63	0.41	0.43	0.71	0.48
algal coverage (%)	85	100	45	65	95	95

Table 2: Data collected by Heal the Bay at the Agoura Hills and Las Virgenes Creek monitoring locations in the Malibu Creek Watershed.

	Solstice Creek (HtB - 14)				
	5/17/2003	6/1/2003	1/11/2004	8/7/2005	10/16/2005
NO_3+NO_2 +NH_3 (mg/l)	0.045	0.06	0.01	0.96	0.71
PO_4 (mg/l)	0.06	0.07	0.05	0.09	0.1
algal coverage (%)	35	35	32	46	42

Table 3: Data collected by Heal the Bay at the Solstice Creek monitoring location in the Solstice Creek Watershed.

2. Excess Algae is a Pollutant that Impairs Beneficial Uses.

Staff also contends that excess algal growth is not a pollutant, thus it should not be listed. As discussed in Section II.E.5, this assessment is incorrect. Narrative standards must also be met through the 303(d) process.

CWA Section 502(6) expressly defines "pollutant" to include "biological materials." 33 U.S.C. §1362(6). Courts also have held that biological materials, such as algae, can be considered a pollutant if they impair beneficial uses. *See Northwest Environmental Advocates v. U.S. EPA*, 2005 WL 756614 (N.D. Cal. 2005), see also *U.S. PIRG v. Atlantic Salmon of Maine* (D.Me., Aug. 2001) (citing *United States v. Hamel*, 551 F.2d 107 (6th Cir. 1977)) ("Courts have interpreted the definition of 'pollutant' expansively, stating that it 'encompasses[es] substances not specifically enumerated but subsumed under the broad generic terms' listed in Section 502(6)."). *U.S. PIRG v. Heritage Salmon Inc.*, Civil No. 00-150-B-C (D.Me. Aug. 28, 2001). Indeed, the definition of pollutant is 'meant to leave out very little.' " *Sierra Club, Lone Star Chapter v. Cedar Point Oil Co.*, 73 F.3d 546, 566-568 (5th Cir. 1996), *cert. denied*, 519 U.S. 811 (1996).

While algae is an important component of the aquatic ecosystem, in excess amounts, algae can cause problems ranging from low oxygen levels to serious human health concerns. For instance, "excess periphyton growth can lead to low dissolved oxygen levels and increased turbidity in the water column, which are harmful to fish and other aquatic life." S. Luce and M. Abramson, Heal the Bay, *Periphyton and Nutrients in Malibu Creek* (2004). In addition, "benthic macroinvertebrates may be affected when periphyton grows on stream substrates and covers important habitat." *Id.* Excess algae can also block sunlight, which in turn affects aquatic organisms. In addition, excess algae impairs other beneficial uses such as fishing, wading, boating, and aesthetic appreciation. Busse, L., Cooper, S., Kamer, K., and Stein, E., SCCWRP, *A Survey of Algae and Nutrients in the Malibu Creek Watershed* (2003) at 412. In some instances, outbreaks of toxic blue-green algae have even caused serious human health impacts. State Water Resources Control Board, *California Water News: Federal, Tribal and State Authorities Advise Caution on Dangerous Klamath River Algae* (retrieved Dec. 1, 2005 from World Wide Web: http://www.waterboards.ca.gov/press/docs/2005/05_019.pdf.).

Excess algal growth must be addressed as it may result in low dissolved oxygen levels as well as block sunlight, thereby affecting aquatic life uses. A recent study found extremely low night-time DO concentrations in areas of Malibu Creek with excess algae:

"All sites with flowing water and >30% algal cover had DO concentrations below reference condition values." Briscoe et al., *Pre-dawn Dissolved Oxygen Levels in Malibu Creek Watershed* (2005). Thus, currently established nitrate criteria, including those used in TMDLs, may not eliminate algal growth or address low dissolved oxygen levels that result from the algal growth. Clearly, consistent with the CWA and case law, excess algal growth must be treated as a pollutant under the Listing Policy.

Ironically, staff itself acknowledges that excess algal growth is a pollutant in other parts of the Draft Revisions. *See e.g.*, Draft Rev. Reg. 4 at 314 (listing excess algal growth as an example of a pollutant). Thus staff directly contradicts itself. In addition to proving our point, this is yet another example of inconsistencies in the Draft Revisions.

3. <u>Qualitative Information on Excess Algal Growth Can Be Linked to Scientifically Sound Evaluation Guidelines</u>

Finally, in proposing to de-list several of these segments, staff discounts available qualitative monitoring data that indicate non-attainment of beneficial uses, insisting that quantitative data are necessary to retain excess algal growth on the 303(d) List. Again, this assumption is flawed and inconsistent with the Listing Policy. For example, Section 6.1.4 of the Listing Policy provides for qualitative data submittals. Yet although four of five algae observations on Coyote Creek were adjudged by Los Angeles County Sanitation District monitoring staff as not supporting beneficial uses, this segment is proposed for de-listing because these data are subjective. Draft Rev. Reg. 4 at 263. This line of reasoning is inappropriate, particularly to de-list segments which were previously listed by the locally knowledgeable regional boards.

In addition, there are reliable quantitative methods to assess narrative water quality objectives. A peer-reviewed study conducted in 2000 developed algae cover guidelines for environmental managers to use in water quality assessments. B. Biggs, New Zealand Ministry for the Environment, *New Zealand Periphyton Guideline: Detecting, Monitoring and Managing Enrichment of Streams* (2000). This study determined that 30% is the maximum cover of visible filamentous algae that will support recreation and habitat. *Id.* Although this Biggs guideline was developed for the New Zealand Ministry for the Environment, the study's findings have been applied by water quality managers in the United States. During the development of the Malibu Creek Nutrient TMDL, for instance, the LA Regional Board recommended that waters with algae cover exceeding 30% in at least 10% of samples be considered impaired by algae. USEPA, *Total Maximum Daily Loads for Nutrients: Malibu Creek Watershed* (March 2002) at 14-15. USEPA agreed, stating, "We believe it was appropriate to apply the Biggs guidelines in the screening-level exercise entailed by the Section 303(d) listing process…." *Id.* The Biggs evaluation guideline meets the six criteria for an acceptable guideline outlined in Section 6.1.3 of the Listing Policy, and therefore, should continue to be used to evaluate algal impacts until such time as the State Board establishes new California-specific numeric criteria for determining algae impairment. Listing Policy at 20-21.

This guideline can be applied directly to the Los Angeles Region. A recent survey conducted in Malibu Creek is an example of how algae impairment has been quantified. Heal the Bay's Stream Team conducted a survey between November 2001 and June 2002 found that a total of 6.7 miles of the 9.79 miles mapped in Malibu Creek had 30% coverage or greater at least 10% of the time. Heal the Bay, *Watershed Assessment of Malibu Creek: Final Report* (2005) at 29. Figures 1 and 2 illustrate the extent of algal coverage in Malibu Creek. As seen in Figure 2, approximately half of the monitored sites have 50% or greater algal coverage over 50% of the time. Heal the Bay, *Stream Team Chemistry Data* (retrieved Dec. 9, 2005 from the World Wide Web: http://www.healthebay.org/streamteam/data/chem/.) Calleguas Creek and Los Angeles River water segments need similar quantification and therefore should not be de-listed until the Biggs guideline is met. Is the State suggesting, by failing to recognize any quantitative guideline such as the Biggs guideline, that reaches exceeding 90% algal coverage should not be acknowledged as impaired? Qualitative information can be assessed using the Biggs quantitative guidelines. This should be recognized in listing and de-listing decisions under the Listing Policy.

In sum, from both a legal and a scientific perspective, none of the proposed justifications for de-listing excess algal growth hold up to scrutiny. The State Board should acknowledge excess algal growth as a pollutant and maintain these listings on the 303(d) List.

4. <u>Quantitative Data Show That Calleguas Creek Reaches 9B, 10 and 13 Should Remain Listed and Reaches 7 and 12 Should Be Added to the List for Excess Algal Growth</u>

Although these reaches should remain listed for all the reasons discussed above, quantitative data also exist for some of these segments which were not evaluated by the State Board. For instance, the Draft Revision proposes to de-list Calleguas Creek Reaches 4, 5, 9B, 10, 11 and 13 for excess algal growth. Yet available evidence plainly shows an algal impairment. First, the staff report for the Nitrogen TMDL for Calleguas Creek specifically identifies algae as a "related effect" that also impairs these segments: "Beneficial uses that algae are most likely to affect in this watershed are aquatic life habitat (WARM) and recreational use (REC-1 and REC-2). Negative effects on aquatic life would result from low dissolved oxygen levels caused by excessive algal blooms, which would also be an aesthetic impairment to recreational use." Los Angeles Regional Board, *Total Maximum Daily Loads for Nitrogen Compounds and Related Effects: Calleguas Creek, Tributaries, and Mugu Lagoon Staff Report* (October 2002). This TMDL thus confirmed that excess algae is present and causing impairments. De-listing these reaches would not only be inconsistent with the TMDL, it would undermine the intent of the TMDL. These segments should not be de-listed until water quality standards are attained and maintained. Instead, they should be placed on the WQLSBA portion of the 303(d) List.

Second, data exist which show that reaches of Calleguas Creek and its tributaries are impaired by algal growth. In 2003, Ambrose et al. submitted a coastal watersheds monitoring study to the Los Angeles Regional Board. As seen in Table 4, data collected through this effort show algal coverage in several reaches of Calleguas Creek at levels greater than the Biggs guideline of 30% maximum algal coverage. Ambrose, R.F., Lee, S.F., and S.P. Bergquist, *Environmental Monitoring and Bioassessment of Coastal Watersheds in Ventura and Los Angeles Counties* (2003). Given these facts, reaches 9B and 13 should remain listed for algal impairments, and reach 12 should be added to the 303(d) List as impaired by excess algal growth. In addition, a doctoral candidate at UCLA, collected photographic evidence of algal impairments in 2000 and 2004. His photographs of Arroyo Conejo Canyon, Hill Canyon Treatment Plant Outflow, Long Canyon and Arroyo Simi at Royal Oaks plainly show algal growth in excess 30%.[23] Indeed, many of the photographs show coverage well in excess of 50%. *Id.* These sites are all located in reaches 10 and 7. Therefore, Reach 10 should remain listed, and Reach 7 should be added to the 303(d) List as impaired for excess algae. At the very least, under Section 4.11, the weight-of-the-evidence approach, these segments should clearly be on the 303(d) List. The State Board again should clarify that Section 4.11 should be used in situations such as this where there is overwhelming evidence to support the listing, even if it does not meet the strict quantitative requirements of Sections 4.1 to 4.10.

Location	**Reach**	**% algal coverage**
Calleguas at Deepwood	13	30
Calleguas at Deepwood	13	55
Oaks Mall	13	45
Oaks Mall	13	65
FC @ VentuPark Rd.	13	75
FC @ VentuPark Rd.	13	50
FC @ VentuPark Rd.	13	45
FC @ VentuPark Rd.	13	60
FC @ VentuPark Rd.	13	60
FC @ VentuPark Rd.	13	50
FC @ Young Rd.	12	40
Upper Wildwood	12	60
Leisure Village	9B	30
Leisure Village	9B	35

Table 4: Calleguas Creek Watershed algal growth data collected by Ambrose et. al in 2001. (*See* Appendix 3-A for full set of Calleguas Creek data collected in this study.)

[23] A selection of these photographs are included in Appendix 3-B.

5. San Gabriel River, Coyote Creek and San Jose Creek should Remain Listed for Excess Algal Growth.

The State Board proposes to de-list San Gabriel River Reach 1, San Jose Creek Reaches 1 and 2 and Coyote Creek for excess algal growth. This is inappropriate given the EPA/Tetra-Tech study currently underway. The Heal the Bay – EPA negotiated Consent Decree required completion of a TMDL addressing algal impairment in the San Gabriel River by 2005. Amended Consent Decree, *Heal the Bay et al. v. Browner* (1997). However, at the urging of EPA and the Los Angeles Regional Board, the parties extended this deadline to 2008. The purpose of the delay was to allow EPA additional time to conduct a study on the San Gabriel River and its tributaries looking at, among other things, the extent and magnitude of the algal impairment and the relationship between beneficial uses and algae. The study includes collecting data from monitoring sites on the San Gabriel River, San Jose Creek and Coyote Creek. It is therefore premature and improper to de-list San Gabriel River before this study is completed. Once the study is finalized in December 2006, the LA Regional Board will be in a better position to evaluate the listings, consistent with the study and the TMDL Consent Decree.

C. Ballona Creek

1. Uncertainty in the Original Data or Lost Data Is Not A Valid Justification for De-listing Without a Showing of Attainment of Uses

Staff proposes de-listing Ballona Creek for PCBs, cadmium, silver, ChemA, chlordane, DDT, dieldrin, and sediment bioassays for estuarine and marine water based on the statement that "it is *likely* that data from Ballona Creek Estuary were applied inappropriately to Ballona Creek." Draft Rev. Reg. 4 at 206-229 (emphasis added). Although the State believes a data mix-up was "likely," there is no solid evidence provided to support this assertion. Thus, the possibility remains that sediment samples were collected in the Creek itself. For instance, sediment monitoring has been conducted in sediment basins and other locations within Ballona Creek in past monitoring efforts, such as a 2003 study conducted by the Army Corps of Engineers. U.S. Army Corps of Engineers, Los Angeles District, *Marina del Rey and Ballona Creek Feasibility Study: Ballona Creek Sediment Control Management Plan* (2003). Through this effort, sediment samples were collected from twenty-four monitoring locations throughout Ballona Creek (see map in Appendix 4). Therefore, the State Board's unsupported assumption that because the data in question are sediment data they must be data from "soft-bottomed" estuary is not necessarily valid.

As the listings were made at the time the data were available, it should be presumed to be valid in the absence of any evidence to the contrary. No justification, legal or technical, has been provided for doing otherwise. In addition, the State Board intended that there also be a showing of current attainment before any waterbody-pollutant combination is removed from the list. This too was not done here.

Similarly, the fact sheets for silver, cadmium and sediment bioassays claim that "the data cannot be found that was used to list this condition." "Faulty data," as defined in Section 4 of the Listing Policy, does not apply to lost data. This is one of the assumptions that staff made on its own and which is not consistent with the Listing Policy. Thus, the State Board should retain these listings on the 2006 List. Although the data may have been lost, the Regional Board originally evaluated the data and ascertained an impairment. Given this, de-listing should only occur if the State can demonstrate that the impairment no longer exists. This was not done. As the State has not demonstrated that Ballona Creek is no longer impaired by these pollutants, these constituents should remain on the 303(d) List until data indicates, with certainty, that the waterbody is no longer impaired.

2. <u>Ballona Creek Estuary Should Be Listed For Cadmium, Silver, and Dieldrin.</u>

Staff hypothesizes that certain data were incorrectly applied to Ballona Creek although the samples were actually collected in the Ballona Estuary. If this is actually true, it is unclear why staff did not propose that the Ballona Estuary be listed as impaired for all of the pollutants proposed for de-listing in the Creek due to the alleged mix-up. The samples came from either the Creek or the Estuary. So one or both are impaired. The State Board cannot de-list these pollutants in the Creek on the basis of mis-location without then adding these pollutants to the list for the Estuary if that is where the data was taken The data should not be ignored altogether. The State Board-approved Ballona Creek Estuary Toxics TMDL, issued in 2005, appears to partially account for the data "mix-up" as a TMDL was developed for cadmium and silver in the Estuary. The Draft Revisions should reflect these listings as this TMDL evaluation was just done last year.

The adopted TMDL discounts the dieldrin tissue listing, however, stating, "these data sets are over 10-years old and may not reflect current conditions. Given the age of the data, the limited number of samples and the questions about the representativeness of the samples, we find that developing TMDLs based on fish or shellfish tissues is not warranted at this time." LA Regional Board and USEPA, *Total Maximum Daily Loads for Toxic Pollutants in Ballona Creek Estuary* (2005). This line of reasoning is inappropriate for a de-listing decision, as the Listing Policy does not include the age of data as a limiting factor. The State Board's Response to Comments on the Draft Functional Equivalent Document notes that "the age of data requirements have been removed from the Policy so that all relevant data and information can be used." FED at B-65. Further, the Draft Revisions claim that the dieldrin tissue samples do not exceed the allowable frequency for listing in Table 3.1 of the Listing Policy. This analysis is incorrect. The data should be evaluated using the De-listing Factors, since staff is asserting that the historical Ballona Creek listings were actually Estuary listings. Thus, the Estuary should be listed for dieldrin as well.

3. <u>Data Show that Cadmium and Silver Should Remain on the 303(d) List for Ballona Creek.</u>

Finally, as outlined above, due to the data *uncertainties*, Ballona Creek should also be listed as impaired by these pollutants until data is available to show that there is no impairment. Moreover, there are data known to be from the Creek sediments that show an impairment. The Army Corps of Engineers conducted sediment sampling in 1999 and 2001 in Ballona Creek in an effort to pinpoint sources of contaminants. Their results are summarized in the report, *Marina del Rey and Ballona Creek Feasibility Study: Ballona Creek Sediment Control Management Plan* (2003). As seen in Table 5 and Appendix 4, cadmium samples exceeded the ERM evaluation guideline once in a sample size of 26, and silver samples exceeded the guideline three times in a sample size of 26. Thus, in accordance with Section 4.6 of the Listing Policy, these pollutants should remain on the 303(d) List because only one exceedance is necessary for a sample size of 26 or below for the listing to remain.

			Station ID							
	Units	ERM	54	503	Sedimentation Basin - Downstream End	Ballona @ Madison	**Total Exceedances**	**Total Sample Size**	Exceedances to **not** be de-listed
Cd	mg/kg	9.6	ND	2.877	23.4	ND	1	26	1
Ag	mg/kg	3.7	5	3.769	ND	9.42	3	26	1

ND = not detected

Table 5: Sediment data from the ACOE report, *Marina del Rey and Ballona Creek Feasibility Study: Ballona Creek sediment Control Management Plan* (ACOE, 2004). (*See* Appendix 4 for full data set).

D. <u>Dominguez Channel, Los Angeles/ Long Beach Harbor and Los Angeles River</u>

1. <u>The Dominguez Channel, Dominguez Channel Estuary, and Los Angeles River Estuary (Queensway Bay) Should Remain Listed for DDT in sediments and Dominguez Channel and Estuary Should Remain Listed for DDT in Tissue.</u>

Staff maintains that there is no acceptable sediment quality guideline for DDT and thus proposes to de-list Dominguez Channel, Dominguez Channel Estuary and Los Angeles River Estuary (Queensway Bay) which are currently listed as impaired by DDT in sediments. This assertion is incorrect. A scientifically sound effects range-median (ERM) sediment quality guideline exists for DDT. Long, E.R., MacDonald, D.D., Smith, S.L., and F.D. Calder. (1995). Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments, *Environmental Management* at 19(1): 81-97. ERMs represent a concentration level above which toxic effects are often observed. These guidelines were derived from data collected from nearly 350 publications. *Id.* Subsequent to the initial study, the authors conducted an analysis of the predictive ability of the guidelines by evaluating a new set of data and found that "the incidence of highly significant toxicity in the amphipod survival tests among samples that exceeded individual ERMs and PELs generally agreed with the intent of these values." Long, E.R., Field, L.J. and D.D. MacDonald. (1998). Predicting Toxicity in Marine Sediments with Numerical Sediment Quality Guidelines, *Environmental Technology and Chemistry* at 17(4): 714-727. Specifically, the DDT ERM was found to be a reasonable predictor of sediment toxicity and was not an outlier in the group of chemicals assessed in the study. Id. A third study looked at an even larger data set and concluded that "the sediment guidelines can be used to reliably estimate the probability of acute toxicity in laboratory bioassays." Long, E.R., MacDonald, D.D., Severn, C.G., and C.B. Hong. (2000). Classifying Probabilities of Acute Toxicity in Marine Sediments with Empirically Derived Sediment Quality Guidelines, *Environmental Toxicology and Chemistry* at 19(10): 2598-2601. In addition, the Listing Policy specifically provides ERMs as an example of an "acceptable guideline" and does not exclude any specific ERM values. Therefore, the DDT ERM should be utilized in data evaluation of these and other waters of the State.

In addition, readily available data show that sediment toxicity has been observed in the Dominguez Channel and Dominguez Channel Estuary. The Draft Revisions reference a toxicity sample collected in the Estuary that showed 61% survival. Draft Rev. Reg. 4 at 72. Thus, there is observed toxicity in the Estuary. In addition, NPDES sediment sampling results for the Shell Los Angeles Refinery show observed toxicity at five monitoring locations in the Dominguez Channel (see Appendix 5).[24] Thus, in accordance with the State Board's interpretation of Section 3.6 of the Listing Policy, the Dominguez Channel and Estuary should remain listed for DDT in sediment because there is significant exceedances of the DDT SQG along with observed toxicity.

State Board staff also discount existing fish tissue data: "The tissue sample taken is not representative and the number of samples was insufficient to support the listing." Draft Rev. Reg. 4 at 290. This line of reasoning is inappropriate considering that the State Board's sport fish contamination monitoring program has been discontinued due to lack of funding and other monitoring efforts have not been undertaken. Not looking is not a justification for de-listing, especially where human health is concerned. As the data that do exist suggest an impairment, and it has already been listed previously in combination with all of the other factors listed at footnote 17, *supra*, the State Board should maintain this listing until additional monitoring clearly demonstrates that there is no impairment. This is entirely consistent with Section 4.11 of the listing Policy.

If this isn't enough, historical information clearly indicates that the Dominguez Channel and LA River Estuary should remain listed for DDT. Between the late 1950's to the early 1970's, Montrose Chemical Corporation released around 1,700 tons of DDT to the sewer system which discharged to the Palos Verdes shelf. Consequently, the Palos Verdes shelf is highly contaminated with DDT, and the area is now a Superfund site. Montrose also contaminated adjacent groundwater and soil with DDT. U.S.

[24] Of note, our interpretation of these data is conservative because we assumed that controls only had 90% survival when survival was likely 100%. Therefore, we interpreted anything under 70% survival as a violation instead of 80% survival.

Environmental Protection Agency, *Cleaning up the Palos Verdes Shelf*, retrieved November 9, 2005 from: http://www.epa.gov/region09/features/pvshelf/. Since the Montrose site is located in the Dominguez Watershed, the Dominguez Channel has acted as a conduit for much of the contamination and therefore, itself, has been greatly impacted. The Los Angeles River Estuary also received Montrose DDT runoff. Although DDT was banned in 1972, residual DDT remains in the environment and continues to impact organisms. DDT is a highly persistent compound in the environment that bioaccumulates in organisms and fish tissue. Birds become exposed through predation on contaminated fish. Eggshell thinning and embryo deaths have been attributed to this exposure. Humans may also become exposed to DDT by eating contaminated fish. Based on the historical contamination that has not been remediated to date and the persistent nature of DDT, it is inappropriate to remove the DDT listing for the Dominguez Channel without strong evidence of no impairment. This evidence does not currently exist.

This is a glaring example of the need for the situation specific weight of evidence approach set forth in sections 3.11 and 4.11 of the Listing Policy. Montrose Chemical Corporation, the largest producer of DDT in the world, contaminated the soil and nearby waterbodies. The contamination is so significant that the Palos Verdes shelf is now a Superfund site. The Dominguez Channel was a main conduit for much of the pollution reaching Consolidated Slip, and the Bay and most of San Pedro Bay are listed as impaired for DDT. Therefore, the weight of evidence strongly points towards maintaining the listings for DDT in the Dominguez Channel, Dominguez Channel Estuary and LA River Estuary.

2. Los Angeles/Long Beach Outer Harbor should remain listed for PCBs.

Staff proposes to de-list PCBs in Los Angeles/Long Beach Outer Harbor. This action is inappropriate given the fact that there is a fish consumption advisory due in part to PCB contamination. Interestingly, staff contradicts itself in this regard because other proposed listings are based solely on an advisory being in place. For example, staff proposes listing the Los Angeles Harbor – Cabrillo Marina for DDT stating, "An OEHHA fish consumption advisory has been established in this water body segment. Under section 3.4 of the Listing Policy any water body segment where a health advisory against consumption of edible resident organisms has been issued shall be placed on the section 303(d) list." Draft Rev. Reg. 4 at 94. The State Board should apply this reasoning consistently.

In addition, historical information supports this listing under the weight of evidence approach in Sections 3.11 and 4.11. Between the late 1950's and early 1970's, industries in the area discharged PCBs to sewers which discharged to the Palos Verdes shelf. Consequently, the Palos Verdes shelf is now a Superfund site for PCB and DDT contamination. The Palos Verdes shelf extends to Point Fermin, adjacent to the Los Angeles/ Long Beach Harbor. The Los Angeles River and Dominguez Channel were also a source of PCBs to San Pedro Bay. Since no clean-up has occurred to date, contamination still exists and the marine environment remains severely impacted.

Although the limited mussel data may not show guideline exceedances, the fish advisory is in place for a sound reason. PCBs are known to be highly toxic and persistent in the environment. These chemical compounds bioaccumulate in the fatty tissue of animals, and PCB exposure has been linked to serious health problems such damage to the immune system and cancer. Based on this historical knowledge and the scientific understanding that PCBs bioaccumulate, it is appropriate to maintain the PCB listing.

Based on all the available evidence, PCBs should remain listed in the Los Angeles/Long Beach Outer Harbor. The fish consumption advisory and historical knowledge provide the weight of evidence necessary to maintain the listing.

3. <u>LA Harbor Consolidated Slip Should Be Listed for Dieldrin in Sediments.</u>

The Staff Report proposes the de-listing of dieldrin in fish tissue in the Los Angeles Harbor Consolidated Slip. While this de-listing appears appropriate, the sediment data referenced in the first line of evidence appears to support the listing of LA Harbor Consolidated Slip for dieldrin *in the sediments*. This sediment data, obtained from the Contaminated Sediments Task Force, show 10 exceedances of the sediment guideline out of 38 total samples, which exceeds the allowable frequency listed in Table 3.1 of the Listing Policy. In addition, the Consolidated Slip is listed separately for sediment toxicity. Therefore, consistent with section 3.6 of the Listing Policy, the State Board should list the Los Angeles Harbor Consolidated Slip for dieldrin in sediments.

IV. <u>ADDITIONS TO THE 303(d) LIST</u>

The Listing Policy requires that "RWQCBs and SWRCB shall actively solicit, assemble, and consider all readily available data and information." Listing Policy at 17. Under Federal regulations, "each state shall assemble...all existing and readily available...data and information." (40 C.F.R. § 130.7(b)(5)). Upon review of certain data that are commonly referenced in Region 4, it appears that the State Board failed to obtain or analyze much widely available data. This lack of review has major implications on the content of the proposed 303(d) List. For example, as discussed in detail below, beach bacteria data collected by county health departments and ocean dischargers and posted weekly on Heal the Bay's website show that 7 beaches in Los Angeles County should be added to the 303(d) List. The fact that this data source was not evaluated is an egregious error and has major implications on the 303(d) List. In addition, the State Board proposes sediment pollutant de-listings in Ballona Creek, but the ACOE report discussed above includes data that support the listing. These examples of data that were not analyzed are an indicator of major problems with the State Board's data collection and review process. The data provided and discussed below should be evaluated by the State Board in this listing cycle, as it was readily available for analysis prior to the issuance of the Draft Revisions.

Region 4: ADD TO 303(D) LIST

Water Segment	Pollutant	Line(s) of Evidence	Listing Policy Section(s)
Ballona Creek Estuary	Cadmium (sediment)	Data Mix-up	
Ballona Creek Estuary	Silver (sediment)	Data Mix-up	
Ballona Creek Estuary	Dieldrin (tissue)	Data Mix-up	
Ballona Creek	Zinc (sediment)	Readily Available Data	3.11; 6.1.1
Ballona Creek	Copper (sediment)	Readily Available Data	3.11; 6.1.1
Ballona Creek	Benzo(a)anthracene (sediment)	Readily Available Data	3.11; 6.1.1
Ballona Creek	Dibenzo-a,h-anthracene (sediment)	Readily Available Data	3.11; 6.1.1
Calleguas Creek - Reach 7	Excess Algal Growth	Photographic Evidence	3.11
Calleguas Creek - Reach 12	Excess Algal Growth	Readily Available Data	3.7; 6.1.1
Compton Creek	Trash	1)Readily Available Data; 2)Photographic Evidence	3.11; 6.1.1
Dominguez Channel	Sediment Toxicity	Readily Available Data	3.6; 6.1.1
LA Harbor Consolidated Slip	Dieldrin (sediment)	Data Mix-up	3.6
Piru Creek, Unknown Creek, Revolon Slough, Unnamed Creek, Cattle Creek, Boulder Creek, Arroyo Conejo Creek, NF Arroyo Conejo Creek, Arroyo Simi Creek, Bouquet Canyon Creek, Beardsley Wash, Conejo Creek, Castaic Creek, Calleguas Creek, Santa Clara River, San Gabriel River, San Francisquito Creek, Simi Las Posas Creek, Tapo Canyon Tributary, Coyote Creek, San Jose Creek, Walnut Channel, Arroyo Seco, Compton Creek, Zone 1 Ditch, Los Angeles River, Ballona Creek, Madea Creek, Cold Creek, Dominguez Channel, Ventura River, Matilija Creek, Las Virgenes Creek, Malibu Creek, Triunfo Creek	Biological Communities Impairment	Readily Available Data	3.9; 3.11; 6.1.1
Malibu Creek, Cold Creek, Las Virgenes Creek, LV Tributary, Stokes Creek, Liberty Canyon Creek, Triunfo Creek Reach 1, Triunfo Creek Reach 2, Medea Creek Reach 1, Medea Creek Reach 2, Lindero Creek Reach 1, Lindero Creek Reach 2, Malibou Lake, Lake Sherwood, Lake Enchanto, Century Lake (Century Reservoir), Westlake, Lake Lindero, Malibu Country Club Golf Course Ponds, Trancas Creek, Topanga Creek	Exotic Species	Readily Available Data	3.10
Long Beach City Beach, Alamitos Bay Beach, Colorado Lagoon Beach, Westward Beach, Latigo Canyon Beach, Corral State Beach, Solstice Canyon Beach	Bacteria	Readily Available Data	3.3; 6.1.1

Table 6: Water-segment/pollutant combinations that should be added to the 303(d) List based upon the weight of evidence.

A. Beaches

Heal the Bay's Beach Report Card (BRC) contains bacterial data for approximately 450 of the State's beaches and is posted weekly on Heal the Bay's website. Also, Heal the Bay has the raw fecal indicator bacteria data available upon request. As discussed above, our analysis indicates that in Region 4, 7 beaches should be added to the 303(d) List. The summary of these data are found in Appendix 1-A, at Tables 3 and 4. Moreover, there are numerous other beaches around the state that should be listed for the same reasons and based on the same data sources. The readily available data show that 49 beaches outside of LA County should be added to the 303(d) List. Appendix 1-B. In addition, a statewide data analysis shows that staff's proposed de-listings of the Mission Bay Shoreline beaches and Pacific Ocean Shoreline – Scripps HA beaches should be rejected as well. Appendix 1-B provides a full evaluation of the available data and suggested actions for all beaches statewide (outside Region 4).

The State's documentation for the 2006 List must include a "rationale for any decision to not use any existing and readily available data and information for any one of the categories of waters as described in §130.7(b)(5)." 40 C.F.R § 130.7(b)(6)(iii). The data submitted along with these comments were and are readily available to the State Board and should be included in the evaluation for the 2006 303(d) List updates.

B. Ballona Creek

The mouth of Ballona Creek and the Marina del Rey Harbor entrance channel accumulate large volumes of sediment and are dredged every three to five years to eliminate shoaling problems. Every time these sediments have been dredged (200 K to 500 K yds^3) over the last decade or more, a significant fraction of these sediments have been found to be contaminated and toxic to marine life in bioassays. As such, the Army Corps of Engineers conducted sediment sampling in 1999 and 2001 in Ballona Creek in an effort to pinpoint sources of contaminants. Their monitoring results are summarized in Table 7 and Appendix 4. U.S. Army Corps of Engineers, *Marina del Rey and Ballona Creek Feasibility Study: Ballona Creek Sediment Control Management Plan* (2003). As seen in Table 7 , zinc, copper, benzo(a)anthracene, and dibenzo-a,h-anthracene concentrations in sediment samples exceed ERM guidelines at various monitoring locations. *Id.* Since there is no section in the Listing Policy that specifically addresses pollutants in sediment, the State Board should evaluate the data under section 3.11, using situation-specific weight of evidence. The weight of evidence indicates that these constituents should be included on the 303(d) List. First, the number of exceedances for each of these constituents necessitates listing as required under Table 3.1 of the Listing Policy. In addition, an exceedance of an ERM guideline indicates that toxicity is present and beneficial uses are impaired. Moreover, the sediment quality guidelines are exceeded by several orders of magnitude in some cases. Thus, zinc, copper, benzo(a) anthracene, and dibenzo-a,h-anthracene should be added to the 303(d) List for Ballona Creek.

Parameters	ERM	648	494	54	Higuera	B. Canyon Ch.	RDD 208	2901	Sepulveda Blvd.	503	51
Zinc	410	1830	1280	483.4	185.673	467.18	1247.423	495.868	642.857	887.692	1840.136
Copper	270	614	310.204	76.24	29.386	213.9	600	230.579	283.673	253.846	242.857
Benzo(a) anthracene	1600	ND	2245	ND	ND	ND	ND	ND	ND	ND	4422
Dibenzo-a,h-anthracene	260	1429	ND	470	292	ND	ND	ND	ND	308	680

Table 7: Sediment data from *Marina del Rey and Ballona Creek Feasibility Study: Ballona Creek Sediment Control Mgmt Plan* (ACOE, 2004). Exceedances are in red.

C. Dominguez Channel

Dominguez Channel should be placed on the 303(d) List for sediment toxicity based on readily available data. Data collected by the Shell Los Angeles Refinery under their NPDES Permit No. CA003778 and submitted to the Regional Board indicate sediment toxicity in Dominguez Channel. As shown by the highlighted values in Table 8, sediment toxicity is apparent in the Channel. Since control results are unavailable, a conservative approach was taken in interpreting the data by assuming 90% survival for controls and classifying samples with <70% survival as a failed test. Section 3.6 of the Listing Policy states that "waters may also be placed on the section 303(d) list for toxicity alone." Listing Policy at 5. Thus, the State Board should place Dominguez Channel on the 303(d) List for a sediment toxicity impairment.

Sediment Toxicity (Amphipod)
Dominguez Channel NPDES Monitoring Stations

Location[1]	Aug-00	Feb-01	Aug-01	Feb-02	May-02	Jan-03	May-03	Feb-04	Apr-04
R1	72	97.5	NS	NS	NS	NS	NS	NS	NS
R2	NS	NS	NS	NS	NS	NS	NS	NS	NS
R3	NS	NS	NS	NS	NS	NS	NS	9	NS
R4	NS	NS	NS	0	56	NS	NS	NS	NS
R5	NS	NS	10	0	0	4	48	0	NS
R6	NS	NS	4	0	9	26	74	1	68
R7	88	76.3	74	0	0	49	82	0	82

Table 8: Dominguez Channel Sediment Toxicity Data. Source of Data: Retec Group, Inc., Report of NPDES Sediment Sampling Results for Shell Los Angeles Refinery, NPDES Permit No. CA003778 (2005).

[1] Sampling locations were established mid-channel at the intersection of the Dominguez Channel and Anaheim Street (R1), Pacific Coast Highway (R2), Sepulveda Boulevard (R3), Alameda Street (R4), 223rd Street/Wilmington Avenue (R5), Avalon Boulevard (R6), and Main Street (R7). (see Appendix 5 for site map).

NS – Not sampled due to insufficient sediment at the sampling location.
Highlighted values are <70% survival. Control results not available; however, basic QA/QC standards require at least a 90% survival for controls. Assuming a 90% control, any test showing less than 70% would be considered a failed test.

D. <u>Compton Creek Trash</u>

Compton Creek should be placed on the 303(d) List for trash based on the situation-specific weight of evidence under section 3.11 of the Listing Policy. Compton Creek Watershed is arguably the most visibly polluted watershed in California, let alone Los Angeles County. Large volumes of trash collect in the flowing water and along the banks and the unlined portions of Compton Creek. Compton Creek supports many beneficial uses including ground water recharge, water contact recreation, non-contact water recreation, warm freshwater habitat, wildlife habitat and wetland habitat. The high concentration of trash in Compton Creek impairs these beneficial uses. In addition, the trash pollution violates the LARWQCB Basin Plan's narrative water quality objective that "waters shall not contain floating materials including solids, liquids, foams and scum, in concentrations that cause nuisance or adversely affects beneficial uses."

There are three lines of evidence available to assess trash in Compton Creek. The first line of evidence is data on the tonnage of trash collected by Los Angeles County Department of Public Works between 2002 and 2005. In 2002, the County instituted a trash removal program for Compton Creek. As shown in Appendix 2, large amounts of trash have been collected and removed from Compton Creek through this effort. For instance in July of 2002, over 23 tons of trash were removed through this program. The second line of evidence, presented in Appendix 2, is data on the tonnage of trash collected by volunteers at Coastal Cleanup Day and Earth Day events since 2002. At the April 2003 clean-up event, volunteers removed over 10 tons of trash in a period of less than three hours. The final line of evidence is Heal the Bay's photographic documentation of trash pollution in Compton Creek. As presented in Appendix 2, the photographs show large amounts of accumulated trash in various sections of Compton Creek. These photographs were taken at various Heal the Bay-sponsored clean-up activities. Heal the Bay has been the Los Angeles County coordinator for Coastal Cleanup Day and Adopt A Beach for 15 years. During that time, there have been regular clean-ups at over 60 locations. Not one of these locations is even close to as polluted with trash as Compton Creek. Based on these three lines of evidence, the weight of evidence clearly indicates that water quality standards are not attained. Thus, under section 3.11 of the Listing Policy, Compton Creek should be listed for trash on the 303(d) List.[25]

<u>E. Exotic Species Data Should Be Considered in the Listing Process.</u>

Heal the Bay has significant data indicating impairments by exotic species in Region 4. This data and supporting evidence are provided in Appendix 6. Heal the Bay urges the

[25] Compton Creek should be listed for trash separately from the Los Angeles River. The LA River Trash TMDL may not address the trash problem in the portions of Compton Creek situated above the LA River. Several reaches of the Creek are grossly polluted with trash that gets stuck in the mud and vegetation and never actually flows down into the LA River. Without a separate listing for Compton Creek, there is no requirement to ensure that BMPs are places so as to keep trash from accumulating in the upper reaches of the Creek or to do so in a timely manner.

State Board to accept this data and list these reaches for invasive species because it was not until 2005, when the Northern District ruled on this issue, that the State Board indicated that it must consider listing exotic invasive species under Section 303(d). This is clearly a problem for many reaches in Region 4, which contain populations of sensitive and federally endangered species such as the California red-legged frog that are particularly sensitive to the addition of invasive species into the ecosystems. *See* Appendix 6.

F. Index of Biotic Integrity (IBI) Scores Should be Considered in the Listing/de-listing Process.

The diversity and sensitivity of the various species within a stream environment are important indicators of stream health. For instance, healthy communities tend to have a diverse set of invertebrate species, while degraded communities often have fewer sensitive species and a higher proportion of hardy species. Based on these principles, an index of biological integrity focuses on specific metrics to provide a comprehensive measure of stream health.

The California Department of Fish and Game ("CDFG") developed the Index of Biological Integrity ("IBI") in 2002 for the San Diego Region and adapted the methodology to all of southern California in 2005. Ode, P.R., A.C. Rehn and J.T. May., A Quantitative Tool for Assessing the Integrity of Southern Coastal California Streams, *Environmental Management*. 35:493-504 (2005). The IBI provides a quantitative means of evaluating the biotic conditions of a waterbody by analyzing seven metrics, including the number of different species present from the mayfly (*Ephemeroptera*), stonefly (*Plecoptera*) and caddisfly (*Trichoptera*) families and the number of different beetle species present. *Id.* The metrics are evaluated at a specific site and then converted to a score between 0 and 100 (zero being the worst case scenario). The study's authors chose two standard deviations below the mean reference site score to develop the impairment threshold. An IBI score of 39 is established as the boundary between "fair" and "poor" biological conditions, and a score of 20 is the division between "poor" and "very poor" biological conditions. *Id.*

This is relevant because readily available IBI score data indicate biological community impairment in numerous stream reaches located in Region 4. IBI scores compiled in the CDFG study show that 22 monitored reaches in Region 4 have IBI scores within the poor and very poor ranges, indicating biological impairment (*see* Appendix 7, Table 1). *Id.* In addition, Los Angeles County and the Ventura County Watershed Protection District have calculated IBI scores for various water segments in Region 4. Ventura County Watershed Protection District, *Ventura River Watershed 2004 Bioassessment Monitoring Report*, (2005); Los Angeles County, *Los Angeles County 1994-2005 Integrated Receiving Water Impacts Report* (2005). These scores are shown in Appendix 7, Tables 2 and 3. As seen in the highlighted sections, there are sixteen sites with scores at or below 39. In addition, monitoring efforts by Heal the Bay in the Malibu Creek Watershed indicate seven sites with low IBI scores. Several of the water segments monitored by the four entities overlap. Heal the Bay, *Watershed Assessment of Malibu*

Creek: Final Report, (2005). These extremely low IBI scores indicate a biological community impairment; thus, these reaches should be listed on the 303(d) List as biologically impaired. While we only looked at available IBI score data in Region 4, it is expected that the State Board would have made similar findings in other regions if it had looked at the readily available data of its sister agency, CDFG.

Particularly noteworthy, IBI scores calculated for Calleguas Creek reaches 4, 5 and 13, each of which the State Board proposes to delist for excess algal growth because they argue that quantitative data are unavailable[26], indicate extreme biological impairment. The IBI scores qualify as another valid line of evidence as well as provide a quantitative measure of impairment. Algal impairment often smothers habitat, reduces dissolved oxygen levels, and decreases available rocky bottom substrate. The end result is lower IBI scores and elimination of sensitive macroinvertebrates such as the Plecoptera family that are often found in healthy, non-algae impaired communities. Thus, the State Board should consider these IBI scores as another line of evidence that points towards an excess algal growth impact in these reaches. Further, the Calleguas watershed has been extensively studied in terms of biological impairment. If other waterbodies in the region and the state were subject to such intensive study, it is likely that similar findings would be made for those waterbodies.

Regardless, these reaches of Calleguas Creek should be placed on the 303(d) List for biological communities impairment based upon this readily available IBI data. Specifically, water segments with IBI data in the poor and very poor ranges meet the listing factors in sections 3.9 and 3.11 of the Listing Policy. Inherently, the IBI scoring system compares monitoring site conditions to reference sites. Thus, in accordance with Section 3.9, the IBI data indicate significant degradation in biological populations and/or communities as compared to reference sites. In addition, one sample is sufficient for considering IBI scores due to the sampling protocol used in the IBI process, which takes into account site variability and is designed to combat sampling errors.[27] In essence, one IBI score is really multiple samples within a creek run. In other words, the Board does not need to use the Listing Policy's binomial distribution table to correct for these issues. Finally, biological impairment demonstrated by low IBI scores can be related to other 303(d) listed pollutants in these water segments. Listing Policy at 7. For instance, Malibu Creek is included on the 303(d) List for several impairments, including nutrients and sedimentation. This, along with 20 of 22 IBI scores from seven sites in the poor or very poor ranges is sufficient to indicate that Malibu Creek should be placed on the 303(d) List for biological impairment under Section 3.9.

Second, IBI scores can and should be evaluated using the situation-specific weight of evidence approach. Section 3.11 of the Listing Policy states that "if the weight of

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[26] We disagree with the assertion that no quantitative data are available for algal growth. *See supra* sections III.B.3 and III.B.4.

[27] Specifically, the study looks at a minimum linear area of 150 meters having at least 5 riffles. Within this area, the sampler randomly selects 3 out of 5 riffles where the transects will be taken. Within the 3 riffles, the samples are taken from three transects per riffle. A transect is comprised of three 1ft x 2 ft x 6 in deep samples within the randomly selected location on the riffle. Of note, the riffle habitat is the most productive habitat and therefore is the most conservative for documenting degradation of streams.

evidence indicates non-attainment [of water quality standards], the water segment shall be placed on the section 303(d) list." Listing Policy at 8. The IBI scores should be weighed heavily in conducting such an analysis. Water quality standards and beneficial uses are not being attained in waterbodies with an IBI score less than 39.

In sum, IBI data compiled by CDFG, Los Angeles County, Ventura County and Heal the Bay are readily available and qualify as applicable listing factors in Sections 3.9 and 3.11 of the Listing Policy. Moreover, the State Board should support the IBI methodology developed by its sister agency, CDFG, and include these quantitative data in the listing analysis.

Given all of the above, the water segments highlighted in Appendix 7, Tables 1-4 should be included on the 303(d) List as impaired for biological communities. At the very minimum, the IBI scores should be used as another line of evidence in listing/de-listing decisions. On this latter basis Calleguas Creek reaches 4, 5 and 13 should remain on the 303(d) List for excess algal growth or algae. Finally, while we focused on Region 4; we believe the State Board should evaluate IBI data available for other areas of the State as well.

V. CONCLUSION

For all of the reasons set forth above, we urge the State Board to reject the proposed de-listings for the waterbody-pollutant combinations set forth in Table 1 and to add listings for the waterbody-pollutant combinations set forth in Table 6.

In addition, we strongly urge the State Board to:

(1) ensure that all readily available information is evaluated;

(2) state that as a rule previous listings for which TMDLs have already been adopted should not be re-evaluated and overturned during the listing process and that this issue is more properly addressed as part of TMDL implementation;

(3) make clear that the Listing Policy should not be used retroactively to overturn prior listing decisions unless one of the three situations set forth in Section 4 of the Listing Policy exists <u>and</u> there is substantial evidence to demonstrate with a high degree of persuasion that the previous decision was not correct (including an affirmative demonstration of a lack of current impairment);

(4) direct State Board staff to forego re-evaluating previous listings in this round and leave that task to the individual regional boards, who are more knowledgeable about their own local waterbodies and listing decisions, to implement during the next round of listing in 2008 in accordance with the above clarifications;

(5) clarify that the situation specific weight-of the evidence approach was intended to act as a "safety net," and thus Section 3.11 and 4.11 require an

evaluation of all available evidence under the situation specific weight of the evidence approach whenever there is *any* information that indicates non-attainment of standards; and

(6) clarify that narrative standards must be fully evaluated under Sections 3.7 and 4.7 as well as Sections 3.11 and 4.11 of the Listing Policy for both pollutants and conditions and regardless of the availability of quantitative data or guidelines.

If you have any questions or would like to discuss any of these comments, please feel free to contact us. Thank you for your consideration of these comments.

Sincerely,

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Appendix 1: Beach Bacteria Analysis

1-A: Los Angeles County Beaches
1-B: State-wide Beaches
1-C: Compliance Data

Kirsten James

Appendix 1-A: LA County Beaches

Heal the Bay analyzed statewide, routine beach monitoring data following the methods outlined in the State's Listing Policy. As part of our weekly Beach Report Card program, Heal the Bay maintains an extensive database of routine beach monitoring data collected by local health and water agencies for the purpose of public health protection at recreational marine beaches. For the past several years, we have received routine beach data on a weekly basis from over 20 different local agencies covering 350 beaches in the winter and 460 beaches during the summer. For this analysis, we included all data collected from the past five years (2000 to 2004). For the summer AB-411 time period of April to October, we included the summer of 2005, for a total of 6 years of data. All of the beaches are monitored at least weekly during this summer time period.

To analyze our database for the purposes of evaluating beaches for potential 303(d) listing, we divided the statewide beach data into two components: 1) LA County beach data and, 2) data from beaches located throughout the rest of the state. This division was necessary for two reasons. First, the method for listing and delisting beaches in LA County is different from other beaches in the State because the Los Angeles Regional Board has established site-specific exceedance frequencies for LA County (the preferred method for listing per Section 3.3 of the Listing Policy). For beaches outside LA County, the binomial model method was used (again per Section 3.3 of the Listing Policy). The second reason we analyzed LA County data separately from the rest of the State data is because, in addition to the routine monitoring data collected to protect public health at recreational beaches, we included TMDL compliance data available for several LA County beaches that are not routinely monitored through a public health protection program.

For both the LA County beaches and the rest of the beaches throughout the state, we calculated the number of exceedance-days of the State's bacteriological standards for recreational marine waters[1]. Using these exceedance-days numbers, we followed the State's policy on listing based on bacteria densities and then compared our results with the existing 303(d) list, the proposed delistings, and the proposed listings.

LA County Beaches

Analysis Description: The Los Angeles Regional Board has established site-specific exceedance frequencies for recreational beaches in LA County, with Leo Carrillo beach serving as the reference beach. Section 3.3 of the State's Listing Policy states that use of site-specific frequencies is the preferred method for evaluating beaches. The Los Angeles Regional Board established site-specific frequency exceedances in the Santa

[1] State of California has 4 single-sample standards and 3 geometric mean standards for the bacteriological quality of marine recreational waters. See http://www.dhs.ca.gov/ps/ddwem/beaches/AB411_Regulations/default.htm and http://www.dhs.ca.gov/ps/ddwem/beaches/AB411_Regulations/default.htm.

Monica Bay Beaches Bacteria TMDL[2] in the form of exceedance-days, and has used these frequencies in subsequent bacteria TMDLs developed within LA County:

Time Period	Site-Specific Allowable Exceedance-Days* (Single-sample standards)
AB-411 period (April through October)	0
Dry Weather (November through March)	3 (daily monitoring) 1 (weekly monitoring)
Wet Weather (November through March)	17 (daily monitoring) 3 (weekly monitoring)

*No exceedances of the geometric mean standards are allowed for all three time periods.

For each of these time periods, we determined the number of exceedance-days of the State's bacteriological standards for each beach monitored, and compared these to the allowable, site-specific frequencies. Two sets of data were used: 1) the routine, public health monitoring data collected by local agencies from 2000 to 2005, and, 2) compliance monitoring data for the Santa Monica Bay Beaches Bacteria TMDL collected from November 2004 (the start of this monitoring program) to September 2005.

For the routine monitoring data, Heal the Bay calculated the number of exceedance-days of the single sample standards and compared these to the number of allowable, site-specific frequencies set by the LA Regional Board. Heal the Bay did not have the resources to calculate 30-day rolling geometric means, as defined by the Los Angeles Regional Board, within the 303(d) listing timeframe. Thus, our findings are based only on exceedance-days of the single-sample standards.

For the TMDL compliance data, the numbers of exceedance-days of all the State's bacteriological standards (single sample standards and geometric mean standards) were reported in two letter reports from the City of Los Angeles to the EPA, Region IX, dated October 27, 2005 (see attached). Heal the Bay used the reported number of exceedance-days to compare to the allowable site-specific frequencies.

Results- Proposed De-listings: The results of our analysis indicates that 11 routinely monitored beaches and four TMDL compliance beaches ***proposed for delisting by the SWRCB*** do not actually meet the delisting criteria (Tables 1 and 2). The 11 routinely monitored beaches are: Abalone Cove, Bluff Cove, Hermosa, Malaga Cove, Malibu, Whites Point, Manhattan, Nicholas Canyon, Portugese Bend, Puerco, and Royal Palms. All 11 beaches have exceeded the site-specific exceedance frequency set by the Los Angeles Regional Board during the AB-411 time period in multiple years from 2000 to

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[2] See RWQCB Basin Plan Amendments http://www.waterboards.ca.gov/losangeles/html/meetings/tmdl/santa_monica/02_0124_smb%20tmdl%20BP%20language%20final.pdf (dry weather Santa Monica Bay Beaches Bacteria TMDL) and http://www.waterboards.ca.gov/losangeles/html/meetings/tmdl/santa_monica/02_1025/02_12_BPA_WET_121202.pdf (wet weather Santa Monica Bay Beaches Bacteria TMDL).

2005. Nine of the 11 beaches also exceeded the site-specific frequency for dry winter weather during one or more years between 2000 and 2004, and three have exceeded the allowable number of exceedances during all three time periods.

The 4 TMDL compliance beaches proposed for delisting that do not meet the listing criteria are: Carbon, Escondido, Inspiration, and Las Tunas. TMDL compliance monitoring reports indicate that these four beaches exceeded both the single-sample and geometric mean site-specific exceedance-day frequencies not only during the AB-411 time period, but also during the dry winter, and wet winter periods (with the exception of Inspiration Point that exceeded the AB-411 and dry winter site-specific frequencies, but not the wet winter frequency.)

Additionally, based on our database and our knowledge of the beaches within LA County, we determined that data is not available for the following 11 beaches because they are not included in the routine monitoring programs (including the TMDL monitoring): Flat Rock Point, Point Fermin Park, Point Vicente, Resort Point, Rocky Point, Torrance Beach, Zuma Beach, La Costa, Lunada Bay, Point Dume, and Sea Level.

Finally, 5 beaches proposed for delisting are listed for other bacteria-related impairments: Dockweiler, Venice, Trancas, Will Rogers, and Topanga.

Results – New Proposed Listings: Heal the Bay also compared beaches that exceeded the site-specific frequencies to the current 303(d) list and the proposed new listings. We found 6 routinely monitored LA County beaches that should be listed, but are currently not listed or proposed for listing (for any bacteria or beach closure-related reason) (Table 3). These six beaches are: Long Beach City Beach, Alamitos Bay, Colorado Lagoon, Westward, Latigo Canyon, and Corral State. Our conclusion that these beaches should be listed are based on weekly monitoring data collected from 2000 – 2005. All six beaches exceeded the AB-411 site-specific exceedance frequency over multiple years (with the exception of Corral State, which exceeded the AB-411 frequency once). Long Beach City Beach, Alamitos Bay, Colorado Lagoon, and Latigo Canyon exceeded site-specific frequencies for all three time periods (AB-411, dry winter and wet winter) during at least one of the 5 years we evaluated. In fact, Colorado Lagoon is such a well know beach pollution problem, it was awarded major funding from the SWRCB under the Clean Beach Initiative.

Additionally, one of the TMDL monitoring beaches, Solstice Canyon, qualifies for listing, but is currently not listed. Solstice Canyon exceeded site-specific exceedance frequencies during the AB-411 time period (both single sample and geometric mean exceedances) and during the wet winter period (single sample standard exceedances.)

Conclusions

As discussion in section III of this letter, all proposed beach de-listings in LA County should be rejected because all Santa Monica Bay beaches are covered under existing bacteria TMDLs. Attainment of water quality standards therefore should be determined under the TMDL, which sets forth a procedure to accomplish this – not through the listing process. In addition, the first year of monitoring data under the TMDL has been compiled and does not indicate attainment. The proper action in this case is to retain these beaches on the 2006 List until compliance is determined under the already adopted TMDLs. Notably, of the 31 beaches proposed for de-listing, only five are also listed for bacteria in addition to "beach closures;" the remaining 26 beaches would no longer be listed *at all* if staff's proposed changes are adopted. As all of these beaches are addressed in the SMB TMDLs, it is inappropriate to de-list them for this impairment. If the State Board is not comfortable with the term "Beach Closures" for these listings, it should simply replace this term with the term "Bacteria Indicators" on the List for the 26 beaches so affected. All 31 beaches then should be placed in the WQLSBA category as provided for in Section 2.2 of the Listing Policy.

Even though the 31 Santa Monica Bay beaches should not even be considered for de-listing in this process, as discussed above, readily available data clearly shows that 15 of these beaches do not meet the de-listing criteria per the State's policy. The SWRCB has, in-house, a routine beach monitoring database used to generate annual reports to the U.S. EPA, that contains virtually all the data used in Heal the Bay's analysis. Clearly, the SWRCB did not use readily available information before proposing the de-listing of these beaches, as required.

Finally, analysis of readily available, routine monitoring and TMDL data, shows that 7 additional beaches meet the State listing criteria and should be added to the 303(d) list. We respectively request the SWRCB to add these beaches to the list for Region IV for bacteria impairment: Long Beach City Beach, Alamitos Bay, Colorado Lagoon, Westward, Latigo Canyon, Corral State, and Solstice Canyon.

Table 1

LA County Beaches

Summary of Exceedance-day Frequencies[1] for Routinely-monitored Beaches Proposed for Delisting that do not Meet Delisting Criteria[2,5]

Red blocks denote time periods when delisting criteria was not met[3,4]

Description	Monitoring Agency/ID	Monitoring Frequency	Exceedance Freq. - AB-411							Exceedance Freq. - Dry Winter						Exceedance Freq. - Wet Winter					
			Allow[3]	2000	2001	2002	2003	2004	2005	Allow[3]	2000	2001	2002	2003	2004	Allow[3]	2000	2001	2002	2003	2004
e Cove Shoreline Park	LACSD2	daily	0	1	0	1	0	0	2	3	0	0	0	0	0	17	0	0	0	0	3
/erdes (Bluff) Cove, Palos Verdes Estates	LACSDB	weekly	0	1	0	2	0	2	0	1	0	0	0	0	1	3	0	0	0	0	2
sa City Beach at 26th St.	DHS (114)	weekly	0	0	1	0	2	2	0	1	0	1	0	0	0	3	2	2	2	2	2
sa Beach Pier- 50 yards south	S15	daily	0	2	0	1	0	5	6	3	0	1	3	2	4	17	7	6	3	5	7
ı Cove, Palos Verdes Estates-daily	S18	daily	0	0	0	1	2	4	2	3	0	0	1	7	6	17	1	0	1	2	5
ı Cove, Palos Verdes Estates-weekly	LACSDM	weekly	0	0	0	0	2	2	1	1	0	0	0	1	1	3	1	0	0	1	1
Point	DHS (003)	weekly	0	5	1	2	8	2	6	1	1	3	1	2	1	3	5	7	3	4	2
Annex, San Pedro	LACSD6	daily	0	0	0	0	1	1	0	3	1	0	0	0	3	17	0	1	0	0	3
ttan State Beach at 40th Street	S13	daily	0	1	1	0	2	1	6	3	1	0	1	1	4	17	2	3	1	4	4
ttan Beach, projection of 27th street	DHS (113)	weekly	0	0	0	1	4	6	4	1	0	0	1	1	2	3	0	0	2	2	2
ttan Beach Pier- 50 yards south	S14	daily	0	2	2	3	0	3	2	3	2	2	2	0	5	17	4	1	1	2	6
ət west of lifeguard tower	DHS (009)	weekly	0	1	2	1	0	0	1	1	0	2	1	0	0	3	2	4	2	1	1
uese Bend Cove, Rancho Palos Verdes	LACSD3	daily	0	1	0	1	0	3	0	3	1	0	0	0	0	17	2	0	0	0	2
ı Beach, 25500 PCH at lifeguard station	DHS (004)	weekly	0	0	0	1	2	1	2	1	1	0	0	0	2	3	0	4	2	2	1
Palms State Beach	LACSD5	daily	0	4	0	1	2	2	2	3	0	0	0	4	14	17	5	0	0	1	7

ı exceedances only. Rolling geometric means were not calculated.

e monitoring results from Los Angeles City Sanitation Department (LACSD) and Los Angeles County Department of Health Services (DHS)

:riteria for delisting beaches based on numeric water quality objectives for bacteria in water (Section 4.3) states that removing waters from the 303(d) list shall be based on the site-specific exceedance frequency
əgion IV has a site specific exceedance frequency, in terms of exceedance-days, based on reference beach Leo Carillo.

əer of exceedance-days (site specific exceedance frequency) per Santa Monica Bay Beaches Bacteria TMDLs. Allowable exceedance-days are set for three time periods: AB-411 (April - Oct.), Dry Winter (dry
ıter (wet, non-AB-411). Allowable exceedance-days varies with sampling frequency.

have mulitple listing such as beach closures, coliform counts, etc. So, if delisted as proposed, there is no other listing that will cover bacteriological pollution.

Table 2

LA County Beaches

Summary of Exceedance-day Frequencies for TMDL Compliance Beaches Proposed for Delisting that do not Meet Delisting Criteria[1,4,5]

Red blocks denote time periods when delisting criteria was not met[2,3]

Single-Sample Standards

Description	Monitoring Agency/ID	Monitoring Frequency	Exceedance Freq. - AB-411		Exceedance Freq. - Dry Winter		Exceedance Freq. - Wet Winter	
			Allow[3]	2005	Allow[3]	2004-2005	Allow[3]	2004-2005
Sweetwater Canyon outlet	LACSD/SMB 1-13	weekly	0	7	1	4	3	5
Escondido Creek outlet	LACSD/SMB 1-8	weekly	0	45	1	7	3	5
Tuna Canyon Outlet	LACSD/SMB 1-17	weekly	0	7	1	2	3	3
Pena Creek Outlet	LACSD/SMB 1-16	weekly	0	3	1	2	3	6

Rolling Geometric Mean Standards

Description	Monitoring Agency/ID	Monitoring Frequency	Exceedance Freq. - AB-411		Exceedance Freq. - Dry Winter	
			Allow[3]	2005	Allow[3]	2004-2005
Sweetwater Canyon outlet	LACSD/SMB 1-13	weekly	0	71	0	24
Escondido Creek outlet	LACSD/SMB 1-8	weekly	0	168	0	55
Tuna Canyon Outlet	LACSD/SMB 1-17	weekly	0	114	0	49
Pena Creek Outlet	LACSD/SMB 1-16	weekly	0	7	0	48

- *Month of September Monitoring Report - Examination of SMBBB TMDL Stations of Santa Monica Bay*, October 27, 2005.

' states criteria for delisting beaches based on numeric water quality objectives for bacteria in water (Section 4.3) states that removing waters from the 303(d) list shall be based on the site-specific ency assigned to the region. Region IV has a site specific exceedance frequency, in terms of exceedance-days, based on reference beach Leo Carillo.

ble number of exceedance-days (site specific exceedance frequency) per Santa Monica Bay Beaches Bacteria TMDLs. Allowable exceedance-days are set for three time periods: AB-411 (April - 'dry non-AB-411), and Wet Winter (wet, non-AB-411). Allowable exceedance-days varies with sampling frequency.

'MDL compliance beaches began November 2004.

beaches have mulitple listing such as beach closures, coliform counts, etc. So, if delisted as proposed, there is no other listing that will cover bacteriological pollution.

Table 3

LA County Beaches

Summary of Exceedance-day Frequencies[1] for Historically Monitored Beaches that meet the Listing Criteria but are not Listed[2,5]

Red blocks denote time periods when listing criteria are met[3,4]

	Description	Monitoring Agency/ID	Monitoring Frequency	Exceedance Freq. - AB-411							Exceedance Freq. - Dry Winter						Exceedance Freq. - Wet Winter					
				Allow[3]	2000	2001	2002	2003	2004	2005	Allow[3]	2000	2001	2002	2003	2004	Allow[3]	2000	2001	2002	2003	2004
ach	projection of 3rd Place	CLB/B63	weekly	0	10	3	3	3	4	3	1	2	5	5	3	0	3	1	3	1	1	3
ach	projection of 5th Place	CLB/B5	weekly	0	3	2	2	2	4	3	1	2	4	3	1	2	3	0	2	0	0	3
ach	projection of 10th Place	CLB/B56	weekly	0	10	0	1	3	2	6	1	0	0	3	2	0	3	0	0	0	0	2
ach	projection of 16th Place	CLB/B6	weekly	0	10	2	1	2	3	5	1	0	1	5	1	1	3	1	0	1	1	3
ach	projection of Molino Ave.	CLB/B60	weekly	0	2	1	1	3	2	3	1	2	3	3	5	2	3	1	1	1	0	4
ach	projection of Coronado Ave.	CLB/B7	weekly	0	2	0	0	2	2	2	1	0	0	2	2	2	3	1	0	0	1	2
ach	projection of 36th Place	CLB/B62	weekly	0	4	2	1	3	4	3	1	0	3	3	2	2	3	1	0	0	0	3
ach	Belmont Pier - westside	CLB/B8	weekly	0	5	2	0	2	2	5	1	0	3	3	2	2	3	1	0	0	0	2
ach	Belmont Pier - eastside	CLB/B3	weekly	0	4	4	1	2	2	1	1	0	0	6	2	1	3	1	1	1	1	3
ach	projection of Prospect Ave.	CLB/B9	weekly	0	1	0	1	3	2	3	1	0	0	0	1	2	3	1	1	0	1	2
ach	projection of Granada Ave.	CLB/B64	weekly	0	6	4	4	3	2	2	1	0	0	1	0	3	3	1	1	1	1	2
ach	projection of 54th place	CLB/B65	weekly	0	6	3	4	4	2	1	1	1	1	0	1	1	3	1	1	0	1	2
ach	projection of 55th place	CLB/B10	weekly	0	0	0	0	3	2	1	1	0	1	0	0	2	3	0	0	0	1	1
ach	projection of 62 place	CLB/B66	weekly	0	1	0	1	4	2	2	1	0	0	1	0	1	3	0	0	0	1	1
ach	projection of 72 place	CLB/B11	weekly	0	2	0	1	4	2	3	1	1	1	4	2	2	3	0	0	0	2	3
	56th Place on bayside	CLB/B31	weekly	0	2	0	0	1	1	1	1	1	0	1	0	0	3	1	1	0	0	3
	1st and Bayshore	CLB/B29	weekly	0	2	0	3	0	1	3	1	0	1	4	0	0	3	1	0	0	1	4
	Alamitos Bay - Shore Float	CLB/B14	weekly	0	0	0	1	2	1	3	1	0	2	0	1	0	3	0	1	0	0	2
	Mother's Beach	CLB/B22	weekly	0	4	0	2	0	5	1	1	1	0	2	1	1	3	0	1	1	0	3
	2nd St. Bridge and Bayshore	CLB/B67	weekly	0	4	0	2	1	3	2	1	0	0	1	3	1	3	1	0	0	0	4
	north	CLB/B25	weekly	0	0	10	3	2	4	7	1	0	1	1	2	0	3	0	0	1	1	4
	center	CLB/B26	weekly	0	0	1	1	0	4	4	1	0	2	2	1	0	3	0	0	0	0	3
	south	CLB/B24	weekly	0	0	2	1	1	2	2	1	0	3	4	1	0	3	0	1	0	0	5
	East of Zuma Creek	DHS (007)	weekly	0	0	1	0	1	0	7	1	0	0	0	1	1	3	2	3	2	2	1
	Latigo Canyon Creek Outlet	DHS (005)	weekly	0	2	0	1	1	2	9	1	2	2	3	1	3	3	5	6	2	1	0
	Corral Canyon Outlet	DHS (005)	weekly	0	1	0	0	0	0	0	1	0	0	0	0	0	3	3	0	0	0	0

andards only. Rolling Geometric means were not calculated.

Routine monitoring results from Long Beach Department of Health Services (CLB) and Los Angeles County Department of Health Services

:es criteria for listing beaches based on numeric water quality objectives for bacteria in water (Section 3.3) states thata site-specific exceedance frequency can, and to the extent possible and allowed by water quality ojectives, ace waters on the 303(d) list. Region IV has a site specific exceedance frequency based on reference beach Leo Carillo.

ͅ number of exceedance-days (site specific exceedance frequency) per Santa Monica Bay Beaches Bacteria TMDLs. Allowable exceedance-days are set for three time periods: AB-411 (April - Oct.), Dry Winter (dry non-AB-411), t, non-AB-411). Allowable exceedances varies with sampling frequency.

:aches are currenty listed for any bacteriological-related pollution such as beach closures, high coliform densities, etc.

Table 4

LA County Beaches

Summary of Exceedance-Day Frequencies for TMDL Compliance Beaches that Meet the Listing Criteria[1,4]

Red blocks denote time periods when delisting criteria was not met[2,3]

Single-Sample Standards

	Description	Monitoring Agency/ID	Monitoring Frequency	Exceedance Freq. - AB-411		Exceedance Freq. - Dry Winter		Exceedance Freq. - Wet Winter	
				Allow[3]	2005	Allow[3]	2004-2005	Allow[3]	2004-2005
h	Solstice Canyon Outlet	LACSD/1-10	Weekly	0	10	1	0	3	4

Rolling Geometric Mean Standards

	Description	Monitoring Agency/ID	Monitoring Frequency	Exceedance Freq. - AB-411		Exceedance Freq. - Dry Winter	
				Allow[3]	2005	Allow[3]	2004-2005
h	Solstice Canyon Outlet	LACSD/1-10	Weekly	0	105	0	0

- Month of September Monitoring Report - Examination of SMBBB TMDL Stations of Santa Monica Bay, October 27, 2005.

' states criteria for delisting beaches based on numeric water quality objectives for bacteria in water (Section 4.3) states that removing waters from the 303(d) list shall be based on the site-specific ency assigned to the region. Region IV has a site specific exceedance frequency, in terms of exceedance-days, based on reference beach Leo Carillo.

ble number of exceedance-days (site specific exceedance frequency) per Santa Monica Bay Beaches Bacteria TMDLs. Allowable exceedance-days are set for three time periods: AB-411 (April - dry non-AB-411), and Wet Winter (wet, non-AB-411). Allowable exceedance-days varies with sampling frequency.

MDL compliance beaches began November 2004.

beaches have mulitple listing such as beach closures, coliform counts, etc. So, if delisted as proposed, there is no other listing that will cover bacteriological pollution.

Appendix 1-B: Statewide Beaches

As previously discussed, Heal the Bay analyzes bacteria data collected by local health and water agencies at approximately 450 of the State's beaches to develop the weekly Beach Report Card. Thus, in addition to evaluating beach bacteria data in Los Angeles County, we analyzed statewide beach data in the context of the 2006 303(d) List. As described in detail below, our analysis revealed that there are numerous beaches that do not have a bacteria-related listing and are not currently proposed for listing despite the fact that readily available data show these beaches meet the listing criteria (per the State's listing policy section 3.3). Thus, State Board should include these beaches in the 2006 303(d) List updates. In addition, a number of the State's beaches are proposed for de-listing where readily available data show that the de-listing criteria is not met (per the State's listing policy section 4.3).

<u>Analysis Description</u> Section 3.3 of the Listing Policy outlines listing factors for bacteria at coastal beaches. Since beaches outside of Los Angeles County do not have a site-specific exceedance-day frequency, we evaluated the data in terms of the binomial distribution if the beaches are monitored year-round and a 4% exceedance percentage if they are only AB411-monitored beaches, as outlined in the listing policy. The first step in our analysis was to calculate rolling geometric means for all beaches for any 30-day period in which 5 samples were collected, as defined by the State Department of Health Services. The number of geometric means calculated was used as the sample count in the binomial model to determine whether a beach should be listed because of geometric mean exceedances. Next, for beaches monitored only during the AB-411 period, the numbers of single-sample exceedance-days were evaluated based on a 4% allowable exceedance-day rate. Beaches monitored year-round were evaluated by looking at the exceedance-days in terms of the binomial model for de-listing conventional pollutants. Because the task of evaluating all of the State's beaches was extremely time consuming, we analyzed geometric mean exceedance days separately from single-sample exceedance-days. This analysis approach is more lenient than the State's listing policy, and likely resulted in fewer proposed listings.

Data were analyzed year-by-year, rather than grouping all years together, because of the significant effect annual rainfall has on bacteriological water quality. A single very wet year (e.g., 1998, 2004-05) could result in the listing of beaches that typically have good water quality. Likewise, a few drought years could result in beaches with poor water quality during moderately rainy years, to not be listed. The Listing Policy is silent on this issue. In this analysis, we recommend listing beaches that meet the listing criteria in 1 of the past 3 years, or 2 of the past 5 years.

Our analysis is based on exceedance-days, which is consistent with reporting protocols used by local agencies to report health standards exceedances to the SWRCB, and by the SWRCB to the U.S. EPA. Also exceedance-days, rather than the number of exceedances per bacteria indicator type, are the relevant measure of water quality at beaches. For instance, warning signs are posted at beaches and the beneficial use of recreational water use is lost each day a sign is posted regardless of the type of bacteria indicator(s) that exceeded the health standards. In addition, bacteria TMDLs are designed around exceedance-days, not the number of overall exceedances, because this measure directly targets the impairment as perceived by the average beach-goer. The State's Listing Policy is silent on this issue. However, if the 4% allowable exceedances for beaches monitored only during AB-411 were applied to each indicator type separately, the beach could be conceivably posted 16% of the summer (4 single-sample standards), and still not be listed. This is not consistent with the study that forms the basis of the 4%, in which the 4% was a reported rate of exceedance-days.[1]

<u>The State Board Should Add 49 Statewide Beaches to the 2006 303(d) List Based Upon Readily Available Data.</u>

Our data analysis shows that fourteen beaches (28 monitoring locations) which are not currently on the 303(d) List for bacteria indicators or proposed for listing meet the listing criteria based on exceedance-days of the geometric mean standards. Thus, the following statewide beaches should be added to the 303(d) List: *Campbell Cove State Park, Aquatic Park, Crissy Field, Baker Beach, Jackrabbit Beach, Windsurfer Circle, Sunnydale Cover, Linda Mar, Capitola, Rio Del Mar, Goleta, Leadbetter, Monarch, and San Diego Bay.* In addition, *Newport Bay* exceeded the geometric mean exceedance-day listing criteria. State Board staff is currently proposing to list this beach. Thus, our analysis supports the staff's decision to list Newport Bay for bacteria indicators. These data are summarized in Table 1.

As seen in Table 2, thirty-one beaches (37 monitoring locations) that are monitored only during the AB-411 time period meet the listing criteria based on exceedance-days of the single-sample standards. Two of these monitoring locations, Campbell Cover and San Diego Bay (Bayside Park) also meet the geometric mean listing criteria, as reported above. None of these beaches are currently on the 303(d) List or proposed for listing in the 2006 cycle. Given our analysis of readily available data, the following beaches should be included on the 303(d) List as impaired for bacteria indicators: *Trinidad State Beach, Luffenholtz Beach, Moonstone County Park (Little River State Beach), Clam Beach County Park, Russian Gulch Campground, Goat Rock State Park Beach, Salmon Creek State Park Beach, Campbell Cove State Park Beach, Doran Regional Park Beach, Lawson's Landing, Heart's Desire, Chicken Ranch Beach, Golden Hinde, Millerton Point, Bolinas Beach, Muir Beach-North, Baker Beach, Schoonmaker Beach, Paradise Cove, China Camp, McNears Beach, Monterey Municipal Beach, San Carlos Beach, Asilomar State Beach, Spanish Bay, Stillwater Cove, Pico Ave.-San Simeon, Encinitas-Swami's Beach, La Jolla, Pacific Beach, San Diego Bay.*

As illustrated in Table 3, seventeen beaches (30 monitoring locations) monitored year-round meet the listing criteria based on exceedance-days of the single-sample standards.

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[1] Noble, Rachel T., Dorsey, J., Leecaster, M., Mazur, M., McGee, C., Moore, D., Victoria, O., Reid, D., Schiff, K., Vainik P., Weisberg, S. 1999. <u>Southern California Bight 1998 Regional Monitoring Program, Vol I: Summer Shoreline Microbiology.</u> Southern California Coastal Water Research Project, Westminster, CA.

Twelve of these beaches also met the geometric mean criteria for listing. None of these beaches are on the 303(d) List or proposed for listing. Thus, the State Board should list the following beaches as impaired by bacteria indicators: *Aquatic Park Beach, Crissy Field Beach, Baker Beach, Fort Fuston, Candlestick Point-Jackrabbit Beach, Candlestick Point-Windsurfer Circle, Candlestick Point-Sunnydale Cove, Capitola Beach, Rio Del Mar Beach, Stillwater Cove, Pismo Beach, Haskell's Beach, Goleta Beach, Leadbetter Beach, Huntington State Beach, Newport Bay, Monarch Beach.*

<u>Ormond Beach, San Buenaventura Beach, Mission Bay Shoreline and Pacific Ocean Shoreline – Scripps HA Should Remain on the 303(d) List.</u>

State Board staff proposes to de-list Ormond Beach, San Buenaventura Beach, the beaches of Mission Bay Shoreline and the beaches of Pacific Ocean Shoreline – Scripps HA for bacteria indicators. However, our analysis indicates that these beaches do ***not*** meet the de-listing criteria outlined in Section 4.3 of the Listing Policy. First, Ormond Beach at the industrial drain does not meet the de-listing criteria based on the number of exceedance-days of the geometric mean standard (Table 4), and San Buenaventura Beach at San Jon Rd. does not meet the de-listing policy for exceedance-days of the geometric mean standard or the single-sample standard (see Tables 4 and 6). Thus Ormond Beach and San Buenaventura should remain on the 303(d) List as impaired by bacteria indicators. In the San Diego Region, the State Board lumps numerous beaches under the headings "Mission Bay Shoreline" and "Pacific Ocean Shoreline - Scripps HA." However, individual beaches within these units are monitored and should be evaluated. Our analysis found that 15 of the monitoring locations within Mission Bay Shoreline do not meet the de-listing criteria for the geometric-mean standards (Table 4). Additionally, twenty-one monitoring sites within the Mission Bay Shoreline and five sites within the Scripps HA do not meet the de-listing criteria for the single-sample standard (see Tables 5 and 6). Thus, the State Board should maintain the individual beaches of Mission Bay Shoreline and Pacific Ocean-Scripps HA that correspond to the monitoring locations that do not meet the de-listing criteria.

Conclusion

The statewide coastal beaches bacterial data described above and presented in Tables 1 to 3 demonstrate the need for numerous additional bacteria indicator listings. In addition, as illustrated in Tables 4 and 6, several of the proposed beach de-listings are erroneous. As these data were and are readily available to the State Board, as part of their routine beach monitoring database maintained by the SWRCB partially to meet reporting requirement of the U.S. EPA, they should be included in the evaluation for the 2006 303(d) updates.

Table 1

Statewide Beaches that meet the listing criteria for Geometric Mean Exceedances-days[1,2] but are not Listed[3,4]

h Name	Description	Monitoring ID	Data Start Date	Data End Date	Frequency	# of Geomeans	# of Exceed-Days
Park Beach		SON60	04/02/01	11/28/05	Weekly	129	63
	211 Station	SFC10	08/01/02	12/07/05	Weekly	196	93
	East, 202.4 Station	SFC30	08/01/02	12/07/05	Weekly	163	74
	West, 202.2 Station	SFC50	08/01/02	12/07/05	Weekly	138	36
	Lobos Creek outlet	SFC80	10/16/02	12/06/05	Weekly	243	54
	Candlestick Point	SFC170	08/01/02	12/07/05	Weekly	131	33
	Candlestick Point	SFC180	08/01/02	12/07/05	Weekly	200	140
	Candlestick Point	SFC190	08/01/02	12/07/05	Weekly	155	77
	San Pedro Creek outlet	SMC50	10/06/98	11/28/05	Weekly	184	41
	East of pier	SCC170	04/03/00	06/28/05	Weekly	46	8
	West of Jetty	SCC180	06/14/01	12/05/05	Weekly	126	45
	East of Jetty	SCC190	06/15/01	12/05/05	Weekly	127	25
		SCC220	04/03/00	12/05/05	Weekly	173	64
		SBC9	06/28/99	12/05/05	Weekly	274	61
		SBC12	06/28/99	12/05/05	Weekly	272	62
	Newport Dunes-North	BNB24N	03/19/01	11/21/05	Weekly	177	75
	Newport Dunes-East	BNB24E	03/19/01	11/21/05	Weekly	164	45
	Newport Dunes-Middle	BNB24M	03/19/01	11/21/05	Weekly	167	52
	Newport Dunes-West	BNB24W	03/19/01	11/21/05	Weekly	163	41
	Garnet Avenue Beach	BNB31	03/19/01	11/21/05	Weekly	163	27
	43rd Street Beach	BNB09	03/19/01	11/21/05	Weekly	147	61
	38th Street Beach	BNB10	03/19/01	11/21/05	Weekly	181	82
	19th Street Beach	BNB14	03/19/01	11/21/05	Weekly	165	35
	10th Street Beach	BNB17	03/19/01	11/21/05	Weekly	187	68
	Harbor Patrol Beach	BNB33	03/19/01	11/21/05	Weekly	190	85
	North	OSL25	03/20/01	11/22/05	Weekly	187	54
	South	OSL23	03/20/01	10/23/02	Weekly	66	14
	Bayside Park (proj. of J Street)	EH120	04/05/00	10/26/05	Weekly	153	40

ulated for every 30-day period in which 5 samples were collected, per DHS guidance and the State Health Code.

e monitoring results from The County of Sonoma Environmental Health Division; The County of San Francisco, in partnership with the San Francisco Public Utilities Commission; The County of Health Department; The County of Santa Cruz Environmental Health Services; The County of Santa Barbara Environmental Health Agency; The County of Orange Environmental Health; The stewater Authority; The Orange County Sanitation District; The County of San Diego Department of Environmental Health.

.3 process for using the binomial model used to evaluate number of exceedances for listing.

ite 303(d) list, none of these beaches are currently listed for any bacteriological-related pollution such as beach closures, high coliform densities, etc.

ly proposed for listing.

Table 2

Statewide Beaches Monitored only during the AB-411 Period that meet the listing criteria for Single-sample Standard Exceedance-days[1,2] but are not Listed[3,4]

Red blocks denote time periods when listing criteria are met

		2000			2001			2002			2003			2004			2005		
Beach Name	Monitoring ID	Count	Exceed-Day	%	Count	Exceed-Day	%	Count	Exceed-Day	%	Count	Exceed-Day	%	Count	Exceed-Day	%	Count	Exceed-Day	%
ı near Mill Creek	HC10										28			31	2	7%	27	2	7%
ıar Luffenholtz Creek	HC20										28			32	2	6%	27	3	11%
ark (Little River State Beach)	HC30										30	1	3%	33	4	12%	28	2	7%
Park near Strawberry Creek	HC40										29	1	3%	32	3	9%	28	1	4%
ıground	Men40										12	1	8%						
k Beach	SON40				31			30			33	3	9%	27			29		
Park Beach	SON50				31			31	1	3%	33	5	15%	28	1	4%	32	4	13%
; Park Beach	SON60				38	10	26%	39	11	28%	35	13	37%	35	17	49%	30	6	20%
Beach	SON70				31			30			32	2	6%	28	2	7%	30	1	3%
	MC20										31	2	7%	30	4	13%			
	MC50										31	2	7%	30	2	7%			
:h at Channel	MC70										31	3	10%						
:h at Creek	MC80										31	2	7%	30	1	3%			
	MC90										31	1	3%	30	2	7%			
	MC100										31	3	10%	30	3	10%			
f Rd)	MC150										26			30	3	10%			
	MC200										31	8	26%	26	2	8%			
;hoe Cove NW	MC270										26	3	12%	28	2	7%			
;hoe Cove NE	MC280										26	3	12%	28	4	14%			
	MC290										23	1	4%	30					
	MC300										25			30	2	7%			
	MC310										31	2	7%	30	2	7%			
	MC320										25	1	4%	30	4	13%			
3each (at the commercial wharf)	MON20				32	4	13%	32	4	13%	27	1	4%	30	2	[illegible]	28	2	[illegible]
San Carlos Beach Park	MON30				31	2	7%	29			27			30	2	7%	28		
ı, projection of Arena Av.	MON50				30			30	1	3%	30	3	10%	28			29	1	3%
3each), end of 17 mile drive	MON60				31	2	7%	29			27			29	3	10%	29	1	3%
each and Tennis Club	MON70				33	4	12%	32	3	9%	33	9	27%	34	7	21%	27	3	11%
on	PICO23													13			20	1	5%
each (Seacliff Park)	EH410	30			31			27			28			25	2	8%	30	3	10%
ops Pier	EH350	30	2	7%	31	2	7%	29	1	3%	28	1	4%	29	1	3%	29		
/e	FM070	29	2	7%	29			31	2	7%	33	3	9%	28	2	7%	30	2	7%
ıl Pier (projection of Garnet)	FM020	26	1	4%	28			29	1	3%	29	2	7%	23	1	4%	26		
ı of Kellogg St.	EH210	33	2	6%	34	4	12%	29			29	1	3%	27	1	4%	18	1	6%
ıish Landing Park beach	EH160	31	2	7%	31	3	10%	37	9	24%	29	1	3%	30	2	7%	36	3	8%
side Park (projection of J Street)	EH120	41	7	17%	39	5	13%	37	9	24%	33	3	9%	36	7	19%	35	7	20%
etta Bay Park at boat launch	EH080	29	1	3%	33	2	6%	31	1	3%	28			27			23	2	9%

ance day is a sample day in which one or more of the 4 state bacteriological single-sample standards were exceeded.
ıe monitoring results from The County of Humboldt Environmental Health Department; The County of Mendocino Environmental Health Department; The County of Sonoma Environmental Health Division; The County of Marin Environmental Health Department; The onmental Health Agency; The County of San Luis Obispo Environmental Health Department; The County of San Diego Department of Environmental Health
.3 evaluation method specifies a maximum allowable exceedance frequency of 4% for beaches only monitored during the AB-411 time period. All of these beaches exceeded 4% during 1 of the 3 past years, or 2 of the last 5 years.
eview of the 2002 State 303(d) list, none of these beaches are currenty listed for any bacteriological-related pollution such as beach closures, high coliform densities, etc.
es that also should be listed based on geometric mean exceedance days - see Table 1.

Table 3

Statewide Beaches Monitored Year-round
that meet the listing criteria for Single-sample Standard Exceedance-days[1,2]
but are not Listed[3,4]

Red blocks denote time periods when listing criteria are met

		2000			2001			2002			2003			2004		
Beach	fpkLocId	Count	Exceed-Day	List	Count	Exceed-Day	List	Count	Exceed-Day	List	Count	Exceed-Day	List	Count	Exceed-Day	List
211 Station	SFC10							50	16	yes	94	23	yes	61	10	
ast, 202.4 Station	SFC30							34	9	yes	76	14	yes	65	14	yes
/est, 202.2 Station	SFC50							32	7	yes	65	9		57	6	
Creek	SFC80							37			151	12		71	14	yes
te Lake Merced overflow structure	SFC160							15	1		112	5		9	5	yes
ckrabbit Beach	SFC170							33	7	yes	68	9		51	4	
indsurfer Circle	SFC180							53	26	yes	105	38	yes	60	11	yes
innydale Cove	SFC190							37	13	yes	79	22	yes	59	8	
of the jetty	SCC180				20	8	yes	48	13	yes	55	17	yes	52	8	
of the jetty	SCC190				23	5	yes	47	7		55	9		52	7	
[illegible]	SCC220	38	10	yes	50	12	yes	47	8	yes	51	12	yes	52	6	
each and Tennis Club	MON70				34	4		36	3		37	9	yes	38	7	yes
) feet south of the pier	PB4				31	1		34	3		55	10	yes	53	4	
n. Tecolote and Winchester Cyn Creeks)	SBC75				27	5	yes	55	2		53	6		54	5	
[illegible]	SBC9	58	10	yes	60	14	yes	57	5		54	6		53	3	
[illegible]	SBC12	54	9	yes	60	16	yes	57	6		53	5		53	4	
ach, projection of Brookhurst Street	OHB03	180	36	yes	210	28		257	30		257	36		252	34	
rt Dunes-North[5]	BNB24N				41	10	yes	54	13	yes	58	14	yes	52	12	yes
rt Dunes-East	BNB24E				41	11	yes	53	9	yes	51	7		53	15	yes
rt Dunes-Middle	BNB24M				41	6		53	7		52	7		51	10	yes
noa Beach	BNB07				41	3		54	9	yes	49	5		49	4	
acht Club Beach	BNB32				41	7	yes	53	5		50	6		49	3	
Avenue Beach	BNB02				41	7	yes	54	6		52	7		49	6	
Canal	BNB34				41	7	yes	53	4		49	6		50	6	
treet Beach	BNB09				41	11	yes	53	15	yes	48	23	yes	48	9	yes
treet Beach	BNB10				41	8	yes	53	10	yes	61	11	yes	59	14	yes
treet Beach	BNB14				41	9	yes	54	12	yes	53	9	yes	51	6	
treet Beach	BNB17				41	6		53	9	yes	66	17	yes	56	12	yes
Patrol Beach	BNB33				41	9	yes	57	21	yes	59	10	yes	61	13	yes
th)	OSL25				40	3		54	5		61	10		60	12	yes

ance-day is a sample day in which one or more of the 4 state bacteriological single-sample standards were exceeded.
ne monitoring results from The County of San Francisco, in partnership with the San Francisco Public Utilities Commission; The County of Santa Cruz Environmental Health Services; The County of Monterey Environmental Health
an Luis Obispo Environmental Health Department; The County of Santa Barbara Environmental Health Agency; The County of Orange Environmental Health; The South Orange County Wastewater Authority; The Orange County

.3 evaluation method specifies using the binomial model for evaluating beaches monitored year-round. All of these beaches exceeded the binomial model allowance during 1 of the 3 past years, or 2 of the last 5 years.
eview of the 2002 State 303(d) list, none of these beaches are currenty listed for any bacteriological-related pollution such as beach closures, high coliform densities, etc.
ty proposed for listing.
es that also should be listed based on geometric mean exceedance days - see Table 1.

Table 4

Statewide Beaches that do not meet the de-listing criteria for Geometric Mean Exceedance-days[1,2] but are Proposed for De-Listing[3,4]

h Name	Description	Monitoring ID	Data Start Date	Data End Date	Frequency	# of Geomeans	# of Exceed-Days
each	south of drain at San Jon Rd.	VC19000	07/12/99	10/31/05	Weekly	243	62
	Oxnard Industrial drain, 50 yds. no. of the drain	VC43000	07/12/99	10/25/05	Weekly	211	42
Cove	north cove	MB170	03/22/00	08/27/04	Weekly	209	85
'oint-northside	apex of Gleason Rd.	MB160	03/22/00	10/25/05	Weekly	153	40
an Cove	west of boat launch	MB140	03/22/00	06/27/01	Weekly	54	12
lara Cove	projection of Portsmouth Ct.	MB131	03/30/00	10/20/03	Weekly	52	18
Park	projection of Fanuel St.	MB120	03/22/00	10/25/05	Weekly	142	49
Shores	projection of La Cima Dr.	MB110	03/22/00	10/20/03	Weekly	113	25
Point Shores		MB100	03/21/00	10/25/05	Weekly	143	28
Refuge near fence	projection of Lamont St.	MB090	03/21/00	10/25/05	Weekly	163	50
ind	west of Rose Creek	MB080	03/21/00	11/28/05	Weekly	258	158
a Cove	mid-cove	MB070	03/21/00	10/25/05	Weekly	186	88
Center	projection of Clairemont Dr.	MB060	03/21/00	10/25/05	Weekly	242	149
e Shores drain		MB040	03/21/00	10/25/05	Weekly	154	47
e Playground	watercraft area	MB031	06/13/01	10/25/05	Weekly	41	7
e Creek outlet		MB030	03/21/00	02/10/03	Weekly	106	73
Anchorage		MB020	03/21/00	03/12/03	Weekly	74	36

ılated for every 30-day period in which 5 samples were collected, per DHS guidance and the State Health Code.

ıe monitoring results from The County of Ventura Environmental Health Division andCity of San Diego Stormwater Division.

n 4.3 process for using the binomial model was used to evaluate number of exceedance-days for de-listing.

ıte 303(d) list, none of these beaches are currenty listed for any bacteriological-related pollution such as beach closures, high coliform densities, etc.

Table 5

Statewide Beaches Monitored only during the AB-411 Period that do not meet the de-listing criteria for Single-sample Standard Exceedance-days[1,2] but are Proposed for De-Listing[3,4]

Red blocks denote time periods when de-listing criteria are not met

		2000			2001			2002			2003			2004			2005		
Beach Name	Monitoring ID	Count	Exceed-Day	%	Count	Exceed-Day	%	Count	Exceed-Day	%	Count	Exceed-Day	%	Count	Exceed-Day	%	Count	Exceed-Day	%
ection of Ave De La Playa	FM080	28	1	4%	29	2	7%	28			39	3	8%	32	4	13%	38	3	8%
Beach	EH305				30			29			29	2	7%	24			27	1	4%
ebo)	EH303							30	2	7%	28			27	3	11%	25		
f Vallecitos	EH320				6	3	50%				3	1	33%	3			4		
ool	EH310	25	16	64%	8	5	63%	3	2	67%	16	12	75%	14	9	64%			
s Basin (proj. of Balboa Ct.	MB225	29			31	1	3%	31	3	10%	31	2	7%	28	1	4%	31	2	7%
Cove (north cove)	MB170	48	8	17%	49	8	16%	40	3	8%	45	7	16%	1					
Cove (east cove)	MB173													35	5	14%	32	2	6%
Point-northside (apex of Gleason Rd.	MB160	45	14	31%	30	4	13%	33	3	9%	26	1	4%	31	3	10%	30		
Clara Cove (proj. Portsmouth Ct.	MB131	14	1	7%	6			37	6	16%	31	7	23%						
Park (proj. of Fanuel St.	MB120	32	7	22%	31	5	16%	32	3	9%	35	5	14%	26	1	4%	32	2	6%
Shores (proj. of La Cima Dr.	MB110	30	5	17%	31	5	16%	34	5	15%	26								
Point Shores	MB100	38	5	13%	30	2	7%	29			27	2	7%	32	5	16%	31	2	7%
Refuge near fence (proj. of Lamont St.	MB090	33	6	18%	30	5	17%	34	4	12%	32	1	3%	38	7	18%	30	1	3%
Cove (mid-cove)	MB070	41	11	27%	43	13	30%	34	5	15%	34	4	12%	34	5	15%	31	3	10%
Center (proj. of Clairemont Dr.	MB060	44	14	32%	39	6	15%	38	13	34%	34	3	9%	43	16	37%	32	5	16%
t Station north of Leisure Lagoor	MB053													31	3	10%	32	3	9%
Lagoon	MB050	36	3	8%	30	2	7%	34	5	15%	33	2	6%	34	3	9%	39	6	15%
e Shores drain	MB040	37	11	30%	32	3	9%	31	2	7%	29			33	5	15%	29	1	3%
e Playground (watercraft area	MB031				5			12	1	8%	30	4	13%	29	2	7%	35	6	17%
e Creek outlet	MB030	31	6	19%	40	9	23%	34	10	29%									
sland, NW shore	MB085													4	3	75%			
n Isle Ski Beach	MB203													34	2	6%	30		

ance-day is a sample day in which one or more of the 4 state bacteriological single-sample standards were exceeded.

e monitoring results from The County of San Diego Department of Environmental Health andCity of San Diego Stormwater Division.

n 4.3 evaluation method specifies a maximum allowable exceedance frequency of 4% for beaches only monitored during the AB-411 time period. All of these beaches exceeded 4% during 1 of the 3 past years, or 2 of the last 5 years.

eview of the 2002 State 303(d) list, none of these beaches are currenty listed for any bacteriological-related pollution such as beach closures, high coliform densities, etc.

es that should not bede- listed based on geometric mean exceedance-days - see Table 4.

Table 6

Statewide Beaches Monitored Year-round
that do not meet the de-listing criteria for Single-sample Standard Exceedance-days[1,2]
but are Proposed for De-Listing[3,4]

Red blocks denote time periods when de-listing criteria are not met

		2000			2001			2002			2003			2004			2005[5]		
Beach	fpkLocId	Count	Exceed-Day	List	Count	Exceed-Day	List	Count	Exceed-Day	List	Count	Exceed-Day	List	Count	Exceed-Day	List	AB411 count	Exceed-Day	%
each- south of drain at San Jon Rd.	VC19000	57	10	yes	56	13	yes	54	3		51	3		50	9	yes	31	6	19%
ind (west of Rose Creek)	MB080	54	10	yes	66	20	yes	51	17	yes	69	23	yes	48	12	yes			

ance day is a sample day in which one or more of the 4 state bacteriological single-sample standards were exceeded.
e monitoring results from The County of Ventura Environmental Health Division and City of San Diego Stormwater Division.
n 4.3 evaluation method specifies using the binomial model for evaluating beaches monitored year-round. All of these beaches exceeded the binomial model allowance during 1 of the 3 past years, or 2 of the last 5 years.
eview of the 2002 State 303(d) list, none of these beaches are currenty listed for any bacteriological-related pollution such as beach closures, high coliform densities, etc.
es that also should be listed based on geometric mean exceedance days - see Table 4.
each sampling cut back to AB411 only in 2005. For this time period, the 4% allowable exceedance-day rate was applied.

CITY OF LOS ANGELES

CALIFORNIA

ANTONIO R. VILLARAIGOSA
MAYOR

DEPARTMENT OF
PUBLIC WORKS

BUREAU OF SANITATION

RITA L. ROBINSON
DIRECTOR

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EXECUTIVE OFFICER

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ASSISTANT DIRECTORS

ENVIRONMENTAL MONITORING DIVISION
HARRY PREGERSON BUILDING
12000 VISTA DEL MAR
PLAYA DEL REY, CA 90293
TEL: (310) 648-5610
FAX: (310) 648-5731

October 27, 2005

Mr. Wayne Nastri
Regional Administrator
Environmental Protection Agency, Region IX
75 Hawthorne Street
San Francisco, CA 94105

EXAMINATION OF SMBBB TMDL STATIONS OF SANTA MONICA BAY
MONTH OF SEPTEMBER 2005

RE: SANTA MONICA BAY BEACHES BACTERIAL TOTAL MAXIMUM DAILY LOAD COORDINATED SHORELINE MONITORING PLAN

Dear Mr. Nastri:

The enclosed monthly monitoring report complies with the requirements of the Santa Monica Bay Beaches Bacterial Total Maximum Daily Load Coordinated Shoreline Monitoring Plan (SMBBB TMDL CSMP). These requirements are specified in the SMBBB TMDLs as adopted on July 15, 2003 for the responsible Jurisdictional Groups. The SMBBB TMDLs were issued by the California Regional Water Quality Control Board (CRWQCB), Los Angeles Region, and the Regional Administrator of the U.S. Environmental Protection Agency, Region IX. The monthly summaries include tabular data of concentrations of coliforms and enterococcus measured in water samples collected along the shoreline in Santa Monica Bay from the Los Aliso subwatershed in the north to the Ballona Creek subwatershed in the south, and a noncompliance remarks section.

The enclosed monitoring data were produced by the Environmental Monitoring Division (EMD).The EMD is responsible for monitoring and reporting data and observations for Jurisdictional Groups 1 through 6, 8, and 9.

If you have any questions regarding to these reports, please call Ms. Kay Yamamoto of my staff at (310) 648-5727.

Sincerely,

Masahiro Dojiri, Ph.D.
Division Manager
Environmental Monitoring Division

Enclosure

GEM: KMY
c. County of Los Angeles, Department of Health Services

Appendix 1-C

SEPTEMBER 2005

TABLE OF CONTENTS

PAGE

SECTION A

MONTHLY SUMMARY

SANTA MONICA BAY BEACHES BACTERIAL TMDL
SINGLE SAMPLE LIMIT EXCEEDANCE TABLE

November 2004 to September 2005

MONTH	1-2	1-3	1-6	1-8	1-10	1-12	1-13	1-14	1-16	1-17	1-18	2-1	2-2	2-4	2-7	2-10	2-11	2-13	3-3	3-4	3-5	3-6	3-8	BC-1	MC-2
	WINTER - DRY (NOVEMBER 1 - MARCH 31) EXCEEDANCE DAYS ^																								
NOV 2004						8					7	4	5	3	16	3		2	13	8	3		1	5	11
DEC 2004				1		1					8	6		1	13	1		1	9	5	4		4		12
JAN 2005	1			1			3	1	1		6	2	2	3	10				2	7	3	2	1	7	4
FEB 2005			1	2		3	1		1		2	3	2	2	9				5	6	1		1	5	
MAR 2005			2	3		5				2	4	2	1	7	11	1			9	8	1		1	6	1
TOTAL YTD	1		3	7		17	4	1	2	2	27	17	10	16	59	5		3	38	34	12	2	8	23	28
ALLOWANCES	1	1	1	1	1	1	1	1	1	1	3	1	1	3	3	3	1	2	3	3	3	1	2	3	3
EXCEEDED?			Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

MONTH	1-2	1-3	1-6	1-8	1-10	1-12	1-13	1-14	1-16	1-17	1-18	2-1	2-2	2-4	2-7	2-10	2-11	2-13	3-3	3-4	3-5	3-6	3-8	BC-1	MC-2
	SUMMER - DRY (APRIL 1 - OCTOBER 31) EXCEEDANCE DAYS *																								
APR 2005				6		2	1	4	1	1	8	5	3	8	21			3	8	9	1	2	1	5	14
MAY 2005				7	1	6		4		4	12	6		7	10	1		2	6	11			2	9	10
JUN 2005				13	2	4	1	1		1	10	7		6	23			8	12	4			1	10	20
JUL 2005				12	4	4	4		2	1	17	8	2	3	18				10	2	1	1	1	7	16
AUG 2005				6	1	11	1				7	10	7	1	13	3			12	1				11	10
SEP 2005				1	2	6					3	7	2	1	8				7	1				3	7
TOTAL YTD				45	10	33	7	9	3	7	57	43	14	26	93	4		13	55	28	2	3	5	45	77
ALLOWANCES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EXCEEDED?				Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

MONTH	1-2	1-3	1-6	1-8	1-10	1-12	1-13	1-14	1-16	1-17	1-18	2-1	2-2	2-4	2-7	2-10	2-11	2-13	3-3	3-4	3-5	3-6	3-8	BC-1	MC-2
	WET - WEATHER EXCEEDANCE DAYS @																								
NOV 2004																									
DEC 2004	1	1			1	1	1	1	1		6	1	1	6	7	3	1	4	7	7	6	1	4	6	7
JAN 2005	1	1	2	2	1	1	2	1	1		13	2	2	12	15	9	1	6	11	12	10	2	7	14	14
FEB 2005				1	1	3		3	4		11	5	1	11	12	3	1	6	11	11	7	2	7	12	8
MAR 2005				1		1				2	6	2	1	8	11	1		3	6	10	4		2	8	4
APR 2005											3		1	2	3	2		3	2	3	3		2	3	2
MAY 2005				1		1	1	1		1	1			2	4	1			2	2				2	2
JUN 2005																									
JUL 2005																									
AUG 2005																									
SEP 2005					1	1	1				2	1	1	1	4			1	2	2	2			3	2
TOTAL YTD	2	2	2	5	4	8	5	6	6	3	42	11	7	42	56	19	3	23	41	47	32	5	22	48	39
ALLOWANCES	3	3	3	3	3	3	3	3	3	3	17	3	3	17	17	17	3	17	17	17	17	3	13	17	17
EXCEEDED?				Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Generated by NDL at 10/19/2005 08:00:33 AM using the Production Database and WISARD V2.(
WISARD - Legal TMDL - SMBBB Summary

LEGEND:
* - Summer-Dry compliance to be achieved by July 15, 200€
^ - Winter-Dry compliance to be achieved by July 15, 200!
@ - Wet-Weather compliance date 10-18 years from July 15, 2003

Appendix 1-C

Shaded columns denote exceedance counts greater than allowance:

Single-Sample Limits:
Total coliform density shall not exceed 10,000/100 ml
Fecal coliform density shall not exceed 400/100 ml
Enterococcus density shall not exceed 104/100 ml
Total coliform density shall not exceed 1,000/100 ml
if the ratio of fecal-to-total coliform exceeds 0.1

SANTA MONICA BAY BEACHES BACTERIAL TMDL
ROLLING 30-DAY GEOMETRIC MEAN EXCEEDANCE TABLE

November 2004 to September 2005

MONTH	1-2	1-3	1-6	1-8	1-10	1-12	1-13	1-14	1-16	1-17	1-18	2-1	2-2	2-4	2-7	2-10	2-11	2-13	3-3	3-4	3-5	3-6	3-8	BC-1	MC-2
	WINTER - DRY (NOVEMBER 1 - MARCH 31) EXCEEDANCE DAYS ^																								
NOV 2004						1					1	1	1		1				1	1					1
DEC 2004						31					31	31	12		31				31	30					31
JAN 2005			24			17					12	31	20		12				31	2	17			5	31
FEB 2005			19	24		20	24	6	17	18	28	28	28	23	28				17	25	19			28	26
MAR 2005			31	31		31		31	31	31	31	23	31	31	31				13	28				31	31
TOTAL YTD			74	55		100	24	37	48	49	103	114	92	54	103				93	86	36			64	120
ALLOWANCES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EXCEEDED?			Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				Yes	Yes	Yes			Yes	Yes

MONTH	1-2	1-3	1-6	1-8	1-10	1-12	1-13	1-14	1-16	1-17	1-18	2-1	2-2	2-4	2-7	2-10	2-11	2-13	3-3	3-4	3-5	3-6	3-8	BC-1	MC-2
	SUMMER - DRY (APRIL 1 - OCTOBER 31) EXCEEDANCE DAYS *																								
APR 2005			22	30		30		30		23	30	30	30	28	30				30	15				26	30
MAY 2005				31	2	31	14	28	4	20	31	31	31	31	31			21	9	28				12	31
JUN 2005				30	30	30	5	30		30	30	30	30	1	30			6	24	21				30	30
JUL 2005				31	31	31	26	31	3		31	31	12	23	31	5			31					31	31
AUG 2005				31	24	31	26			13	30	31	31	30	31	31			31					31	31
SEP 2005				15	18	30				28		30	11		30	11			30					30	9
TOTAL YTD			22	168	105	183	71	119	7	114	152	183	145	113	183	47		27	155	64				160	162
ALLOWANCES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EXCEEDED?			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes				Yes	Yes

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WISARD - Legal TMDL - SMBBB Summary

LEGEND:

* - Summer-Dry compliance to be achieved by July 15, 200€
^ - Winter-Dry compliance to be achieved by July 15, 200ς

Shaded columns denote exceedance counts greater than allowance≤

Rolling 30-day Geometric Mean Limits:
Total coliform density shall not exceed 1,000/100 ml
Fecal coliform density shall not exceed 200/100 ml
Enterococcus density shall not exceed 35/100 ml

CITY OF LOS ANGELES

CALIFORNIA

ANTONIO R. VILLARAIGOSA
MAYOR

DEPARTMENT OF
PUBLIC WORKS
BUREAU OF SANITATION
RITA L. ROBINSON
DIRECTOR
JOSEPH E. MUNDINE
EXECUTIVE OFFICER
VAROUJ S.ABKIAN
TRACI J. MINAMIDE
ENRIQUE C. ZALDIVAR
ASSISTANT DIRECTORS
ENVIRONMENTAL MONITORING DIVISION
HARRY PREGERSON BUILDING
12000 VISTA DEL MAR
PLAYA DEL REY, CA 90293
TEL: (310) 648-5610
FAX: (310) 648-5731

October 27, 2005

Mr. Wayne Nastri
Regional Administrator
Environmental Protection Agency, Region IX
75 Hawthorne Street
San Francisco, CA 94105

EXAMINATION OF DHS SMBBB TMDL STATIONS OF SANTA MONICA BAY MONTH OF SEPTEMBER 2005

RE: SANTA MONICA BAY BEACHES BACTERIAL TOTAL MAXIMUM DAILY LOAD COORDINATED SHORELINE MONITORING PLAN – Department of Health Services Bacteriological Data

Dear Mr. Nastri:

The enclosed monthly monitoring report complies with the requirements of the Santa Monica Bay Beaches Bacterial Total Maximum Daily Load Coordinated Shoreline Monitoring Plan (SMBBB TMDL CSMP). These requirements are specified in the SMBBB TMDLs as adopted on July 15, 2003 for the responsible Jurisdictional Groups. The SMBBB TMDLs were issued by the California Regional Water Quality Control Board (CRWQCB), Los Angeles Region, and the Regional Administrator of the U.S. Environmental Protection Agency, Region IX. The monthly summaries include tabular data of concentrations of coliforms and enterococcus measured in water samples collected along the shoreline in Santa Monica Bay from the Arroyo Sequit subwatershed in the north to the Redondo subwatershed in the south, and a noncompliance remarks section.

The enclosed monitoring data were produced by the County of Los Angeles Department of Health Services (LACDHS) and reported by the City of Los Angeles. Please note that beginning July 1, 2005 EMD produced a portion of the monitoring data for SMB 5-2 (old DHS 113) and SMB 6-2 (old DHS 115). The EMD is responsible for submitting LACDHS bacteriological data for Jurisdictional Groups 1 through 6, 8, and 9.

Please note that data corrections to the August 2005 DHS report are included herein. The data changes affect the SMB-6-01 station on August 17, 2005. Please replace this page in your August 2005 report.

If you have any questions regarding to these reports, please call Ms. Kay Yamamoto of my staff at (310) 648-5727.

Sincerely,

Masahiro Dojiri, Ph.D.
Division Manager
Environmental Monitoring Division

Enclosure

GEM: KMY

c. County of Los Angeles, Department of Health Services

SANTA MONICA BAY BEACHES BACTERIAL TMDL
SINGLE SAMPLE LIMIT EXCEEDANCE TABLE
COUNTY OF LOS ANGELES DHS LABORATORY MONITORING

November 2004 to September 2005

MONTH	1-1	1-4	1-5	1-7	1-9	1-11	1-15	2-3	2-5	2-6	2-8	2-9	2-12	2-14	2-15	3-1	3-2	3-7	3-9	4-1	5-2	5-4	6-1	6-4	MC-1	MC-3
	WINTER - DRY (NOVEMBER 1 - MARCH 31) EXCEEDANCE DAYS ^																									
NOV 2004		2	1	5	1	1	1	1	1	2					1	1		1	2		3		1	1		1
DEC 2004		1		1						1		1	1											1		
JAN 2005	2	5	2	1					2	4	1		1			2	2									3
FEB 2005	2	5	5	3	3					5			1			2			1	2					1	1
MAR 2005	1	2	1	2	2				1	3													1		2	1
TOTAL YTD	5	15	9	12	6	1	1	1	4	15	1	1	3		1	5	2	1	3	2	3		2	2	3	6
ALLOWANCES	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1
EXCEEDED?	Yes	Yes	Yes	Yes	Yes				Yes	Yes			Yes			Yes	Yes		Yes	Yes	Yes		Yes	Yes	Yes	Yes
	SUMMER - DRY (APRIL 1 - OCTOBER 31) EXCEEDANCE DAYS *																									
APR 2005	3	2	3	3	4				3	3	1	1	1			1		1			2				1	1
MAY 2005	4		4	6	4	1	1								1		1			1	2				1	1
JUN 2005			2	1			1									1										
JUL 2005				1	7				1												3		2		2	
AUG 2005				3	1	1	1		1			1					1				3		1			
SEP 2005							1	1							1								1		3	2
TOTAL YTD	7	2	9	14	16	2	4	1	5	3	1	2	1		2	2	2	1		1	10		4		7	4
ALLOWANCES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EXCEEDED?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes		Yes	Yes		Yes		Yes	Yes
	WET - WEATHER EXCEEDANCE DAYS @																									
NOV 2004																										
DEC 2004																										
JAN 2005	1	2	2	1	1	1	1	2	2	4	2	2	1	1	2	2	2	2	2	1	2	2	2	1	1	1
FEB 2005	1	1	1	2	2	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
MAR 2005	1	2	5	4	2				1	5		1		1	2				2		1		2			3
APR 2005									1																	
MAY 2005	1		1	2				1	1																	2
JUN 2005																										
JUL 2005																										
AUG 2005																										
SEP 2005																					1		3			
TOTAL YTD	4	5	9	9	5	2	2	4	6	12	3	4	2	3	5	3	3	3	5	2	5	3	8	2	2	7
ALLOWANCES	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	2	3	3	3	3
EXCEEDED?	Yes	Yes	Yes	Yes	Yes			Yes	Yes	Yes		Yes			Yes				Yes		Yes	Yes	Yes			Yes

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WISARD - Legal TMDL - SMBBB Summary

LEGEND:

* - Summer-Dry compliance to be achieved by July 15, 200€
^ - Winter-Dry compliance to be achieved by July 15, 200ç
@ - Wet-Weather compliance date 10-18 years from July 15, 2003

Appendix I-C

Shaded columns denote exceedance counts greater than allowances

Single-Sample Limits:
Total coliform density shall not exceed 10,000/100 ml
Fecal coliform density shall not exceed 400/100 ml
Enterococcus density shall not exceed 104/100 ml
Total coliform density shall not exceed 1,000/100 ml
if the ratio of fecal-to-total coliform exceeds 0.1

SANTA MONICA BAY BEACHES BACTERIAL TMDL
ROLLING 30-DAY GEOMETRIC MEAN EXCEEDANCE TABLE
COUNTY OF LOS ANGELES DHS LABORATORY MONITORING

November 2004 to September 2005

MONTH	1-1	1-4	1-5	1-7	1-9	1-11	1-15	2-3	2-5	2-6	2-8	2-9	2-12	2-14	2-15	3-1	3-2	3-7	3-9	4-1	5-2	5-4	6-1	6-4	MC-1	MC-3
	WINTER - DRY (NOVEMBER 1 - MARCH 31) EXCEEDANCE DAYS ^																									
NOV 2004				1					1	1					1			1	1		1		1	1		
DEC 2004		30	24	31					28	10		4	6	5	11	28	24	31	1		16		18	31		
JAN 2005		7	31	31			2		8	1		31					6	3						31		
FEB 2005	16	28	28	28	15		5		27	28	20	28				15	20			23	24		6	11	17	25
MAR 2005		31	31	31	31		3		19	31	12	21								8	1		14	18	31	31
TOTAL YTD	16	96	114	122	46		10		83	71	32	84	6	5	12	43	50	35	2	31	42		39	92	48	56
ALLOWANCES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EXCEEDED?	Yes	Yes	Yes	Yes	Yes		Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
	SUMMER - DRY (APRIL 1 - OCTOBER 31) EXCEEDANCE DAY																									
APR 2005	20	19	30	30	30				4	30											9				17	19
MAY 2005	26		31	31	31				8	5		13	8								30				30	20
JUN 2005	7		29	11	13																					19
JUL 2005	10				25	7																				21
AUG 2005				9	30	13			5			29												3		
SEP 2005				2								8														
TOTAL YTD	63	19	90	83	129	20			17	35		50	8								39			3	47	79
ALLOWANCES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EXCEEDED?	Yes	Yes	Yes	Yes	Yes	Yes			Yes	Yes		Yes	Yes								Yes			Yes	Yes	Yes

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WISARD - Legal TMDL - SMBBB Summary

LEGEND:

* - Summer-Dry compliance to be achieved by July 15, 2006
^ - Winter-Dry compliance to be achieved by July 15, 2009

Shaded columns denote exceedance counts greater than allowances

Rolling 30-day Geometric Mean Limits:
Total coliform density shall not exceed 1,000/100 ml
Fecal coliform density shall not exceed 200/100 ml
Enterococcus density shall not exceed 35/100 ml

Appendix 1-C

Appendix 2: Compton Creek Trash

Issue Summary
Tonnage Data
Photographic Evidence

Compton Creek Trash

Compton Creek should be placed on the 303(d) List for trash based on the situation-specific weight of evidence under section 3.11of the Listing Policy. Compton Creek Watershed is arguably the most visibly polluted watershed in California, let alone Los Angeles County. Large volumes of trash collects in the flowing water and along the banks of Compton Creek. Compton Creek supports many beneficial uses including ground water recharge, water contact recreation, non-contact water recreation, warm freshwater habitat, wildlife habitat and wetland habitat. The high concentration of trash in Compton Creek impairs these beneficial uses. In addition, the trash pollution violates the LARWQCB Basin Plan's narrative water quality objective that "waters shall not contain floating materials including solids, liquids, foams and scum, in concentrations that cause nuisance or adversely affects beneficial uses."

There are three lines of evidence available to assess trash in Compton Creek. The first line of evidence is data on the tonnage of trash collected by Los Angeles County Department of Public Works between 2002 and 2005. In 2002, the County instituted a trash removal program for Compton Creek. As see in Table 1, large amounts of trash have been collected and removed from Compton Creek through this effort. For instance in July of 2002, over 23 tons of trash were removed through this program. The second line of evidence, presented in Table 2, is data on the tonnage of trash collected by volunteers at Coastal Cleanup Day and Earth Day events since 2002. At the April 2003 clean-up event, volunteers removed over 10 tons of trash in a period of less than three hours. The final line of evidence is Heal the Bay's photographic documentation of trash pollution in Compton Creek. The photographs below show large amounts of accumulated trash in various sections of Compton Creek. These photographs were taken at various Heal the Bay-sponsored clean-up activities. Heal the Bay has been the Los Angeles County coordinator for Coastal Cleanup Day and Adopt A Beach for 15 years. During that time, there have been regular clean-ups at over 60 locations. Not one of these locations is even close to as polluted with trash as Compton Creek. Based on these three lines of evidence, the weight of evidence clearly indicates that water quality standards are not attained. Thus, under section 3.11 of the Listing Policy, Compton Creek should be listed for trash on the 303(d) List.

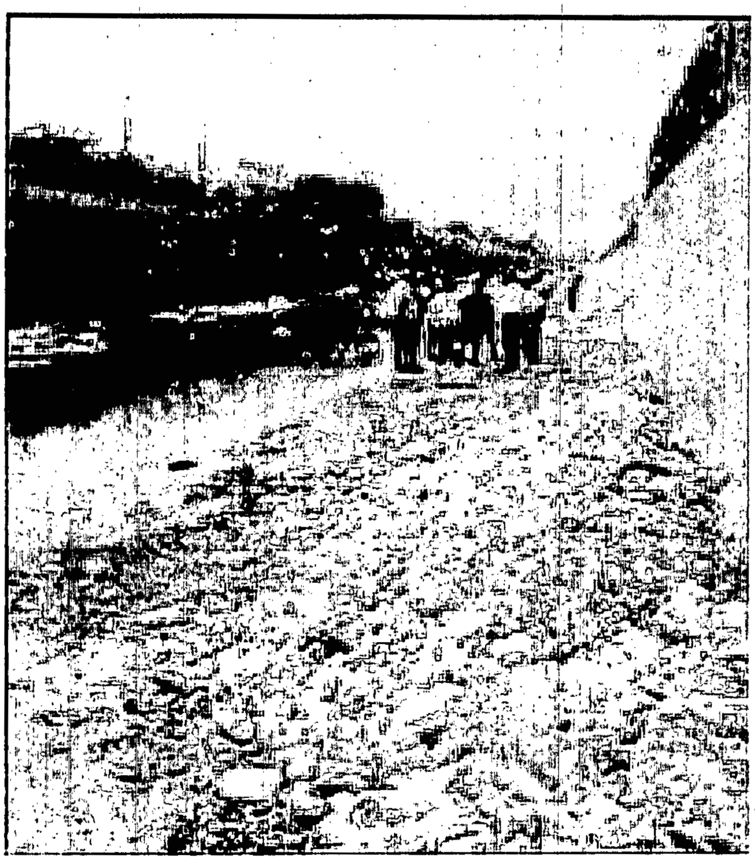
Month	Tons Removed
Jul-02	23.35
Aug-02	3.98
Sep-02	3.16
Oct-02	4.84
Nov-02	2.63
Dec-02	3
Apr-03	13.73
May-03	5.53

Month	Tons Removed
Jul-03	7.55
Aug-03	7.2
Sep-03	8.36
Oct-03	8.18
Apr-04	1.61
May-04	4.21
Jun-04	3.34
Sep-04	4.15
Oct-04	3.21
Nov-04	5.6
Jun-05	6.23
Jul-05	3.37
Aug-05	4.65
Sep-05	4.6
Oct-05	2.7

Table 1: Tons of trash removed from Compton Creek by Los Angeles County Department of Public Works. (Daniel Sharp, Los Angeles County Department of public works (DSHARP@ladpw.org).)

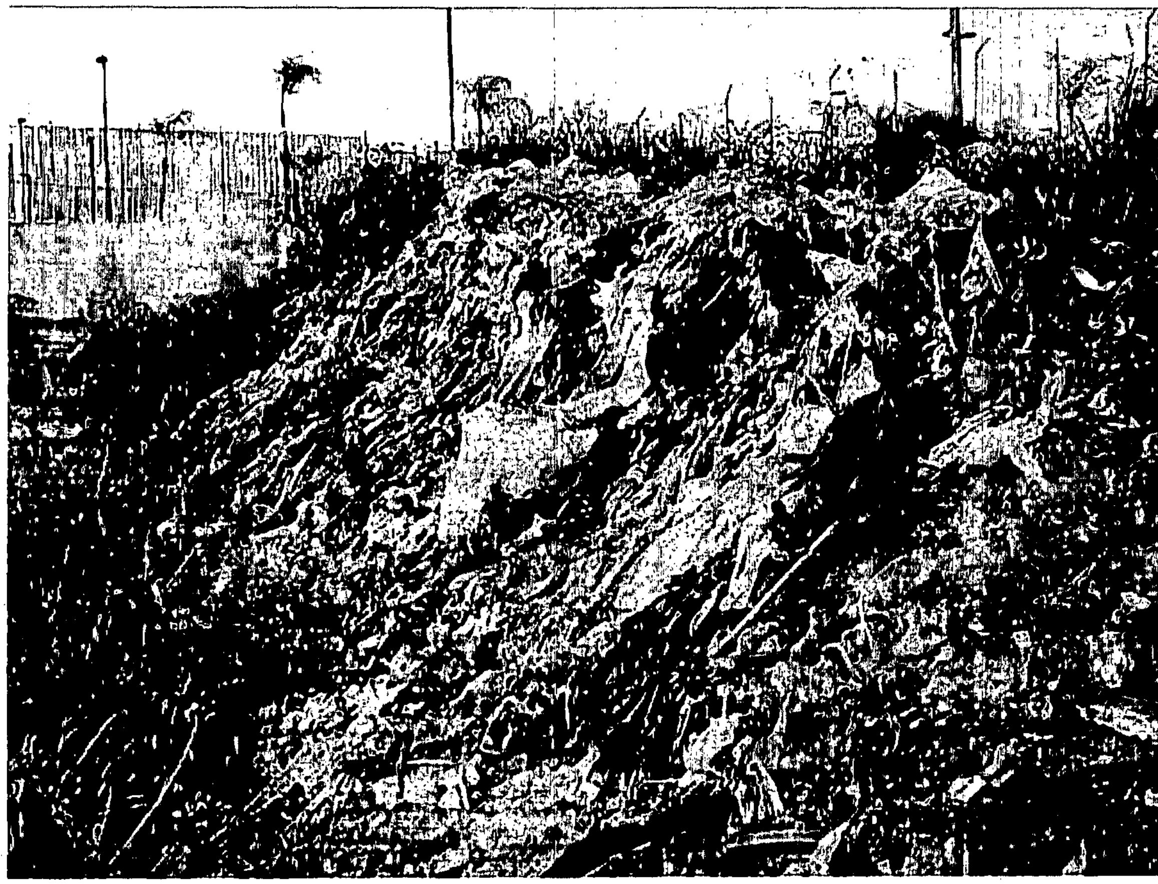
Month	Tons Removed
21-Sep-02	1
1-Apr-03	2
20-Sep-03	2.5
17-Apr-04	10
18-Sep-04	5
30-Apr-05	2
17-Sep-05	4

Table 2: Tons of trash removed from Compton Creek by volunteers on Coastal Cleanup Day and Earth Day (Heal the Bay). All Clean-ups were three hours or less.



Compton Creek. Photographic taken by Heal the Bay staff in 2002.

Compton Creek. Photograph taken by Heal the Bay staff at Coastal Cleanup Day on September 20, 2003.



Compton Creek, across from Casino. Photograph taken by Heal the Bay staff in 2004.

Compton Creek: Heal the Bay Executive Director, Mark Gold. Photograph taken at a Heal the Bay-sponsored clean-up on December 22, 2005.

Compton Creek. Photograph taken at a Heal the Bay-sponsored clean-up on December 22, 2005.

Appendix 3:
Excess Algal Growth in Calleguas Creek

3 - A: UCLA Algal Coverage Data
3 - B: Photographic Evidence
3 - C: Map of Low IBI Scores in Watershed

Appendix 3-A: Calleguas Creek Transect Data

Source: Ambrose, R.F., Lee, S.F., and S.P. Bergquist, Environmental Monitoring and Bioassessment of Coastal Watersheds in Ventura and Los Angeles Counties (2003).

Site	Watershed	Macroalgae	Diatoms (Periphyton)		Macroalgae	Macrophytes	Moss	No Cover	Total Cover	Total Vegetation
		Biomass (g/m2)	All diatoms % cover	med. and thick % Cover	% Cover	% Cover	% Cover	%	%	% Cover
Calleguas at Deepwood	Calleguas	0.00	5	0	0	0	0	95	100	5
Calleguas at Deepwood	Calleguas	0.00	95	0	0	0	0	5	100	95
Calleguas at Deepwood	Calleguas	0.00	95	0	0	0	0	5	100	95
Calleguas at Deepwood	Calleguas	0.00	0	0	0	0	0	100	100	0
Calleguas at Deepwood	Calleguas	0.00	55	30	0	0	0	45	100	55
Calleguas at Deepwood	Calleguas	0.00	100	55	0	0	0	0	100	100
Oaks Mall	Calleguas	0.00	65	45	0	0	0	35	100	65
Oaks Mall	Calleguas	0.00	30	10	0	0	0	70	100	30
Oaks Mall	Calleguas	0.02	90	65	0	0	0	10	100	90
Oaks Mall	Calleguas	0.00	25	25	0	0	0	75	100	25
Oaks Mall	Calleguas	0.00	40	25	0	0	0	60	100	40
Oaks Mall	Calleguas	0.00	10	10	0	0	0	90	100	10
Reino Rd.	Calleguas	0.02	50	0	0	20	0	30	100	70
Reino Rd.	Calleguas	0.02	15	5	0	5	0	80	100	20
Reino Rd.	Calleguas	0.02	40	20	0	0	0	60	100	40
Reino Rd.	Calleguas	0.02	40	0	0	5	0	55	100	45
Reino Rd.	Calleguas	0.02	50	25	0	5	0	45	100	55
Reino Rd.	Calleguas	0.02	25	5	0	5	0	70	100	30
FC @ VentuPark Rd.	Calleguas	13.65	25	15	60	5	0	10	100	90
FC @ VentuPark Rd.	Calleguas	0.46	25	10	40	0	0	35	100	65
FC @ VentuPark Rd.	Calleguas	15.95	60	10	35	0	0	5	100	95
FC @ VentuPark Rd.	Calleguas	10.12	50	40	20	5	0	25	100	75
FC @ VentuPark Rd.	Calleguas	6.29	45	30	30	10	0	15	100	85
FC @ VentuPark Rd.	Calleguas	1.40	55	10	40	0	0	5	100	95
FC @ Young Rd.	Calleguas	0.04	50	0	0	0	0	50	100	50
FC @ Young Rd.	Calleguas	1.23	50	0	10	0	0	40	100	60
FC @ Young Rd.	Calleguas	2.05	0	0	40	0	0	60	100	40
FC @ Young Rd.	Calleguas	0.86	10	0	10	0	0	80	100	20
FC @ Young Rd.	Calleguas	0.04	10	0	20	0	0	70	100	30
FC @ Young Rd.	Calleguas	0.08	10	0	20	0	0	70	100	30
Upper Wildwood	Calleguas	0.00	0	0	0	0	0	100	100	0
Upper Wildwood	Calleguas	0.00	5	0	0	0	0	95	100	5
Upper Wildwood	Calleguas	0.00	65	0	0	0	0	35	100	65
Upper Wildwood	Calleguas	0.00	80	60	0	0	0	20	100	80
Upper Wildwood	Calleguas	0.00	0	0	0	0	0	100	100	0
Upper Wildwood	Calleguas	0.00	0	0	0	100	0	0	100	100
Leisure Village	Calleguas	0.15	45	10	20	0	0	35	100	65
Leisure Village	Calleguas	0.02	20	10	25	0	0	55	100	45
Leisure Village	Calleguas	0.02	5	0	20	20	0	55	100	45
Leisure Village	Calleguas	0.02	20	15	0	20	0	60	100	40
Leisure Village	Calleguas	0.02	5	0	5	30	0	60	100	40
Leisure Village	Calleguas	0.48	20	5	10	15	0	55	100	45
Bottom Conejo Creek	Calleguas	0.00	0	0	0	15	0	85	100	15
Bottom Conejo Creek	Calleguas	0.00	5	5	0	5	0	90	100	10
Bottom Conejo Creek	Calleguas	0.00	5	5	0	5	0	90	100	10
Bottom Conejo Creek	Calleguas	0.00	0	0	0	0	0	100	100	0
Bottom Conejo Creek	Calleguas	0.00	0	0	0	0	0	100	100	0
Bottom Conejo Creek	Calleguas	0.00	0	0	10	5	0	85	100	15

Appendix 3-B: Calleguas Creek Photographs

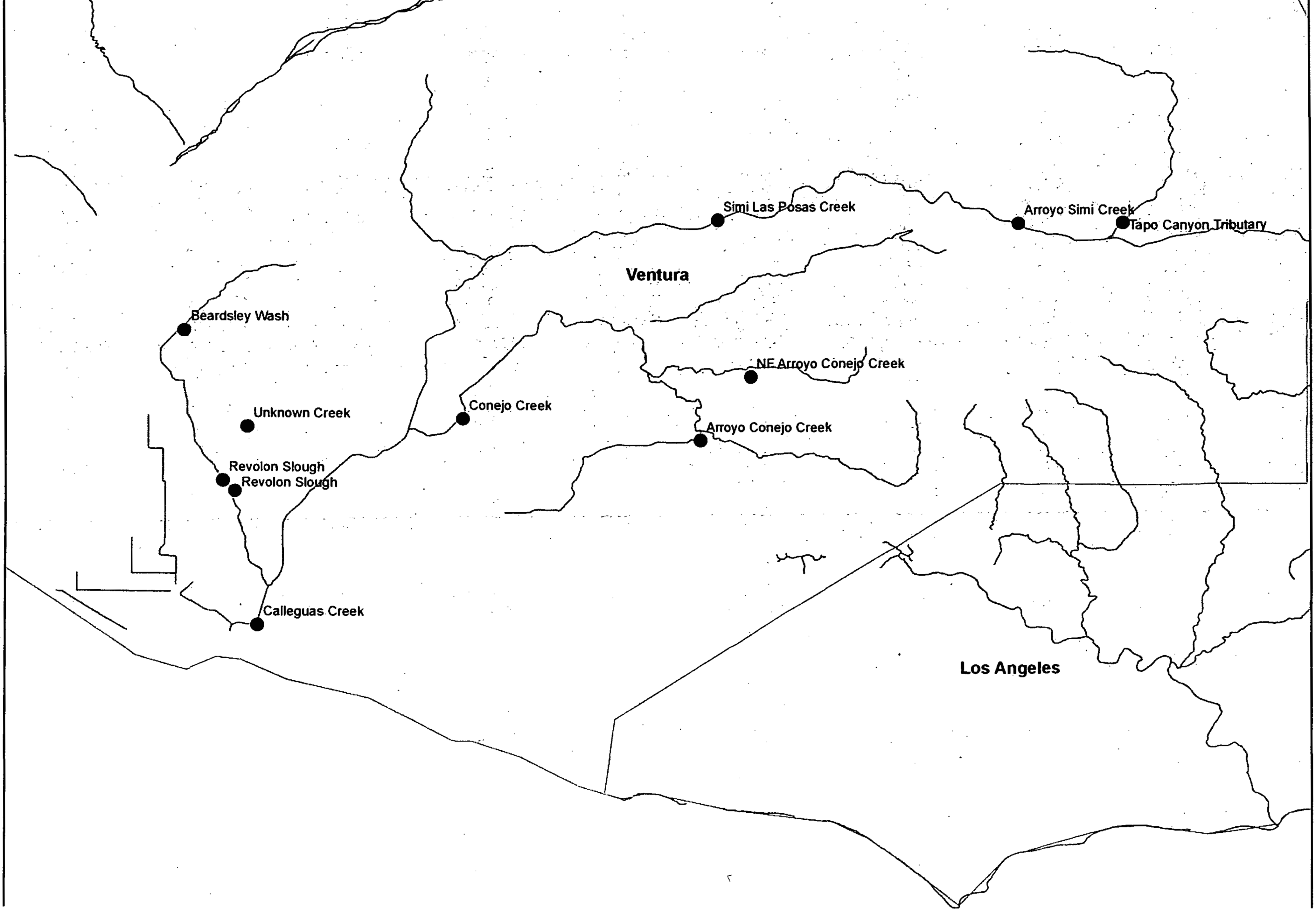
Calleguas Creek – Reach 10 (Arroyo Conejo Canyon). Photograph taken in summer 2004 by Steve Lee of UCLA.

Calleguas Creek – Reach 10 (Arroyo Conejo Canyon). Aerial photograph taken in summer 2004 by Steve Lee of UCLA.

Calleguas Creek – Reach 7 (Arroyo Simi). Photograph taken in summer 2004 by Steve Lee of UCLA.

Calleguas Creek – Reach 7 (Arroyo Simi). Photograph taken in summer 2004 by Steve Lee of UCLA.

Appendix 3-C: Calleguas Creek Locations with IBI Score <39



Appendix 4: Ballona Creek Sediment

ACOE Sediment Chemistry Data
Map of ACOE Monitoring Locations

Sediment Concentration by Site (Dry Weight Basis)

ffect ange ow ERL)*	Ballona @ Pickford	648/Pickford St. Srain	494	54	Ballona @ Fairfax	9408/Holly Hills	DD1-11	84	Higuera	Ince Blvd. Drain/3867	Benedict Canyon Ch.	Ballona @ Madison	RDD 208	2901	425	Sepulveda Blvd.	Ballona @ Sawtelle
	442	22400	177755	1423	285	438	1142	2700	817	494	1741	2975	11340	3269	1119	1327	1012
	942	1200	2510	724	200	224	225	353	573	1010	413	201	258	632	36	673	74
	0.000	0.007	0.035	0.073	0.007	0.012	0.022	0.031	0.126	0.007	0.619	0.545	0.596	0.238	0.036	0.536	0.006
	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	1.208	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
.2	BLD	BLD	BLD	4.862	1.277	1.017	2.564	2.900	1.842	2.399	**10.888**	**9.008**	**9.361**	3.409	BLD	7.585	1.180
	24.362	448.571	593.878	157.735	31.565	26.148	83.381	99.167	50.292	43.967	205.792	175.207	735.052	157.025	12.547	226.190	38.874
	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
.2	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	**3.054**	**2.675**	BLD	BLD	BLD	BLD	BLD
	3.527	30.571	26.735	35.083	5.822	6.964	9.112	12.483	17.251	13.578	25.251	23.967	40.103	31.281	2.870	37.415	7.721
	1.497	16.029	10.408	6.188	2.427	2.028	2.579	3.983	3.275	2.302	7.915	7.300	12.474	5.950	0.793	14.218	2.279
4.0	15.313	**614.286**	**310.204**	**76.243**	**78.249**	9.324	**39.255**	32.833	29.386	**49.515**	**213.900**	**173.278**	**600.000**	**230.579**	3.627	**283.673**	7.976
6.7	**53.828**	**221.714**	**106.735**	**127.348**	12.719	3.929	27.937	**72.500**	**270.468**	26.907	**61.390**	**77.410**	**117.526**	**67.355**	0.928	**100.000**	11.126
.2	BLD	BLD	BLD	BLD	BLD	BLD	**1.533**	0.167	BLD	BLD	BLD	BLD	BLD	BLD	0.129	BLD	BLD
	BLD	BLD	14.755	1.677	5.756	BLD	0.841	1.227	0.830	1.178	5.135	2.383	2.907	2.926	BLD	2.357	BLD
0.9	2.981	**224.286**	**33.673**	**21.796**	6.220	4.273	7.622	9.350	14.035	9.182	**30.386**	**26.749**	**32.371**	19.174	1.317	**35.034**	6.408
	1.392	BLD	BLD	4.862	1.923	1.352	2.292	2.333	1.974	1.498	7.761	5.234	11.753	4.066	BLD	4.320	2.091
.0	BLD	BLD	BLD	**5.000**	**1.277**	BLD	BLD	**1.160**	BLD	BLD	**1.162**	**1.455**	**3.330**	BLD	BLD	BLD	BLD
	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
	4.977	19.057	31.837	21.547	8.011	9.005	10.244	11.717	10.658	8.336	23.591	23.912	40.000	22.603	3.354	54.082	8.056
50.0	54.408	**1830.000**	**1280.000**	**483.425**	149.867	67.092	**187.679**	**208.333**	**185.673**	**235.784**	**467.181**	**358.127**	**1247.423**	**495.868**	26.087	**642.857**	78.016
6.0	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
5.0	BLD	BLD	**2449**	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
61.0	BLD	BLD	**2245**	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
30.0	BLD	BLD	BLD	BLD	BLD	BLD	129	83	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
	BLD	BLD	BLD	166	BLD	BLD	72	BLD	BLD	83	BLD	BLD	BLD	BLD	BLD	238	BLD
	BLD	BLD	1020	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
	104	BLD	BLD	BLD	BLD	BLD	487	BLD	263	97	BLD	BLD	BLD	289	BLD	BLD	BLD
84.0	BLD	**1714**	BLD	138	BLD	BLD	143	BLD	88	69	BLD	BLD	BLD	BLD	BLD	BLD	BLD
3.4	**139**	**1429**	BLD	**470**	BLD	BLD	**244**	**100**	**292**	**139**	BLD	BLD	BLD	BLD	BLD	BLD	BLD
00.0	BLD	BLD	BLD	249	80	BLD	401	BLD	278	166	BLD	138	BLD	BLD	BLD	BLD	BLD
9.0	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	**146**	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
	70	BLD	BLD	138	66	BLD	100	167	146	BLD	309	193	BLD	248	BLD	204	BLD
0.0	BLD	BLD	BLD	BLD	**80**	BLD	**201**	BLD	BLD	**111**	BLD	BLD	BLD	BLD	BLD	BLD	BLD
60.0	**661**	BLD	BLD	BLD	**915**	BLD	BLD	BLD	**1155**	**416**	BLD	BLD	BLD	BLD	BLD	**1088**	BLD
40.0	BLD	BLD	BLD	221	**252**	BLD	**272**	BLD	**409**	**264**	BLD	BLD	BLD	BLD	BLD	BLD	BLD
65.0	BLD	**2000**	BLD	193	BLD	BLD	287	BLD	234	194	309	165	BLD	BLD	BLD	272	BLD
022.0	974	**5143**	**5714**	1575	1393	BLD	2335	350	3012	1540	618	496	BLD	537	BLD	**1803**	BLD
	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD

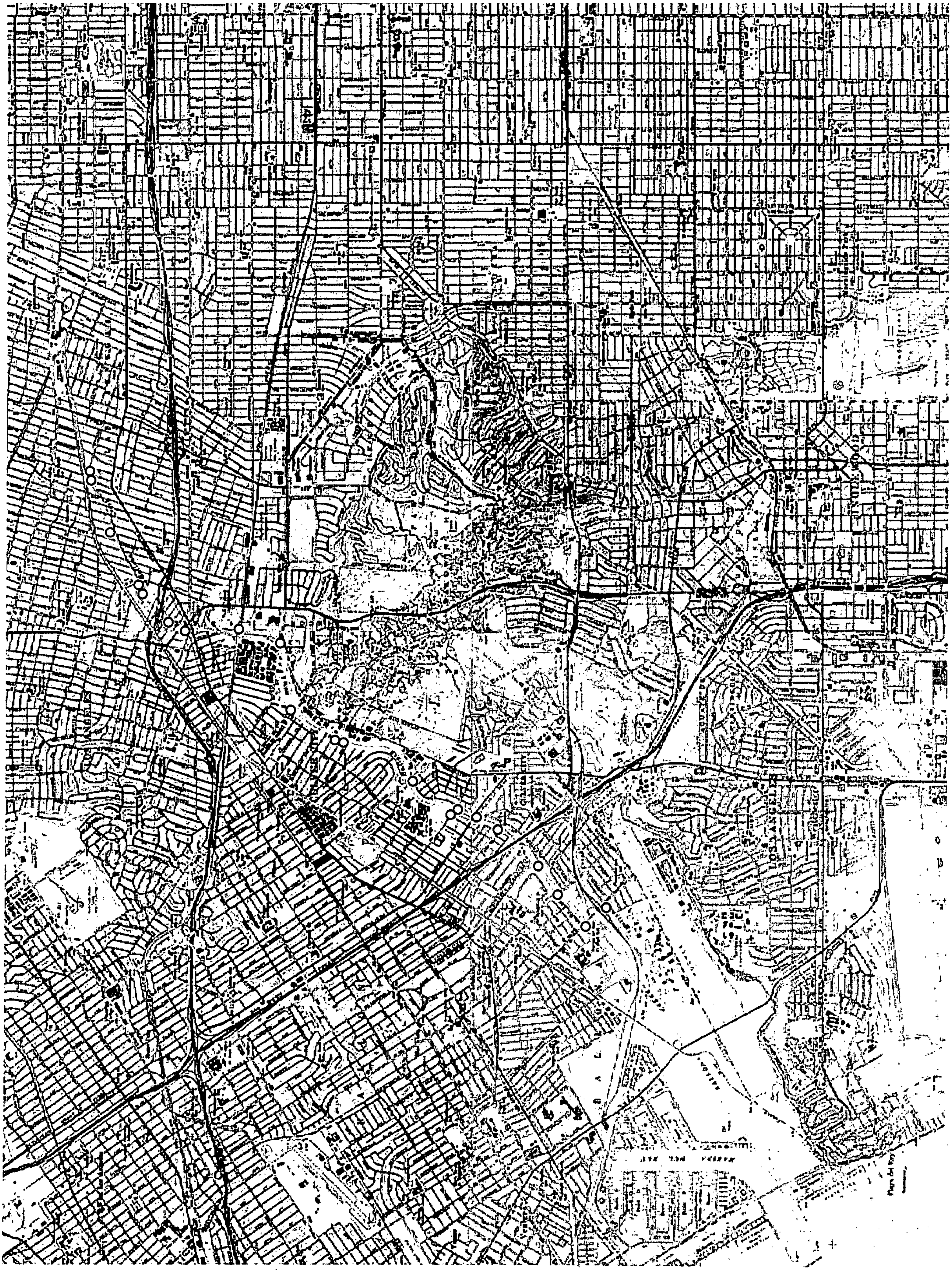
Sediment Concentration by Site (Dry Weight Basis)

:ffect ange .ow ERL)*	Ballona @ Pickford	648/Pickford St. Srain	494	54	Ballona @ Fairfax	9408/Holly Hills	DD1-11	84	Higuera	Ince Blvd. Drain/3867	Benedict Canyon Ch.	Ballona @ Madison	RDD 208	2901	425	Sepulveda Blvd.	Ballona @ Sawtelle
.50	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
.00	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
.00	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
.20	BLD	**1743**	BLD	**12**	BLD	BLD	BLD	**8**	**6**	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
.60	BLD	**1743**	BLD	**12**	BLD	BLD	BLD	**8**	**6**	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
.02	BLD	BLD	BLD	BLD	BLD	6	BLD	BLD	**7**	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
.02	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
.60	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
.20	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD
2.7	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD

le limit.
ıe ERL toxicity values.

	Copper	Site Rank	Lead	Site Rank	Nickel	Site Rank	Zinc	Site Rank	Fluoranthene	Site Rank	Indeno(1,2,3-c,d)Pyrene	Site Rank	Phenanthrene	Site Rank	Pyrene	Si
	614	Higuera	270	648/Pickford St. Drain	224	51	1840	51	8163	51	2449	51	5102	51	8163	
	600	648/Pickford St. Drain	222	51	39	648/Pickford St. Drain	1830	503	862	503	385	503	738	648/Pickford St. Drain	2000	
4	310	Centinela Blvd.	215	503	37	494	1280	DD1-11	401	Benedict Canyon Ch.	309	Higuera	409	503	846	
	284	503	150	Sepulveda Blvd.	35	RDD 208	1247	Higuera	278	2901	248	DD1-11	272	Benedict Canyon Ch.	309	648/ St.
3	254	54	127	494	34	503	888	54	249	Sepulveda Blvd.	204	Ince Blvd. Drain/3867	264	DD1-11	287	Higu
1	243	RDD 208	118	RDD 208	32	Sepulveda Blvd.	643	Ince Blvd. Drain/3867	166	Ballona @ Benedict Canyon Ch.	193	Ballona @ 54	252	Sepulveda Blvd.	272	DD1
1	231	494	107	Benedict Canyon Ch.	30	2901	496	Ballona @ Benedict Canyon Ch.	138	84	167	54	221	Higuera	234	Sep Blvd
	214	Sepulveda Blvd.	100	Ballona @ Benedict Canyon Ch.	27	54	483	Centinela Ch.	138	Higuera	146	Sepulveda Ch.	142	Ince Blvd. Drain/3867	194	
	173	Ballona @ Benedict Canyon Ch.	77	54	22	Benedict Canyon Ch.	467	Sepulveda Ch.	126	54	138	Centinela Ch.	92	54	193	Ince Drai
	78	84	73	2901	19	Ballona @ Benedict Canyon Ch.	358	Ballona @ 54	80	Sepulveda Ch.	126	Benedict Canyon Ch.		Ballona @ Benedict Canyon Ch.	165	Ball
4	76	2901	67	Higuera	14	Ince Blvd. Drain/3867	236	648/Pickford St. Drain		Centinela Ch.	123	2901		Centinela Ch.	138	Ball 648/ St. D
	50	Benedict Canyon Ch.	61	Sepulveda Ch.	10	84	208	494		DD1-11	100	Sepulveda Blvd.		Sepulveda Ch.	95	Cen
	39	Ballona @ 648/Pickford St. Drain	54	84	9	DD1-11	188	RDD 208		Ballona @ 648/Pickford St. Drain	70	Ballona @ Benedict Canyon Ch.		Ballona @ 54		Ben Can
4	33	DD1-11	28	Ince Blvd. Drain/3867	9	Higuera	186	Sepulveda Blvd.		Ballona @ 54	66	84		2901		Sep Ch.
	29	Ince Blvd. Drain/3867	27	DD1-11	8	Ballona @ 54	150	2901		Ince Blvd. Drain/3867		Ballona @ 648/Pickford St. Drain		84		
	28	Centinela Ch.	25	Ballona @ Sawtelle	6	Sepulveda Ch.	120	Benedict Canyon Ch.		648/Pickford St. Drain		648/Pickford St. Drain		Ballona @ 648/Pickford St. Drain		Ball Ben Can
	22	Sepulveda Ch.	17	Ballona @ 54	6	Centinela Ch.	86	84		494		494		494		
t.	15	Ballona @ 54	13	9408/Holly Hills	4	Ballona @ Sawtelle	78	Ballona @ Sawtelle		RDD 208		RDD 208		RDD 208		RDD
s	9	Ballona @ Sawtelle	11	Centinela Ch.	4	9408/Holly Hills	67	9408/Holly Hills		Ballona @ Sawtelle		Ballona @ Sawtelle		Ballona @ Sawtelle		Ball Saw
	8	9408/Holly Hills	4	Ballona @ 648/Pickford St. Drain	3	Ballona @ 648/Pickford St. Drain	54	Ballona @ 648/Pickford St. Drain		9408/Holly Hills		9408/Holly Hills		9408/Holly Hills		9408 Hills
5	4	425	1	425	1	425	26	425		425		425		425		

	Lead	Site Rank	Nickel	Site Rank	Zinc	Site Rank	Fluoranthene	Site Rank	Indeno (1,2,3 c,d) Pyrene	Site Rank	Phenanthrene	Site Rank	P
	330948	Sepulveda Blvd.	26410	Ballona @ 54	525581	DD1-11	351317	Ballona @ 54	232558	Ballona @ 54	883721	Ince Blvd. Drain/3867	3
I	121785	Ballona @ 54	21814	Sepulveda Blvd.	484615	Higuera	339893	Sepulveda Channel	224090	Ince Blvd. Drain/3867	533708	51	3
54	89515	Ince Blvd. Drain/3867	18596	Ince Blvd. Drain/3867	477528	Ince Blvd. Drain/3867	337079	Higuera	178891	Higuera	500894	Higuera	2
	75385	Sepulveda Channel	18011	54	339806	51	320856	Benedict Canyon Ch.	177384	Sepulveda Channel	252101	DD1-11	2
	54494	Benedict Canyon Ch.	17450	Benedict Canyon Ch.	268293	Ballona @ 54	279070	Ballona @ 648/Pickford St. Drain	157480	DD1-11	238394	Sepulveda Blvd.	2
4	44605	Higuera	17174	Higuera	227191	Sepulveda Channel	224090	Sepulveda Blvd.	153846	51	200535	Benedict Canyon Ch.	1
	35255	54	15320	Sepulveda Channel	212885	503	177215	Centinela Ch.	103226	54	155340	503	1
)3	30949	648/Pickford St. Drain	10013	503	182595	54	174757	54	97087	503	151899	Sepulveda Ch	1
	30532	9408/Holly Hills	9767	DD1-11	164366	Centinela Ch.	116129	51	96257	Centinela Ch.	77419	54	1
34	26852	Ballona @ Benedict Canyon Ch.	8991	9408/Holly Hills	153353	Ballona @ Benedict Canyon Ch.	46296	DD1-11	87829	Benedict Canyon Ch.	0	Centinela Ch.	1
	26019	503	7532	2901	151707	Sepulveda Blvd.	0	503	79114	Ballona @ 648/Pickford St. Drain	0	648/Pickford St. Drain	
	24467	Ballona @ 648/Pickford St. Drain	6745	Ballona @ 648/Pickford St. Drain	123097	Benedict Canyon Ch.	0	2901	75853	Sepulveda Blvd.	0	Ballona @ Benedict Canyon Ch.	
1.	21161	DD1-11	6675	Ballona @ Benedict Canyon Ch.	120370	9408/Holly Hills	0	Ballona @ Benedict Canyon Ch.	64815	2901	0	Ballona @ 54	
)1	20607	Ballona @ Sawtelle	6331	RDD 208	110000	2901	0	84	61728	Ballona @ Benedict Canyon Ch.	0	Ballona @ 648/Pickford St. Drain	
	10993	2901	5866	648/Pickford St. Drain	81696	Ballona @ 648/Pickford St. Drain	0	Ince Blvd. Drain/3867	0	84	0	2901	
	10364	84	3463	84	77160	RDD 208	0	9408/Holly Hills	0	9408/Holly Hills	0	84	
I	9898	Centinela Ch.	3419	Ballona @ Sawtelle	77086	648/Pickford St. Drain	0	RDD 208	0	RDD 208	0	9408/Holly Hills	
	8980	RDD 208 S	2855	Centinela Ch.	72516	84	0	648/Pickford St. Drain	0	648/Pickford St. Drain	0	RDD 208	
51	8449	51	1537	51	72326	Ballona @ Sawtelle	0	Ballona @ Sawtelle	0	Ballona @ Sawtelle	0	Ballona @ Sawtelle	



Appendix 5:
Dominguez Channel Sediment Toxicity

NPDES Sediment Toxicity Data
Map of Monitoring Locations

Sediment Toxicity (Amphipod)
Dominguez Channel NPDES Monitoirng Stations

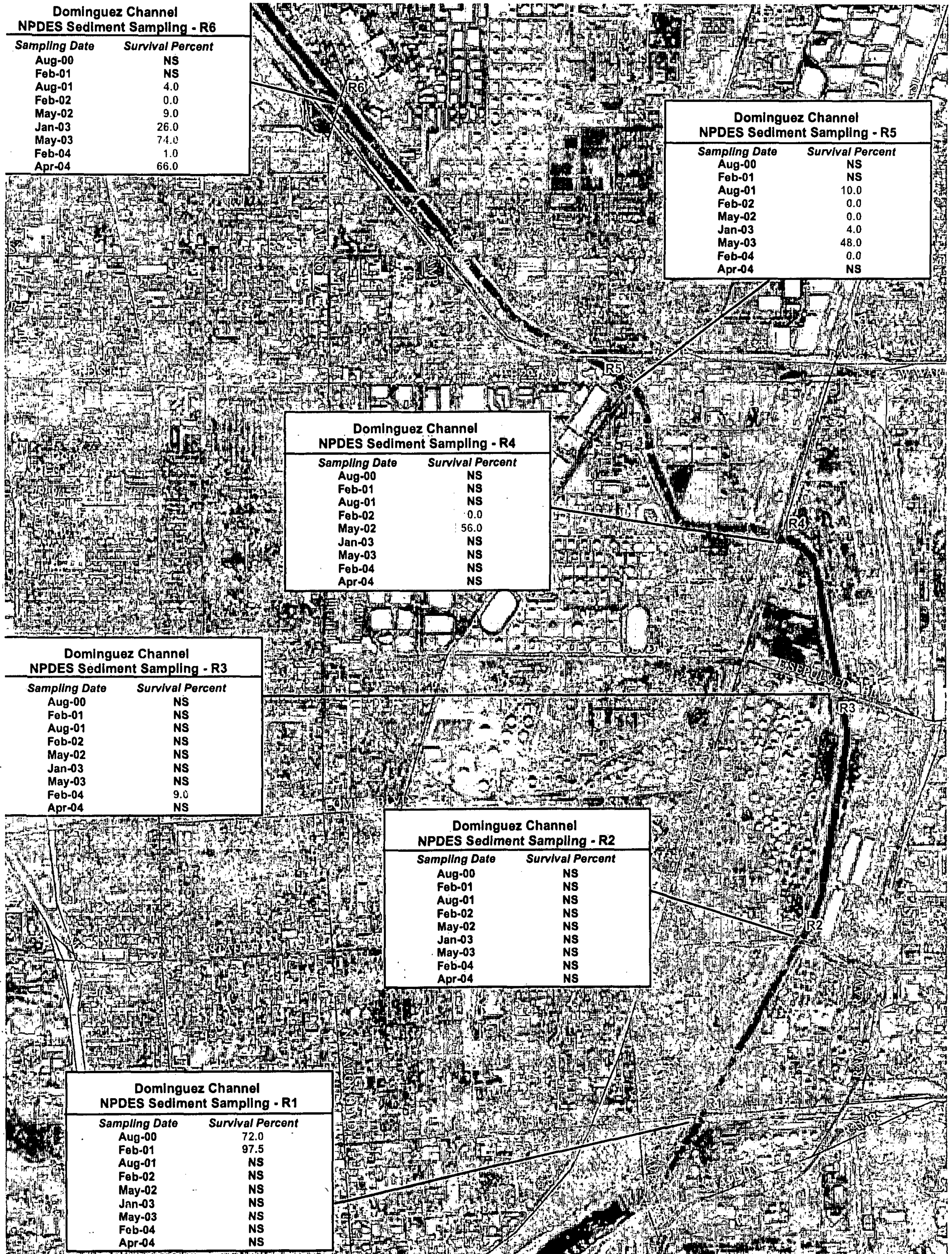
Location[1]	Aug-00	Feb-01	Aug-01	Feb-02	May-02	Jan-03	May-03	Feb-04	Apr-04
R1	72	97.5	NS	NS	NS	NS	NS	NS	NS
R2	NS	NS	NS	NS	NS	NS	NS	NS	NS
R3	NS	NS	NS	NS	NS	NS	NS	9	NS
R4	NS	NS	NS	0	56	NS	NS	NS	NS
R5	NS	NS	10	0	0	4	48	0	NS
R6	NS	NS	4	0	9	26	74	1	68
R7	88	76.3	74	0	0	49	82	0	82

[1] Sampling locations were established mid-channel at the intersection of the Dominguez Channel and Anaheim Street (R1), Pacific Coast Highway (R2), Sepulveda Boulevard (R3), Alameda Street (R4), 223rd Street/Wilmington Avenue (R5), Avalon Boulevard (R6), and Main Street (R7).

NS – Not sampled due to insufficient sediment at the sampling location.

Bold values are <70% survival. Control results not available; however, basic QA/QC standards require at least a 90% survival for controls. Assuming a 90% control, any test showing less than 70% would be considered a failed test.

Source of Data - Retec Group, Inc. 2004. Report of NPDES Sediment Sampling Results for Shell Los Angeles Refinery, NPDES Permit No. CA003778. Letter to Mr. Robert Stockdale (Shell Oil Products US, Los Angeles Refinery) 5 August.



Dominguez Channel
NPDES Sediment Sampling - R6

Sampling Date	Survival Percent
Aug-00	NS
Feb-01	NS
Aug-01	4.0
Feb-02	0.0
May-02	9.0
Jan-03	26.0
May-03	74.0
Feb-04	1.0
Apr-04	66.0

Dominguez Channel
NPDES Sediment Sampling - R5

Sampling Date	Survival Percent
Aug-00	NS
Feb-01	NS
Aug-01	10.0
Feb-02	0.0
May-02	0.0
Jan-03	4.0
May-03	48.0
Feb-04	0.0
Apr-04	NS

Dominguez Channel
NPDES Sediment Sampling - R4

Sampling Date	Survival Percent
Aug-00	NS
Feb-01	NS
Aug-01	NS
Feb-02	0.0
May-02	56.0
Jan-03	NS
May-03	NS
Feb-04	NS
Apr-04	NS

Dominguez Channel
NPDES Sediment Sampling - R3

Sampling Date	Survival Percent
Aug-00	NS
Feb-01	NS
Aug-01	NS
Feb-02	NS
May-02	NS
Jan-03	NS
May-03	NS
Feb-04	9.0
Apr-04	NS

Dominguez Channel
NPDES Sediment Sampling - R2

Sampling Date	Survival Percent
Aug-00	NS
Feb-01	NS
Aug-01	NS
Feb-02	NS
May-02	NS
Jan-03	NS
May-03	NS
Feb-04	NS
Apr-04	NS

Dominguez Channel
NPDES Sediment Sampling - R1

Sampling Date	Survival Percent
Aug-00	72.0
Feb-01	97.5
Aug-01	NS
Feb-02	NS
May-02	NS
Jan-03	NS
May-03	NS
Feb-04	NS
Apr-04	NS

Appendix 6:
Malibu Creek Watershed Exotic Species

Exotic Species

There are numerous data sets and studies documenting both the numbers of native and non-native invasive species in the Santa Monica Bay Watershed. These studies cover large spatial areas and have occurred over many years. The studies include peer reviewed articles, detailed mapping surveys, snorkel survey results, and electro fishing results conducted in coastal watersheds that drain into Santa Monica Bay. Substantial data also exists regarding dramatic declines in native species abundance in these drainages. The species decline is so severe that all the native fish species are either federally endangered, or on the State list of species of special concern. Numerous research projects and studies have documented how the existing populations of exotic invasive predator species that occupy the Santa Monica Bay Watershed directly reduce the population numbers of the protected native species. The sum of this data surely warrants a listing for exotic species in the affected streams and coastal watersheds of Region 4.

The following paragraphs will document the most pertinent studies regarding non-native species distribution in the area, summarize previous studies on the impacts caused to the native species by exotic invasive predator species, and recommend which streams should be placed on the State 303 (d) list as impaired for Exotic Species.

Native Aquatic Species: The Malibu Creek Watershed has three native fish species that occupy freshwater streams: Steelhead trout, Pacific lamprey, and Arroyo chub. The Tidewater goby is a fish that occurs in the Malibu Creek watershed but utilizes brackish water habitat associated with tidal lagoons. Pacific lamprey and Arroyo chub are both on the State of California list of Species of Special Concern due to their dwindling numbers. Steelhead trout and Tidewater goby are federally endangered. Other aquatic species in the Malibu Creek Watershed and other coastal watersheds that drain to Santa Monica Bay are: California newts, Western pond turtles, and Red-legged frogs. Western pond turtles are Federally listed and State listed as a Species of Concern, California newts are listed by the State of California as a Species of Special Concern, and Red legged frogs are a Federally threatened species.

Southern steelhead trout: The Southern Steelhead ESU was listed as endangered by the National Marine Fisheries Service in 1997. "Of 92 streams which it (Steelhead) historically spawned in the six coastal counties, it is now absent from 39, including all streams south of Ventura County except Malibu Creek, and San Mateo Creek. The total stream miles in which juveniles now rear is less than 1 percent of the historical number " Moyle,(Peter B., Inland Fishes of California Revised and Expanded. University of California Press, 2002, pg. 281.) Southern steelhead runs have been identified as "the most jeopardized of all California's steelhead populations and have dropped to less than 1% of their pre-1940 estimated abundance (McEwan and Jackson as reported in (Dagit et al, Topanga Creek Watershed Southern Steelhead Trout Preliminary Watershed Assessment and Restoration Plan Report, Prepared for California Department of Fish and Game, March 2003).

In 1998, a small population of steelhead trout were found in the Topanga Creek watershed south of Malibu Creek. In the Santa Monica Mountains only three streams have an existing steelhead trout population: Arroyo Sequit Creek which drains to Leo Carrillo State Beach, Malibu Creek, and Topanga Creek. Snorkel surveys in these creeks have been conducted by the Resource Conservation District of the Santa Monica Mountains for nearly two years on Malibu and Arroyo Sequit Creeks and for nearly five years on Topanga Creek. Between June of 2001 and March of 2003, the highest number of steelhead trout large enough to possibly qualify as an adult fish (>26 cm or 10.25 inches) recorded in Topanga Creek was 15 with the average hovering at approximately 3 adult sized fish. (Dagit et al, Topanga Creek Watershed Southern Steelhead Trout Preliminary Watershed Assessment and Restoration Plan Report, Prepared for California Department of Fish and Game, March 2003). Similar numbers of adult sized steelhead were found in Malibu Creek and only once was a steelhead trout observed in Arroyo Sequit Creek during the snorkel surveys (Rosi Dagit per.com. October 2005). No Pacific lamprey were identified during any of the fish snorkel surveys on Malibu Creek

"Species diversity in Malibu Creek is low, but typical of a small coastal stream in southern California. In both numbers and biomass, the fish community downstream of Rindge Dam is dominated by introduced species, especially largemouth bass, although differences in species abundance among the study reaches were apparent. Largemouth bass abundance increased with distance downstream of Rindge Dam, the inverse of the juvenile distribution pattern of steelhead trout. Moreover, largemouth bass are known to be a predator of young salmonids" (Moyle 1976 as reported in Entrix Inc., Malibu Creek /Santa Monica Steelhead Investigations 1989).

Red-legged frogs: The Red legged frog has been extirpated from 70 percent of its former range and now is found primarily in coastal drainages of central California, from Marin County south to northern Baja California, Mexico. Potential threats to the species include elimination or degradation of habitat from land development and land use activities and habitat invasion by non-native aquatic species (*Recovery Plan Red legged frog* **(Rana aurora draytonii),** *Region 1 U.S. Fish and Wildlife Service Portland, Oregon May 28, 2002 pg IV).* Its population has declined by at least 90% (Center for Biological diversity website Species section California Red-legged frog visited http://www.biologicaldiversity.org/swcbd/species/rlfrog/ January 2006) The Malibu Creek Watershed and other Coastal Watersheds in the Santa Monica Mountains were designated as critical habitat for red legged frog by the USFWS (Department of the Interior, United States Fish and Wildlife Service, Part II **50 CFR Part 17 Endangered and Threatened Wildlife and Plants; Final Determinations of Critical Habitat for the California Red-legged Frog; Final Rule** Federal Register Vol. 66, No. 49 Tuesday March 13, 2001/Rules and Regulations)

According to (CDFG) website "Establishment of a diverse exotic aquatic predator fauna that includes bullfrogs, crayfish, and a diverse array of fishes likely contributed to the decline of the California red-legged frog (Hayes and Jennings 1986 as reported by http://www.dfg.ca.gov/hcpb/cgibin/more_info.asp?idKey=ssc_tespp&specy=amphibians&query= rana%20aurora% 20draytonii) visited January 06). According to the United State

Fish and Wildlife Service (USFWS) red-legged frog recovery plan available at http://ecos.fws.gov/docs/recovery_plans/2002/020528.pdf the "Factors associated with declining populations of the frog include degradation and loss of its habitat through agriculture, urbanization, mining, overgrazing, recreation, timber harvesting, non-native plants, impoundments, water diversions, degraded water quality, use of pesticides, and introduced predators. In 1999, a remnant population of Red-legged frogs were discovered in the Malibu Creek Watershed. This population is estimated to be approximately 25 adults and is currently the only known population in any coastal watershed draining to Santa Monica Bay.

Tidewater goby: Tidewater Goby was listed as endangered by the USFWS in 1994 and has had fully protected status from the State of California since 1987. "Somewhere between 25% and 50% of its population has been lost in the last 100 years, most of them south of Point Conception."(Moyle, Peter B., Inland Fishes of California Revised and Expanded. University of California Press, 2002, pg. 432)."

Arroyo chub: Arroyo chubs are small chunky fish that reach typical adult size between 70-100 mm (Moyle, Peter B., Inland Fishes of California Revised and Expanded. University of California Press, 2002, pg. 131). Arroyo chub are found in slow-moving or backwater sections of warm to cool (10-24°C) streams with mud or sand substrates with depths typically greater than 40 cm. Presently, arroyo chubs are common at only four places within their native range: upper Santa Margarita River and its tributary, De Luz Creek; Trabuco Creek below O'Neill Park and San Juan Creek; Malibu Creek (Swift et al. 1993); and West Fork San Gabriel River below Cogswell Reservoir (J. Deinstadt, unpubl. data). According to Swift et al. (1993), arroyo chubs are scarce within their native range because the low-gradient streams in which they do best have largely disappeared. (Moyle et al, Department of Wildlife & Fisheries Biology Davis, California 1995 Fish Species of Special Concern Second Edition, Prepared for California Department of Fish and Game, pg 151). Their native range, like that of the sympatric Santa Ana sucker, is largely coincident with the Los Angeles metropolitan area where most streams are degraded and populations reduced and fragmented especially the low-gradient stream reaches which formerly contained optimal habitat (Swift et al. 1993 as reported in Moyle, Peter B., Inland Fishes of California Revised and Expanded. University of California Press, 2002, pg. 132). "Chub generally decline when red shiners and other exotics become abundant. In the Santa Margarita River a dramatic increase in arroyo chub abundance was noted after extreme high-flow events in 1997-1998 reduced the abundance of green sunfish, largemouth bass, Red-eye bass and black bullhead The potential effects of introduced species, combined with the continued degradation of the urbanized streams that constitute much of its habitat, mean that this species is not secure despite its wide range." (Moyle, Peter B., Inland Fishes of California Revised and Expanded. University of California Press, 2002, pg. 132).

California newt (Coast range newt): California newts are moderate-sized (50.0-87.0 mm SVL) dark brown salamander with bright yellow-orange to orange undersurfaces (Riemer 1958); thick, relatively textured skin that becomes markedly rough-glandular during its terrestrial phase, but reverts to a relatively smooth condition during its aquatic phase (Nussbaum and Brodie 1981). Coast Range newts frequent terrestrial habitats, but breed in ponds, reservoirs, and slow-moving streams (Stebbins 1954b, 1985 as reported Jennings & Hayes. Amphibian and Reptile Species of Special Concern for California., November 1994 Prepared for CDFG pg. 40).

Historically, *T. t. torosa* may have been one of the most abundant, if not the most abundant amphibian through much of its range. This species has been depleted by large-scale historical commercial exploitation coupled with the loss and degradation of stream habitats, especially in Los Angeles, Orange, Riverside, and San Diego counties. "Our own observations indicated that the breeding habitat of *T. t. torosa* has, at best, been severely degraded over much of its range, largely due to a shift in sedimentation dynamics that has resulted in greater filling and less frequent scouring of pools to allow them to retain their characteristic structure" (Coming 1975 as modified and cited in Faber et al. 1989 as reported Jennings & Hayes. Amphibian and Reptile Species of Special Concern for California., November 1994 Prepared for CDFG pg. 40). Aquatic predators are particularly detrimental to the egg and larval stages of most amphibians because these stages are restricted to water until metamorphisis. (Kats and Gamradt. Conservation Biology, Volume 10. No4. August 1996, pgs. 1155-1162)

Western Pond Turtle: The Western Pond Turtle, *Clemmys marmorata*, is California's only freshwater turtle. The species ranges from southern British Columbia through Washington, Oregon, California, and into northern Baja California. It is listed as endangered in Washington and Oregon and as a species of special concern in California. It has declined by an estimated 95 % since the early 1900's. The primary cause of decline is loss of wetland habitat. The secondary cause is predation of hatchlings by non-native species, especially bullfrogs and large-mouth bass (Website Nature Alley Pond Turtle Page http://natureali.org/pondturtle.htm visited January 06). Additionally, some introduced exotic aquatic predators or competitors likely extract a significant toll on turtle populations. Bullfrogs prey on hatchling or juvenile turtles (Moyle 1973; Holland 1991a; H. Basey, P. Lahanas, and S. Wray, pers. comm.), and may be responsible for significant mortality because they occupy shallow-water habitats in which the youngest age groups of turtles are frequently observed (pers. observ.). Bass *(Micropterus* spp.) are also known to prey on the smallest juveniles (Holland 1991a), and sunfishes *(Lepomis* spp.), although they are not large enough to prey on hatchling western pond turtles, probably compete with them for food since they are known to be able to keep available nekton at very low levels, stunting their own growth.(see Swingle and Smith 1940). (Jennings & Hayes. Amphibian and Reptile Species of Special Concern for California., November 1994 Prepared for CDFG) pg. 102.

Exotic Invasive Aquatic Species: Several aquatic invasive species have been identified in the Malibu Creek watershed and in adjacent coastal watersheds draining to Santa Monica Bay: Carp, Largemouth bass, Green sunfish, Bluegill, Mosquitofish, Black bullhead, Red swamp crayfish, and Bullfrogs. Exotic fish species like, largemouth bass (*Micropterus salmoides*), green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macrochirus*) and black bullhead (*Ameiurus melas*), have been shown to have a strong competitive edge over resident trout. Green sunfish have been found to feed on juvenile trout and out-compete adult steelhead for benthic food (Swift 1975; Greenwood 1988). Largemouth bass take over as top predator in the habitat they occupy and can directly predate steelhead (Stouder et al, 1997). Black bullhead are highly tolerant of high water temperatures and low dissolved oxygen levels and are extremely prolific. By shear numbers, this species can exert a tremendous competitive pressure on an already limited resource. (As reported Hovey, Tim E. Current Status of Southern Steelhead/Rainbow trout In San Mateo Creek 2002).

Largemouth Bass: "Typically when largemouth bass are abundant native fishes are absent, although there are some exceptions" (Moyle, Peter B., Inland Fishes of California Revised and Expanded. University of California Press, 2002, pg. 400). " The flexible foraging strategies of largemouth bass and their wide environmental tolerances have made them a keystone predator in many bodies of water. A keystone predator is a species whose activities can cause changes throughout the ecosystem, usually by changing abundances of favored prey." (Moyle, Peter B., Inland Fishes of California Revised and Expanded. University of California Press, 2002, pg. 399). "In the lower Colorado River largemouth bass are regarded as part of the complex of predatory exotic fishes that prevent the reestablishment of native minnows and suckers. In southern California streams they prey heavily on endangered species, such as tidewater goby". Moyle,(Peter B., Inland Fishes of California Revised and Expanded. University of California Press, 2002, pg. 400.)

Bluegill and Green sunfish: "Bluegill are highly opportunistic feeders, feeding on whatever animal food is most abundant. Small fish , fish eggs, and crayfish may be eaten when available." (Moyle, Peter B., Inland Fishes of California Revised and Expanded. University of California Press, 2002, pg. 384). "The abundance, ubiquity, aggressiveness, and the broad feeding habits of bluegill in lakes and lowland streams of California make it likely that they are one of the alien fishes that limit native fish populations, especially through predation of larvae, or through indirect effects that make natives more vulnerable to larger predators." (Moyle, Peter B., Inland Fishes of California Revised and Expanded. University of California Press, 2002, pg. 384). "The upper, fresher reaches of goby lagoons often contain non-native species, such as mosquitofish, green sunfish, and largemouth bass. They can at times be significant predators on gobies; for example most of the diet of young-of-the-year largemouth bass in the upper Ynez River Estuary was tidewater gobies." (Moyle, Peter B., Inland Fishes of California Revised and Expanded. University of California Press, 2002, pg. 433).

Carp: "Carp have probably displaced or reduced populations of native fish in some areas and have been responsible for the destruction of shallow waterfowl habitat in various parts of the country. (Moyle, Peter B., Inland Fishes of California Revised and Expanded. University of California Press, 2002, pg. 174). "Fish, probably dead before eaten, and fish larvae and eggs, including carp eggs, have been found in their diets." (Moyle, Peter B., Inland Fishes of California Revised and Expanded. University of California Press, 2002, pg. 173).

Mosquitofish: "Mosquito fish have been accused of eliminating small fish species the world over through predation and competitive interactions and a number of such cases in the southwestern United States and Australia have been documented. For example, in small streams of southern California, mosquitofish can eliminate or reduce the abundance of eggs and larvae of California newts and Pacific treefrogs. In California it is quite likely that mosquitofish have contributed to the decline of isolated pupfish populations. In small experimental ponds introduction of mosquitofish resulted in large blooms of phytoplankton after zooplankton grazers had been eaten." (Moyle, Peter B., Inland Fishes of California Revised and Expanded. University of California Press, 2002, pg. 320).

Mosquitofish (*Gambusia affinis*) are native to the eastern United States and have been introduced to wetlands worldwide as biological control agents for mosquito larvae. Studies have also been conducted in Australia on the effects of a closely related species, *Gambusia holbrooki*, on frog tadpoles (*Crinia glauerti,C. insignifera,* and *Heleioporus eyrei*) under experimental conditions and on frog species richness and abundance in the field. These studies (Blyth 1994, Webb and Joss 1997) showed direct predation on tadpoles, injuries to tadpoles in tanks or ponds with *Gambusia*, and reduced survival and recruitment. This practice is a concern to conservationists because introduced Analysis of field data from Australia (Webb and Joss 1997) demonstrated a significant drop in the abundance of frogs when *Gambusia* were present. Results of a study in artificial ponds showed that mosquitofish and bluegill (*Lepomis machrochirus*) were significant predators of California red-legged frog larvae (Schmieder and Nauman 1994). as reported in *Recovery Plan Red legged frog* **(Rana aurora draytonii),** *Region 1 U.S. Fish and Wildlife Service Portland, Oregon May 28, 2002 pg 25* http://ecos.fws.gov/docs/recovery_plans/2002/020528.pdf.

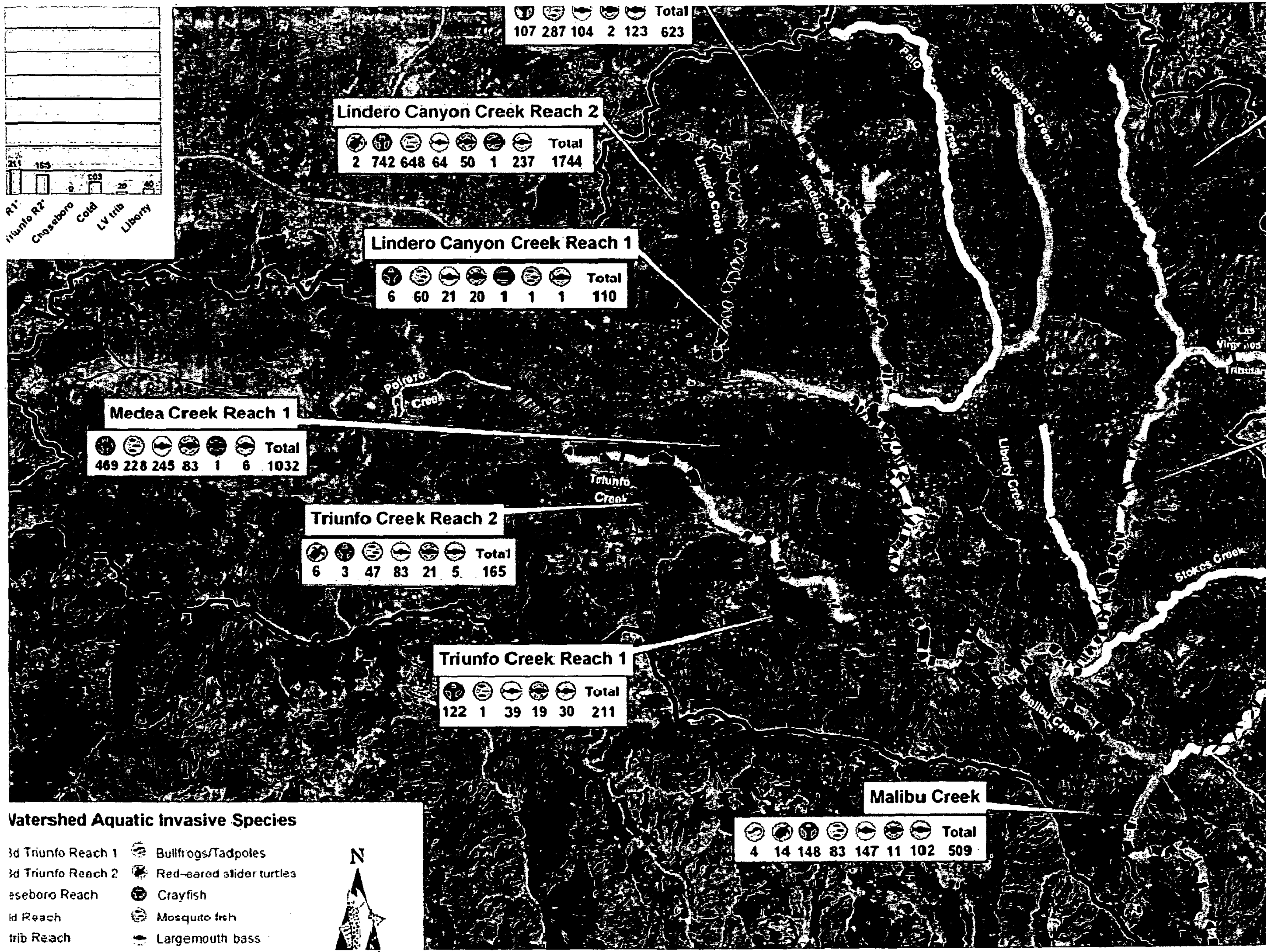
Bullfrogs and Crayfish Introduced bullfrogs, crayfish, and species of fish have been a significant factor in the decline of the California red-legged frog. Introduced aquatic vertebrates and invertebrates are predators on one or more of the life stages of California redlegged frogs. These include bullfrogs, African clawed frogs (*Xenopus laevis*), red swamp crayfish (*Procambarus clarkii*), signal crayfish (*Pacifastacus leniusculus*), and various species of fishes, especially bass, catfish (*Ictalurus* spp.), sunfish, and mosquitofish (*Gambusia affinis*) (Hayes and Jennings 1986) as reported in *Recovery Plan Red legged frog* **(Rana aurora draytonii),** *Region 1 U.S. Fish and Wildlife Service Portland, Oregon May 28, 2002 pg 24*
http://ecos.fws.gov/docs/recovery_plans/2002/020528.pdf.

Several researchers in central California have noted the decline and eventual disappearance
of California red-legged frogs once bullfrogs become established at the same site (Moyle 1976, S. Barry *in litt.* 1992, L. Hunt *in litt.*1993, Fisher and Schaffer 1996). as reported in *Recovery Plan Red legged frog* **(Rana aurora draytonii),** *Region 1 U.S. Fish and Wildlife Service Portland, Oregon May 28, 2002 pg 24*
http://ecos.fws.gov/docs/recovery_plans/2002/020528.pdf.
Lawler *et al.* (1999) found that fewer than 5 percent of California red-legged frogs survived in ponds with bullfrog tadpoles, and the presence of bullfrogs delayed frog metamorphosis. Hayes and Jennings (1986, 1988) found a negative correlation between the abundance of

introduced fish species and California red legged frogs. as reported in *Recovery Plan Red legged frog* **(Rana aurora draytonii),** *Region 1 U.S. Fish and Wildlife Service Portland, Oregon May 28, 2002 pg 24* http://ecos.fws.gov/docs/recovery_plans/2002/020528.pdf. On Vandenberg Air Force Base (Santa Barbara County), the reproductive success of California red-legged frogs in dune ponds with both non-native fish and bullfrogs was nearly eliminated; in ponds with bullfrogs but no fish, reproduction of California red-legged frogs was evident, though low. Reproductive rates were very high in ponds with neither non-native fish nor bullfrogs (S. Christopher *in litt.* 1998). as reported in *Recovery Plan Red legged frog* **(Rana aurora draytonii),** *Region 1 U.S. Fish and Wildlife Service Portland, Oregon May 28, 2002 pg 24* http://ecos.fws.gov/docs/recovery_plans/2002/020528.pdf. Overall, while California red-legged frogs are occasionally known to persist in the presence of either bullfrogs or mosquitofish (and other non-native species), the combined effects of both non-native frogs and non-native fish often leads to extirpation of red-legged frogs (Kiesecker and Blaustein 1998, Lawler *et al.*
2000, S. Christopher *in litt.* 1998). as reported in *Recovery Plan Red legged frog* **(Rana aurora draytonii),** *Region 1 U.S. Fish and Wildlife Service Portland, Oregon May 28, 2002 pg 26* http://ecos.fws.gov/docs/recovery_plans/2002/020528.pdf.

Exotic Invasive Species Distribution and Data Summary:
Heal the Bay conducted detailed GPS mapping and field surveys between 2000 and 2005. The Heal the Bay Stream Team conducted Level IV analysis based on the California Department of Fish and Game Salmonid Stream Habitat Restoration Manual methods created by Flosi and Reynolds1994 to survey and map every pool along 70.5 miles of streams throughout the Malibu Creek Watershed. In conjunction with this Level IV pool data, field crew members also conducted visual counts and identification of all aquatic species that were present at the time of the survey for each mapped and surveyed pool. These numbers were recorded on both the hard copy and GPS data forms. The map Figure 1 shows in black the precise pool locations where exotic invasive aquatic species were visually identified and counted. The map in Figure 1 further breaks down each mapped stream into 303 (d) list designated reaches, unless a reach was not previously designated on the 303 (d) list. The types and numbers of exotic invasive species were then totaled by each 303 (d) designated reach. Finally a bar graph showing the total numbers of invasive species by reach was included in the top left corner of the map. (The GIS data in the form of Arc View shapefiles and all appropriate metadata has been provided along with these comments on a CD).

The following reaches were documented as having exotic invasive species in the Malibu Creek watershed from Heal the Bay Stream Team mapping data (Figure 1).
Cold Creek, Liberty Canyon Creek, Unnamed tributary to Las Virgenes Creek (LV Trib), Las Virgenes Creek, Malibu Creek, Lindero Creek Reach 1 and Reach 2, Medea Creek Reach 1 and Reach 2, Triunfo Creek Reach 1 and Reach 2



Total
107 287 104 2 123 623
Lindero Canyon Creek Reach 2
Total
2 742 648 64 50 1 237 1744
Lindero Canyon Creek Reach 1
Total
6 60 21 20 1 1 1 110
Medea Creek Reach 1
Total
469 228 245 83 1 6 1032
Triunfo Creek Reach 2
Total
6 3 47 83 21 5 165
Triunfo Creek Reach 1
Total
122 1 39 19 30 211
Malibu Creek
Total
4 14 148 83 147 11 102 509
Palo
Cheseboro Creek
Lindero Creek
Medea Creek
Potrero Creek
Triunfo Creek
Liberty Creek
Stokes Creek
Malibu Creek
Las Virgenes Tributary
211
165
0
103
20
40
R1
Triunfo R2
Cheseboro
Cold
LV trib
Liberty
Vatershed Aquatic Invasive Species
3d Triunfo Reach 1
3d Triunfo Reach 2
eseboro Reach
ld Reach
trib Reach
Bullfrogs/Tadpoles
Red-eared slider turtles
Crayfish
Mosquito fish
Largemouth bass
N

Heal the Bay Monitoring: Heal the Bay's monthly monitoring program has been monitoring water chemistry and aquatic vertebrates in the Malibu Creek watershed and a few adjacent reference watersheds for more than 7 years. All water quality monitoring data is available for download via the web at www.healthebay.org/streamteam. This water quality sampling data was analyzed to determine where and which exotic invasive predator species were visually observed during monthly water quality sampling events. The results can be seen in Table 1.

Site	Creek	Bull frogs	Mosquito fish	Largemouth bass	crayfish	carp	Sunfish bluegill	Fathead minnows	Black bullhead	Sample days	Observed days	Observed %
1	Malibu	2	2	1	1	1	0	0	0	83	7	8.4%
2	Cold Creek	0	5	0	3	0	0	0	0	83	7	8.4%
4	Malibu (below Malibou Lake)	0	0	0	0	2	1	0	0	59	3	5.1%
5	Las Virgenes	0	4	1	1	0	0	0	0	83	4	4.8%
7	Medea	0	5	0	3	2	1	0	0	83	2	2.4%
12	Malibu @ Rock pool	1	0	2	6	0	0	0	0	42	7	16.7%
13	Las Virgenes @ Agoura Rd	0	1	0	9	0	0	1	0	42	10	23.8%
16	Stokes Creek	0	2	0	0	0	0	0	0	19	2	10.5%
17	Triunfo Creek	2	0	3	2	0	0	0	1	42	6	14.3%

Table 1: Heal the Bay Monitoring Data

The results of the water chemistry data mining indicate that all of Malibu Creek, Cold Creek, Las Virgenes Creek, Medea Creek, Stokes Creek and Triunfo Creek should be 303 (d) listed for exotic invasive predator species. These records are visual observations recorded in the field during water quality monitoring events. These numbers are believed to be extremely conservative as fish and other aquatic species generally are sheltered and not visible when potential predators, in this case water monitoring personnel, are present.

Kats and Gamradt. Conservation Biology, Volume 10. No4. August 1996, pgs. 1155-1162 Kats surveyed 10 streams in the Santa Monica Mountains of southern California May and June 1994 and May and June 1995 which were known to have had California newts when previously surveyed between 1981 and 1986. The 1994 and 1995 Kats surveys found crayfish in Trancas and Malibu Creeks and mosquitofish in Topanga Creek and Malibu Creek. The three streams that contained mosquitofish, and/or crayfish had no California newt eggs, larvae, or adults. The seven streams without crayfish or mosquitofish did contain California newts. Further, Kats conducted laboratory and field experiments that demonstrated crayfish consume California newt egg masses and both mosquitofish and crayfish consume larval newts. In Trancas Creek heavy rains of 1995 removed the crayfish and mosquitofish from the creek and the following spring newt larvae, egg masses, and adults were found.

In a recent paper by Riley et al published in Conservation Biology 2005 Effects of Urbanization on the Distribution and Abundance of Amphibians and Invasive Species in Southern California Streams, the distribution and abundance of native amphibians and exotic predators was determined in 35 streams throughout the Santa Monica mountains and Simi Hills. The study found that streams with crayfish and exotic fish species had fewer native species such as California newt and California treefrogs. Surveys for this study occurred in 2000-2002 and documented the presence of Crayfish in the following streams: Trancas Canyon Creek, Triunfo Canyon Creek, Topanga Canyon Creek, Las Virgenes Creek, Malibu Creek, Medea Creek, and Lindero Canyon Creek. Additionally, the researchers found exotic fish species in Triunfo Canyon Creek, Topanga Canyon Creek, Las Virgenes Creek, Malibu Creek, Liberty Canyon Creek, Medea Creek, and Lindero Canyon Creek. Bullfrogs were only present in Triunfo Creek during this study period.

The Lakes: The Malibu Creek Watershed has 6 man-made lakes that are hydrologically connected to the watershed: Westlake, Lake Sherwood, Lake Lindero Lake Enchanto, Century Lake and Malibou Lake. The lakes serve as protected breeding and rearing areas for largemouth bass, blue gill, green sunfish, black bullhead, carp, mosquito fish, bullfrogs, and crayfish. It is well known that the privately owned Malibou Lake, Lake Sherwood, Lake Lindero and Malibou Lakes are prized by the lakeside residents for their excellent bass, blue gill, and carp fishing. A cursory look at real estate websites for the private lakes tout the excellent fishing as one of the amenities for living in these areas. "Westlake's 150-acre lake is stocked with bass, blue gill and catfish. Docking privileges, fishing licenses, boating and sailing are available to residents." (Website Beach California .com Westlake Village page http://www.beachcalifornia.com/westlake.html visited January 06). Additionally the Malibu Creek Stream Team has documented red ear slider turtles at Westlake and Malibou Lake. We have recently added 10 sites on Malibou Lake including the inlet to the lake at Triunfo and Medea Creeks. Visual observations during monthly monitoring at these sites confirm that bass, and carp are pervasive throughout the lake.

These lakes afford protection to these species that are not adapted to the climatic conditions normally associated with arid southern California which includes large winter flows, flash flooding, and the drying of surface flows during summers and from prolonged droughts. Because these lakes are deep and perennially wet they provide shelter from these conditions even when the exotic species are flushed from the streams or stranded due to diminished flows. The streams are readily repopulated by exotic invasive species from the lakes. For example, Trancas Creek was the one natural stream in the study with less than 8% developed area that had crayfish. Natural streams were defined as having less than 8% development in the watershed draining to a particular stream. At the top of Trancas Creek the Malibu Country Club ponds have crayfish populations that provide a recurring source of propagules, and enough influence from the irrigation of the golf course to generate perennial water in the stream. (Riley et al, Effects of Urbanization on the Distribution and Abundance of Amphibians and Invasive Species in Southern California Streams, Conservation Biology, 2005).

Crayfish are continually introduced as they are used as fishing bait in the lakes. In order to address the issue of exotic invasive predator species it is necessary to control the sources from the lakes.

It is highly recommended that all the lakes in the Malibu Creek watershed be listed for exotic invasive species. They are a continual population source that allows these predator species to quickly repopulate streams even after catastrophic flood or drought events at the expense of native species. It is recommended that the following lakes be placed on the State 303 (d) list: Lake Sherwood, Malibou Lake, Lake Lindero, Century Lake (Century Reservoir), Lake Enchanto, and Westlake. Additionally, we recommend adding the ponds at the Malibu Country Club Golf Course which were specifically mentioned as the source problem for Trancas Creek (Riley et al Effects of Urbanization on the Distribution and Abundance of Amphibians and Invasive Species in Southern California Streams Conservation Biology 2005).

Index of Biological Integrity: Exotic species can also have a major impact on native macroinvertebrate diversity and abundance for reasons discussed throughout this document. As seen in Appendix 7-A, there are several reaches of the Malibu Creek Watershed that have calculated Index of Biological Integrity (IBI) scores in the "poor" and "very poor" ranges. Specifically, monitored sites within Malibu Creek, Medea Creek, Las Virgenes Creek, and Triunfo Creek have scores below the threshold of 39. These are all areas discussed above as having high densities of exotic predatory species. Thus, in addition to the persuasive information presented above, the low IBI scores should be used as another line of evidence which supports in the listing of exotic species in Malibu Creek Watershed.

Conclusion: This document has presented ample evidence as to the distribution of exotic invasive predator species and their impacts on the dwindling population of native aquatic species in the Santa Monica Mountains and Simi Hills. The documentation provided clearly shows the spatial locations and persistence over time of exotic invasive predator species. This document also clearly demonstrates the need to protect the remaining populations of native aquatic species whose abundance have declined so drastically that all are currently protected by the State of California, the Federal government or both. Based on the presented research and studies we believe that listing for exotic species is warranted and meets the listing criteria. Heal the Bay recommends that the following waterbodies be placed on the State 303 (d) list as impaired for exotic species:

1. Malibu Creek
2. Cold Creek
3. Las Virgenes Creek
4. LV Tributary (Unnamed tributary to Las Virgenes Creek that parallels the 101 fwy in Calabasas).
5. Stokes Creek
6. Liberty Canyon Creek
7. Triunfo Creek Reach 1
8. Triunfo Creek Reach 2
9. Medea Creek Reach 1
10. Medea Creek Reach 2
11. Lindero Creek Reach 1
12. Lindero Creek Reach 2
13. Malibou Lake
14. Lake Sherwood
15. Lake Enchanto
16. Century Lake (Century Reservoir)
17. Westlake
18. Lake Lindero

19. Malibu Country Club Golf Course Ponds
20. Trancas Creek
21. Topanga Creek

Effects of Urbanization on the Distribution and Abundance of Amphibians and Invasive Species in Southern California Streams

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Abstract: *Urbanization negatively affects natural ecosystems in many ways, and aquatic systems in particular. Urbanization is also cited as one of the potential contributors to recent dramatic declines in amphibian populations. From 2000 to 2002 we determined the distribution and abundance of native amphibians and exotic predators and characterized stream habitat and invertebrate communities in 35 streams in an urbanized landscape north of Los Angeles (U.S.A.). We measured watershed development as the percentage of area within each watershed occupied by urban land uses. Streams in more developed watersheds often had exotic crayfish (*Procambarus clarkii*) and fish, and had fewer native species such as California newts (*Taricha torosa*) and California treefrogs (*Hyla cadaverina*). These effects seemed particularly evident above 8% development, a result coincident with other urban stream studies that show negative impacts beginning at 10–15% urbanization. For Pacific treefrogs (*H. regilla*), the most widespread native amphibian, abundance was lower in the presence of exotic crayfish, although direct urbanization effects were not found. Benthic macroinvertebrate communities were also less diverse in urban streams, especially for sensitive species. Faunal community changes in urban streams may be related to changes in physical stream habitat, such as fewer pool and more run habitats and increased water depth and flow, leading to more permanent streams. Variation in stream permanence was particularly evident in 2002, a dry year when many natural streams were dry but urban streams were relatively unchanged. Urbanization has significantly altered stream habitat in this region and may enhance invasion by exotic species and negatively affect diversity and abundance of native amphibians.*

Key Words: amphibian declines, California newts, California treefrogs, crayfish, exotic species, Pacific treefrogs, urban streams

Efectos de la Urbanización sobre la Distribución y Abundancia de Anfibios y Especies Invasoras en Arroyos del Sur de California

Resumen: *La urbanización afecta de muchas formas negativas a los ecosistemas naturales, particularmente a los sistemas acuáticos. La urbanización también está reconocida como uno de los potenciales causantes de las dramáticas declinaciones recientes en las poblaciones de anfibios. Entre 2000 y 2002 determinamos la distribución y abundancia de anfibios nativos y depredadores exóticos y caracterizamos el hábitat y las comunidades de invertebrados en 35 arroyos en un paisaje urbanizado al norte de Los Ángeles. Medimos el desarrollo de la cuenca como el porcentaje de la superficie ocupada por usos urbanos en cada cuenca.*

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*Los arroyos en cuencas más desarrolladas a menudo tenían cangrejos de río exóticos (*Procambarus clarkii*) y peces, y tenían menos especies nativas, como tritones (*Taricha torosa*) y ranas arborícolas (*Hyla cadaverina*). Estos efectos parecieron particularmente evidentes arriba de 8% de desarrollo, un resultado que coincide con otros estudios de arroyos urbanos que muestran impactos negativos a partir de 10-15% de urbanización. La abundancia de* H. regilla*, el anfibio nativo con mayor distribución, fue menor en presencia de cangrejos de río exóticos, aunque no encontramos efectos directos de la urbanización. Las comunidades de macroinvertebrados bentónicos también fueron menos diversas en los arroyos urbanos, especialmente las especies sensitivas, Los cambios en la comunidad de la fauna en arroyos urbanos se pueden relacionar con cambios en el hábitat físico del arroyo, tales como menos hábitat con pozas y más hábitat con corriente y una mayor profundidad y flujo de agua, lo que produce arroyos más permanentes. La variación en la permanencia de los arroyos fue particularmente evidente en 2002, año en el que muchos arroyos naturales se secaron y los arroyos urbanos permanecieron relativamente sin cambios. La urbanización ha alterado significativamente a los hábitats de arroyos en esta región y puede incrementar la invasión de especies exóticas e incidir negativamente en la diversidad y abundancia de anfibios nativos.*

Palabras Clave: arroyos urbanos, cangrejos de río, declinaciones de anfibios, especies exóticas, *Hyla cadaverina, Hyla regilla, Taricha torosa*

Introduction

Freshwater ecosystems are particularly susceptible to disturbance and have become degraded throughout the world (Ricciardi & Rasmussen 1999; Baron et al. 2002). The severe disturbance of urbanization is a significant threat to freshwater systems such as streams (Paul & Meyer 2001). The increased area of impervious surfaces in urban areas produces increased runoff, leading to significant changes in hydrology and consequently in stream habitat, increased inputs of nutrients or pollutants, and, in the end, often radically altered ecological communities. Significant changes have been documented in the abundance and diversity of everything from algae to invertebrates to fishes in urban streams (reviewed in Paul & Meyer 2001). These changes can occur even at fairly low levels of urbanization, frequently beginning when 10–15% of the watershed has become urbanized or converted to impervious surface cover (Paul & Meyer 2001; e.g., Limburg & Schmidt 1990; Booth & Jackson 1997). Amphibian communities, however, have received little attention in urban streams, despite the fact that they may be particularly susceptible to urban impacts.

For more than a decade considerable attention has been paid to declines of amphibian populations worldwide (Blaustein & Wake 1990; Alford & Richards 1999). A range of causes of these declines has been identified, from disease to pollution to exotic species introductions. Many amphibian declines are also related to the loss, degradation, and fragmentation of remaining natural habitat (e.g., Lehtinen et al. 1999; Guerry & Hunter 2002), but perhaps because these threats are generally acknowledged for all taxa, they are less often implicated as a cause of amphibian declines. The sensitivity of amphibians to environmental change, however, renders them particularly susceptible to changes associated with habitat loss and disturbance. Most amphibians require some standing water, at least for breeding. The high rate of loss and degradation of wetlands, therefore, may particularly affect amphibian communities.

The impact of urbanization on amphibian communities has received some attention in the conservation literature, particularly at broad spatial scales. Davidson et al. (2001, 2002) evaluated causes for amphibian declines throughout California and found that the absence of four sensitive species from historical locations was significantly correlated with the amount of surrounding urbanization. Similarly, Knutson et al. (1999) found that urbanization was the strongest (negative) factor in multivariate models of the abundance and distribution of anurans in Iowa and Wisconsin. Although these broad-scale studies are important, there has been little published research at finer scales or on stream-dwelling species. More specific and intensive studies (e.g., Delis et al. 1996) are necessary to determine more local patterns and to evaluate the potential mechanisms of negative impacts. As Knutson et al. (1999) acknowledge, their broad-scale models explain relatively little of the variation in amphibian distribution. Landscape-level studies of multiple streams that also include information about relevant local factors may be particularly useful (Lowe & Bolger 2002). For instance, Orser and Shure (1972) found that dusky salamander (*Desmognathus fuscus*) abundance was inversely related to urbanization in six Georgia streams because of increased erosion and decreased bank soil stability and vegetative cover.

There are many specific ways that amphibians can be adversely affected by urbanization. Of particular concern for many aquatic taxa, including amphibians, is flow regime (Poff et al. 1997; Baron et al. 2002) because the timing and volume of water inputs can be dramatically altered in urban areas. Reduced or altered flow can affect native fish species and communities (e.g., Marchetti & Moyle 2001), but increases in water input can also threaten native aquatic biota, particularly in Mediterranean ecosystems, where native animals are adapted to a seasonal flow regime (Gasith & Resh 1999). In arid systems, more plentiful and permanent water can allow the invasion and persistence of exotic species, which may then eat (Knapp & Matthews 2000), compete with (Kiesecker et al. 2001) or hybridize with (Riley et al. 2003) native species (reviewed in Kats & Ferrer 2003). Significant disturbance of the streambed and surrounding habitats, such as the channelization and bank stabilization that is common in developed areas, most likely also negatively affects amphibian communities. Erosion and sedimentation of streams can increase in urban areas because of deliberate activities such as road construction (Welsh & Ollivier 1998), and as an indirect result of other factors such as increased fire frequency (Kerby & Kats 1998). Finally, collection by humans and predation by domestic cats and dogs may also affect urban amphibian populations.

We examined amphibian distribution, abundance, and reproduction across a range of natural and urban streams in a rapidly urbanizing landscape in southern California. Our goals were to evaluate the degree of urbanization in these watersheds; determine how the distribution and abundance of amphibians, introduced aquatic taxa, and benthic macroinvertebrates vary relative to urbanization; and measure how stream morphology and permanence are affected by urbanization. In the face of increasing urbanization, a better understanding of the threats to amphibians in urban areas will allow more effective conservation of amphibians and other aquatic species.

Methods

Study Area

The 76-km Santa Monica Mountains are bounded on the south by the Pacific Ocean, on the east by the city of Los Angeles, on the west by agricultural areas, and on the north by an eight-lane highway (Highway 101) and the Simi Hills (Fig. 1). The city of Malibu and parts of other incorporated areas are entirely within the mountains, and although much of the area remains undeveloped, new developments sprout up continually throughout the region. Many of the watersheds of the Santa Monica Mountains extend across Highway 101 into the Simi Hills (Fig. 1). Although much of the Simi Hills is protected open space, there is also considerable development within them, especially along streams and near the Highway 101 corridor. California is one of five locations in the world with a Mediterranean climate—cool, wet winters and hot, dry summers. Southern California is particularly arid, annually receiving 44 cm of rain, usually between October and April. Overall, the study area consists of a large expanse of typical Mediterranean climate habitat interspersed with pockets of urbanization and so provides an ideal landscape for investigating urban impacts.

Aquatic amphibian species in the region include California newts (*Taricha torosa*), Pacific treefrogs (*Hyla regilla*), California treefrogs (*H. cadaverina*), western toads (*Bufo boreas*), spadefoot toads (*Scaphiopus hammondii*), and red-legged frogs (*Rana aurora*). Red-legged frogs, formerly common in a number of streams in the

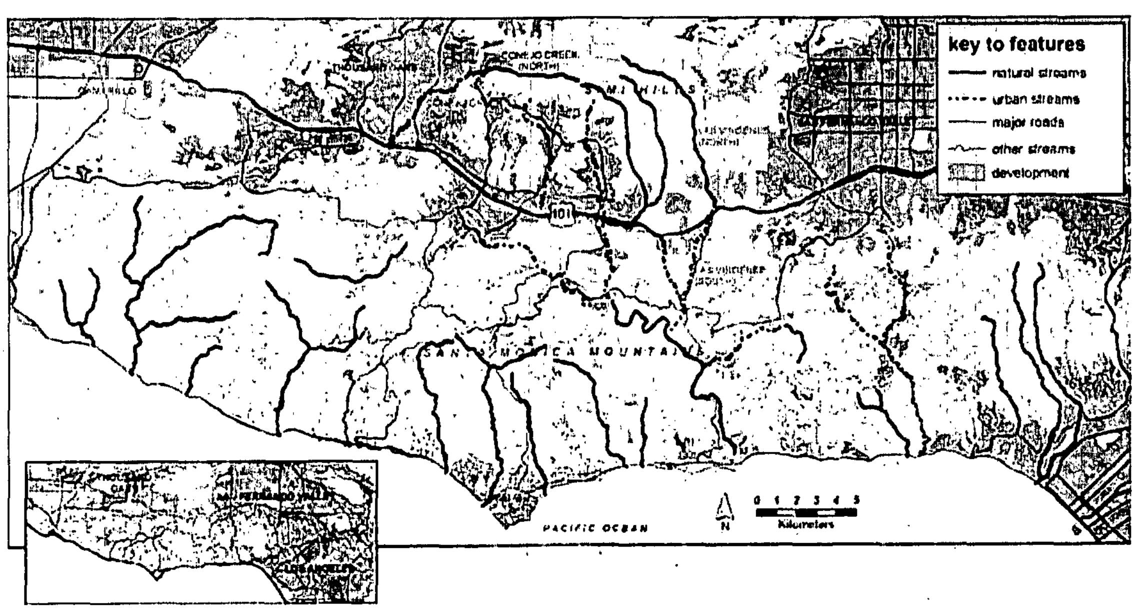

Figure 1. Streams surveyed for amphibians and introduced aquatic species in the Santa Monica Mountains and Simi Hills of southern California.

region (De Lisle et al. 1986), now occur only in one small population in the Simi Hills. Exotic stream species include red swamp crayfish (*Procambarus clarkii*) from the southeastern United States, bullfrogs (*R. catesbeiana*), and a number of fish species, including bass (*Micropterus* spp.), bluegill (*Lepomis macrochirus*), and mosquitofish (*Gambusia affinis*).

Reach Selection

Because our goal was a comprehensive survey of stream amphibian communities in the area, we attempted to survey all the major streams rather than selecting particular study streams. We surveyed a section of at least 500 m where possible. Along some longer streams there were major barriers such as freeways or significant changes in the degree of urbanization. For these streams we surveyed the stream above and below the barrier or change and treated each reach as a separate stream (e.g., north and south Las Virgenes, north and south Conejo Creek, Fig. 1). These reaches are not entirely independent because the upstream reach is contained within the watershed of the downstream reach. We believe, however, that the differences between the reaches were potentially significant in terms of the attributes we were examining. We surveyed 30 streams in 2000, 33 in 2001 (5 were new streams with 2 of the 2000 streams not sampled), and 35 in 2002. Streams were all first or second order except for two third-order streams, so they were generally small streams and of a similar size across the study area.

Stream Surveys

At each stream we selected a starting point based on accessibility and the likelihood of having water during the spring survey period (April–June). Most amphibians breed between February and June in this area, and many streams dry up by July or August. Starting points were recorded with a global positioning system to within 2–5 m. On first reaching the stream, we measured dissolved oxygen, salinity, air temperature, water temperature, pH, conductivity, water flow, and nitrate and phosphate levels.

Moving upstream, we determined whether each habitat segment was a run, riffle, or pool and measured its length, width, and depth; we also measured the length of dry stretches. We visually searched for larval and adult amphibians and exotic species in each segment, examining the water column and stream bottom. The relatively low density of aquatic vegetation in these streams increased the effectiveness of visual surveys. In segments with dense aquatic vegetation or algal blooms, we also used dipnets to capture and count animals. Counts were recorded for each species in each segment. If it was not feasible to count each individual, we used abundance categories of >20, >50, >100, >500, and >1000 (although the latter two categories were rarely used). We surveyed for adult and metamorphic amphibians along the stream edge. We also measured reproductive effort by counting egg masses. For egg masses of California newts and Pacific treefrogs, we searched under rocks and on submerged branches and vegetation. We used a diving mask to count newt egg masses in deep pools. California treefrogs lay eggs singly, which makes counting them impracticable, and we found egg strings from western toads in only one stream. To standardize efforts, our method was reviewed each year and senior personnel conducted survey-team training each spring before surveys and monitored the work periodically throughout the survey period.

In 2001 we also collected benthic macroinvertebrate samples at each stream. Aquatic invertebrates are important components of stream biota that can be sensitive to changes in stream habitat and water quality (Karr & Chu 1999). They are also important prey for aquatic amphibians (Kerby & Kats 1998). For invertebrate sampling, we followed Environmental Protection Agency and California Aquatic Bioassessment protocols (Harrington & Born 2000), modified as appropriate for these small Mediterranean streams. We collected three invertebrate samples at each stream in a random selection of three of the first five riffle habitats. We used kick-net sampling in the middle of the stream and at each edge. Samples were preserved in 70% ethanol and sent to Sustainable Land Stewardship International Institute (Sacramento, California) for identification to family, genus, and, where possible, species.

Analysis

WATERSHED URBANIZATION, STREAM GRADIENT, AND WATER QUALITY

We measured the degree of urbanization within the watershed by calculating the percentage of area upstream from the starting point that consisted of urban land uses. Although impervious surface cover has often been used to measure urban stream impacts and is particularly useful with respect to hydrology (Scheuler 1994; e.g., Finkenbine et al. 2000), the amount of urban land use in the watershed gives a more complete picture of the effects of urbanization. Morley and Karr (2002) found that percent urban cover was more highly correlated with their index of biological integrity for benthic invertebrates than impervious surface area.

We used geographic information systems (GIS) to generate land-use and stream-gradient information. Specifically, we used the grid module of Arc/Info 8.3 software (ESRI, Redlands, California) to calculate the watershed extent above the starting point from 10-m digital elevation models (DEMs) obtained from the U.S. Geological Survey. Land-use cover data provided by the Southern California Association of Governments were intersected with the watershed coverage to create a merged data set. The amount of urban area (industrial, commercial, residential, transportation, floodways) was then summarized for each watershed. Stream gradient was calculated by measuring the difference in elevation (based on the DEMs) over the surveyed stream reach and dividing by the surveyed length. We analyzed conductivity and flow data (from 2001) because we believed these parameters were the most reliably measured and often reflect impacts from urbanization (Paul & Meyer 2001; e.g., Willson & Dorcas 2003).

SPECIES DISTRIBUTION AND ABUNDANCE, BENTHIC MACROINVERTEBRATES, HABITAT CHARACTERISITICS, AND PERMANENCE

We were interested in how biological and physical stream characteristics changed relative to urbanization and whether those changes were continuous or related to a certain threshold of development. Many urban stream studies cite a threshold of development or impervious surface area when effects begin to appear, often about 10-15% (Paul & Meyer 2001). To examine differences between urban and natural streams on average, we classified streams in watersheds with > 8% development as urban and those with < 8% development as natural. Eight percent was the lowest level at which decreases in vertebrate diversity, specifically fishes, have been seen (Yoder et al. 1999; reviewed in Paul & Meyer 2001), and it is the level at which exotic species began to appear in the streams in our study area.

Because we attempted to survey all the major streams in the Santa Monica Mountains and Simi Hills, we realized other important factors would also vary among streams. Stream gradient, in particular, varied from 0.6% to 12.8% and was also correlated with urbanization: urban streams generally had lower gradients (Pearson correlation coefficient = −0.486). Therefore we also included stream gradient as a variable in our analyses. For categorical analyses, we classified streams below the median gradient of 3.5% as low gradient and streams above 3.5% as high gradient. We used two-way analysis of variance (ANOVA) to test for differences between urban and natural and high- and low-gradient streams. Then, to test for continuous relationships and further investigate the nature of potential changes around the threshold of 8% urbanization, we used multiple piece-wise regression analysis (Singer & Willet 2003), including gradient as a second continuous variable. Using piece-wise regression, we were able to test whether the dependent variables were significantly related to urbanization and gradient, whether the slope of the relationship with urbanization changed above and below the 8% threshold, and whether there was a significant jump effect at this threshold as measured by a significant change in the intercept of each regression line with the 8% level of urbanization (see Fig. 2 for examples).

We tested for a relationship between species presence and urbanization with 2 × 2 contingency tables and used Fisher's exact tests when too many cell frequencies were < 5. We tested for relationships between urbanization and stream permanence with 2 × 2 contingency tables

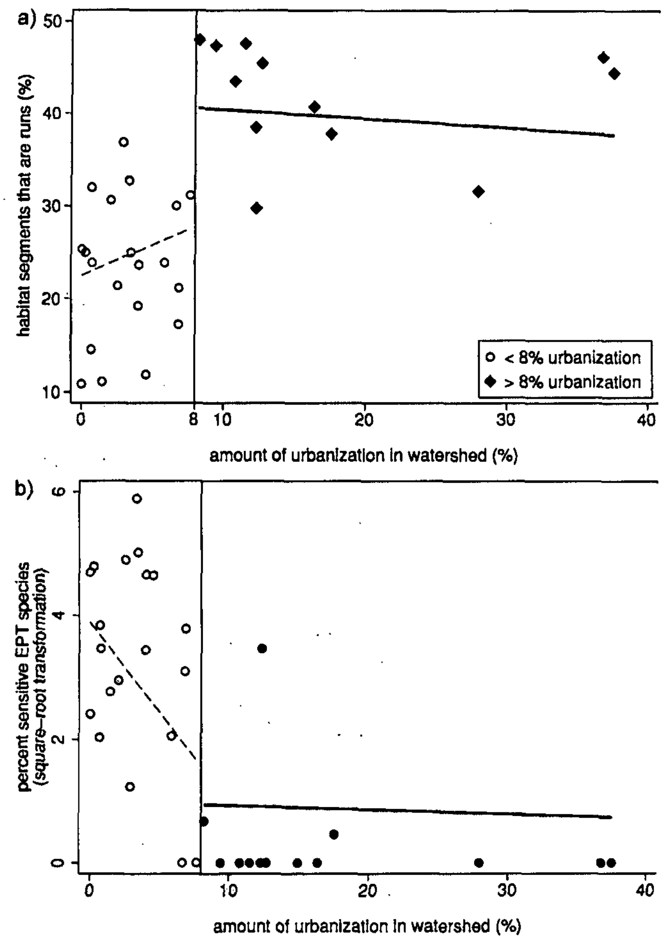

Figure 2. Piece-wise regression analyses of the percentage of watershed urbanization and (a) habitat segments that were runs in 2001 and (b) percent sensitive species (Ephemeroptera, Plecoptera, Trichoptera [EPT]), showing a significant difference in intercept but not slope in (a) and a significant difference in slope but not intercept in (b). The vertical line at 8% urbanization represents the cutoff between streams classified as urban or natural. Urban streams are filled circles (urban = 1) and natural streams are open circles (urban = 0). In (a) neither regression line is significantly different from zero, and the slopes of the lines are not significantly different from each other, but the intercepts where each line intersects the 8%-urbanization line are significantly different. In (b) the regression line for natural streams (< 8% urbanization) is significantly negative, whereas the line for urban streams is not different from zero. There is no significant difference in the intercepts with the line at 8% urbanization, but the slopes are significantly different from each other.

(percentage of streams with dry stretches) and Mann-Whitney tests (length of dry streambed). For stream flow, stream habitat characteristics, and invertebrate community indices, we used multiple piece-wise regression and two-way ANOVA to test for relationships with urbanization and stream gradient. We tested for multicollinearity in the piece-wise regression analyses, and tolerances were always > 0.177. Stream habitat characteristics included the average length of pools, riffles, runs, and of all habitat segments, average depth for runs, riffles, and pools, and the proportion of each stream that consisted of each habitat type, both the proportion of the length and the proportion of the segments.

Dependent variables for the invertebrate communities were species richness; diversity; the richness and percentage of insects from the Ephemeroptera, Plecoptera, and Trichoptera (EPT) orders; the percentage of insects from sensitive EPT taxa (tolerance values 0-2); the percentage of individuals from the most dominant taxon; the percentage of insects from intolerant taxa (tolerance values 0-3); and the percentage of insects from tolerant taxa (tolerance values 8-10). Mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera) are orders of stream invertebrates that can be particularly susceptible to changes in stream habitat complexity and water quality. Because some families in these orders are less sensitive, we also evaluated EPT taxa and overall taxa that are particularly sensitive or insensitive to disturbance, based on tolerance values. Tolerance values represent the relative sensitivity of different invertebrate families within an order to aquatic disturbance and pollution generally but are not specific to the type of stressor (Harrington & Born 2000).

For Pacific treefrogs, we examined larval and egg mass density at the scale of the stream and the scale of the habitat segment within streams. For abundance classes, we used the minimum number of individuals as a conservative estimate of abundance (e.g., for class $x > 50$, we used 50). We used t tests and Mann-Whitney tests to test for relationships between treefrog density and both urbanization and crayfish presence. We report statistical results with a p value of 0.10 or less because of the high variability inherent in these data, the low power of the nonparametric tests used for most of the abundance data, and most importantly to increase our power to detect biologically important effects. Statistical tests were performed with SYSTAT and SPSS (for the piece-wise regressions) software (SPSS, Chicago, Illinois).

Results

Watershed Characteristics, Stream Flow, and Conductivity

The percentage of urbanization in the watersheds varied from 0.0 to 37.5%, with a mean of 8.4 ± 9.5% and a median of 5.9%. Stream gradient varied from 0.6% to 12.8%, with a mean of 4.6 ± 3.4% and a median of 3.5%.

Stream flow was not significantly related to gradient but was positively related to urbanization in the ANOVA (urban/natural $F_{1,29} = 5.33, p = 0.028$) and showed a significant jump effect in the piece-wise regression analysis (intercept difference: $t = 1.98, p = 0.057$). The interaction between gradient and urbanization was also significant in the ANOVA ($F_{1,29} = 5.33, p = 0.028$). For low-gradient streams, flow was significantly higher in urban streams (mean of 1.27 m^3/second) than in natural streams (mean of 0.11 m^3/second), but there was no significant difference in high-gradient streams. Conductivity in urban streams (1643.3 microsiemens), was significantly higher than in natural streams (903.8 microsiemens) (Mann-Whitney $U = 49, p = 0.005$). The conductivity data could not be transformed for the ANOVA or piece-wise regression analyses with gradient.

Species Distribution

In more urban watersheds, some native amphibians such as California newts and California treefrogs were conspicuously absent from streams, whereas exotic aquatic species such as crayfish and introduced fish species were often present (Table 1). In natural streams, species presence was significantly more likely for California newts and California treefrogs and significantly less likely for exotic crayfish and fishes (newts $\chi^2 = 6.37, p = 0.012$; California treefrogs $\chi^2 = 5.22, p = 0.022$; Fisher exact tests: crayfish $p = 0.000$, exotic fish $p = 0.000$). Western toads exhibited variability in distribution between years. In 2000, but not in 2001, toads were detected significantly more often in urban streams (Fisher exact tests: 2000 $p = 0.034$, 2001 $p = 0.130$). Bullfrogs were present in only one stream, and Pacific treefrogs were found in every stream surveyed. The small overall sample size and skewed nature of the presence/absence data rendered logistic regression models (incorporating both urbanization and stream gradient) inappropriate.

Abundance

Because Pacific treefrogs were present in every stream surveyed, we examined the abundance of larvae and egg masses relative to both urbanization and the presence of crayfish. At the stream scale, larval treefrog density was not related to crayfish presence (2000 Mann-Whitney $U = 74, p = 0.521$; 2001 $U = 84, p = 0.873$) or to urbanization in 2000 ($U = 96, p = 0.693$), although in 2001 larval density was marginally higher in urban streams (1.21 tadpoles/m vs. 0.82 tadpoles/m in natural streams; $t = -1.704$ df $= 30$, $p = 0.10$). Egg mass density was significantly lower in urban streams in 2001 ($U = 183$, $p = 0.014$), when there were 0.254 egg masses/m in urban streams and 0.395 egg masses/m in natural streams, but was not related to urbanization in 2000 ($U = 103$, $p = 0.453$). Egg mass density was also significantly lower in streams with crayfish both in 2000, with 0.081 egg masses/m in streams without crayfish versus 0.004 egg masses/m in streams with crayfish ($U = 95.5, p = 0.055$), and in 2001, with 0.244 egg masses/m in streams without crayfish and 0.050 egg masses/m in streams with crayfish ($U = 142, p = 0.013$).

Table 1. Distribution of native amphibians and introduced aquatic species in streams in the Santa Monica Mountains and Simi Hills, California.

		Native species[b]				*Introduced species*[b]		
Stream	*Area developed (%)*[a]	*TATO*	*HYCA*	*BUBO*	*HYRE*	*CRAY*	*RACA*	*exotic fishes*
Lang Ranch, north	0.00	X			X			
Palo Comado Canyon	0.00			X	X			
Temescal Canyon	0.01	X			X			
Sullivan Canyon	0.17				X			
Big Sycamore Canyon	0.26	X	X		X			
Las Virgenes, north	0.70				X			
Wood Canyon	0.71				X			
La Jolla Canyon	0.75				X			
Rustic Canyon	1.45	X			X			
Solstice Canyon	2.07	X	X		X			
Cold Creek, upper	2.55	X	X		X			
Corral Canyon	2.91			X	X			
Arroyo Sequit	3.38	X	X		X			
Ramirez Canyon	3.46	X	X		X			
Serrano Canyon	3.99		X		X			
Trancas Canyon	4.06	X	X		X	X		
Deer Creek	4.58		X		X			
Carlisle Canyon	5.88	X	X	X	X			
Zuma Canyon	6.69	X	X		X			
Newton Canyon	6.84	X	X		X			
Tuna Canyon	6.89	X	X		X			
Cheeseboro Canyon	7.68			X	X			
Triunfo Canyon	8.26			X	X	X	X	X
Old Topanga Canyon	9.42			X	X			X
Lang Ranch, south	10.79			X	X			
Topanga Canyon, Upper	11.51			X	X	X		
Las Virgenes, south	12.28			X	X	X		X
Cold Creek, Lower	12.34	X	X		X			
Topanga Canyon, Lower	12.69	X	X	X	X			
Lower Malibu Creek	14.95				X	X		X
Erbes	16.37				X	X		X
Liberty Canyon	17.57				X			
Medea Creek, north	27.96			X	X	X		X
Lindero Canyon	36.77				X	X		X
Medea Creek, South	37.54			X	X	X		X

[a] *Development includes industrial, commercial, residential, transportation, and floodway areas. Streams in watersheds with >8% development are classified as urban.*
[b] *Abbreviations: TATO,* Taricha torosa; *HYCA,* Hyla cadaverina; *HYRE,* Hyla regilla; *BUBO,* Bufo boreas; *CRAY, crayfish,* Procambarus clarkii; *RACA,* Rana catesbeiana.

In streams that had both crayfish and Pacific treefrogs, at the scale of the stream habitat segment larval treefrog density was significantly higher in segments without crayfish than in those with them, both in 2000 (0.730 tadpoles/m without crayfish and 0.293 tadpoles/m with them, $U = 2367$, $p < 0.001$) and in 2001 (2.820 tadpoles/m without crayfish and 0.820 tadpoles/m with them, Mann-Whitney $U = 3720$, $p < 0.001$).

Stream Habitats

Stream habitat was affected by urbanization (Table 2) and in some cases by gradient (Table 3). There was variation between years, but some effects were also consistent in both years, specifically the tendency for habitat segments, particularly runs, to be longer and for runs and pools to be deeper in urban streams. Overall, the effects of development were particularly strong in 2001, when urban streams had longer pools, riffles, and runs, a higher percentage of the stream length in runs, and a lower percentage of the habitat segments as pools but a higher percentage of them as runs (Table 2, Fig. 3). When gradient was also an important factor, some effects were difficult to test for in high-gradient streams because we had only two high-gradient urban streams. In a number of cases, however, particularly in 2000, urban low-gradient streams ($n = 10$) were significantly different from natural low-gradient streams ($n = 6$) (e.g., for average stream segment length in 2000; Tables 2 & 3).

Based on the piece-wise regression analyses, the habitat changes relative to urbanization were related more to a jump effect (i.e., a large change at about 8% watershed urbanization) than to a change in the slope of the relationship. There was never a significant difference in the slopes

Table 2. Stream habitat characteristics in urban and natural streams in the Santa Monica Mountains and Simi Hills, California.

	2000		2001	
Stream characteristic	*urban*	*natural*	*urban*	*natural*
Average stream segment length (m)	21.08[a]	9.46	17.65[b]	8.81
Average pool length (m)	12.16	6.99	13.93[b]	5.79
Average riffle length (m)	20.10[a]	11.37	16.40[b]	10.59
Average run length (m)	25.52[c]	10.43	19.25[b]	8.12
Stream length consisting of pools (%)	23.34	34.91	11.52	22.30
Stream length consisting of riffles (%)	43.85	47.75	41.82[a]	55.35
Stream length consisting of runs (%)	32.81[a]	17.34	46.35[b]	22.35
Segments that are pools (%)	29.96	45.02	13.63[d]	31.30
Segments that are riffles (%)	42.10	38.00	44.42	45.32
Segments that are runs (%)	27.93[a]	16.98	41.73[b]	23.38
Average pool depth (cm)	54.88[c]	39.04	81.09[c]	47.54
Average riffle depth (cm)	24.43[b]	14.25	17.96	16.53
Average run depth (cm)	40.65[b]	21.10	39.43[c]	26.39

[a] *Significant difference between urban and rural, low-gradient streams, Bonferroni comparisons based on overall* $p = 0.05$.
[b] *Significant difference between urban and rural streams at* $p < 0.01$.
[c] *Significant difference between urban and rural streams at* $p < 0.10$.
[d] *Significant difference between urban and rural streams at* $p < 0.05$.

above and below 8%, but there was a statistically significant intercept change in 2001 for average pool length, percentage of segments that were pools, and percentage of segments that were runs (Fig. 2a). Also, for the habitat variables that showed a significant effect of urbanization in the ANOVA (significant F test), in 11 of 13 cases (3 of 4 in 2000 and 8 of 9 in 2001) the intercept difference was greater than the slope difference based on inspecting the t and p values (Table 3). In fact, there was little statistical evidence of continuous effects of urbanization on habitat; only 1 of 52 regression coefficients (26 variables × 2 years × 2 coefficients, urban and rural) computed for habitat variables were significantly different from 0 (average pool length in 2000; $t = 2.634, p = 0.015$).

Stream Permanence

Although there was annual variation, urban streams consistently had less dry streambed than natural streams (Table 4). Urban streams were not significantly wetter than natural streams in 2000, which was an El Niño year (streams with any dry: $\chi^2 = 0.785, p = 0.376$; percent stream length dry: Mann-Whitney $U = 118, p = 0.278$), but in 2001 and 2002 more natural streams had dry streambed and a greater percentage of the surveyed reaches were dry (2001—streams with any dry: Fisher exact test $p = 0.035$; percent stream length dry: $U = 156$, $p = 0.040$; 2002—streams with any dry: $\chi^2 = 6.65, p = 0.010$; percent stream length dry: $U = 224, p = 0.003$). In 2002, a very dry year, most or all of the surveyed reach of some of the natural streams was dry.

Invertebrates

Invertebrate communities also varied between streams and were related strongly to urbanization and stream gradient. Urban streams had lower invertebrate diversity, greater dominance by the most common taxon and by more-tolerant taxa, and decreased percentages of more sensitive or intolerant taxa overall and within the EPT orders specifically. Within low-gradient streams, overall and EPT richness were also significantly lower in urban streams (Table 5). The piece-wise regression analyses for invertebrates were different from those for habitat variables, in that urbanization effects seemed to be more related to a change in slope than in intercept. Although there was a significant intercept difference for species richness, there was a significant slope difference for EPT taxa and for sensitive EPT taxa (Fig. 2b), and for four of the five variables where there was a significant urbanization effect in the ANOVA, the slope difference was greater than the intercept difference (t and p values, Table 3). The slopes of the relationship between urbanization and invertebrate indices were also significantly different from zero in three cases for natural streams (richness, $t = -2.43, p = 0.022$; EPT taxa, $t = -2.56, p = 0.016$; and sensitive EPT taxa, $t = -2.47, p = 0.020$) and in one case for urban streams (richness, $t = -2.31, p = 0.029$). For every variable, the slope of the relationship with urbanization was greater for natural streams than for urban streams.

The effect of stream gradient on invertebrates was consistently significant for five of the eight variables in both the categorical (ANOVA) and the continuous (piece-wise regression) analyses (Table 3). The proportion of EPT insects (EPT index) was not significantly related to urbanization, although it was related to gradient in both analyses.

Discussion

Habitat Changes, Distribution, and Abundance

In urban streams the absence of some native amphibians and the presence of exotic species such as crayfish and

Table 3. Statistical results for piece-wise regression analyses and two-way analysis of variance (ANOVA) for habitat variables in 2000 and 2001 and benthic macroinvertebrate community indices in 2001 for streams in the Santa Monica Mountains and Simi Hills, California.[a]

	Piece-wise regression[b] t (p)			*Two-way ANOVA* F (p)		
	slope difference	*intercept difference*	*gradient*	*urbanization*	*gradient*	*interaction*
			2000			
Habitat variables						
average stream segment length	0.094 (0.930)	1.220 (0.234)	ns	ns (urb>nat low[c])	ns	ns
average pool length	0.589 (0.969)	−0.756 (0.795)	−2.30 (0.031)	ns	ns	ns
average riffle length	−0.290 (0.774)	0.980 (0.337)	ns	ns (urb>nat low[c])	ns	ns
average run length	−0.485 (0.632)	1.430 (0.165)	−2.11 (0.046)	5.100 (0.033)	ns	ns
percent stream length in pools	−0.744 (0.464)	0.560 (0.581)	ns	ns	ns	ns
percent stream length in riffles	−1.160 (0.257)	−0.022 (0.883)	ns	ns	ns	ns
percent stream length in runs	−0.722 (0.477)	0.729 (0.473)	ns	ns (urb>nat low[c])	ns	ns
percent segments that are pools	0.483 (0.633)	−0.654 (0.519)	ns	ns	ns	ns
percent segments that are riffles	−0.833 (0.413)	0.705 (0.488)	ns	ns	ns	ns
percent segments that are runs	−0.319 (0.752)	0.193 (0.848)	ns	ns (urb>nat low[c])	3.770 (0.064)	3.430 (0.076)
average pool depth	0.032 (0.974)	0.176 (0.862)	ns	5.080 (0.034)	ns	ns
average riffle depth	0.293 (0.772)	1.580 (0.126)	ns	11.290 (0.003)	ns	ns
average run depth	−1.100 (0.283)	0.871(0.393)	ns	7.810 (0.010)	ns	ns
			2001			
average stream segment length	−0.567 (0.576)	1.420 (0.153)	ns	12.690 (0.001)	ns	ns
average pool length	−0.863 (0.397)	2.180 (0.040)	ns	14.200 (0.001)	ns	ns
average riffle length	−0.613 (0.545)	0.398 (0.694)	ns	3.120 (0.088)	ns	ns
average run length	−0.281 (0.781)	1.120 (0.273)	ns	12.090 (0.002)	ns	ns
percent stream length in pools	0.046 (0.963)	0.950 (0.350)	ns	ns	ns	ns
percent stream length in riffles	0.214 (0.832)	−0.071 (0.944)	ns	ns (urb>nat low[c])	ns	ns
percent stream length in runs	−0.440 (0.663)	1.260 (0.218)	-2.040 (0.051)	10.910 (0.003)	ns	ns
percent segments that are pools	0.268 (0.790)	−2.330 (0.028)	ns	6.620 (0.016)	ns	ns
percent segments that are riffles	0.518 (0.609)	1.020 (0.315)	ns	ns	ns	ns
percent segments that are runs	0.268 (0.790)	2.600 (0.015)	−1.780 (0.086)	10.270 (0.003)	ns	ns
average pool depth	−0.856 (0.401)	1.390 (0.179)	ns	3.240 (0.084)	5.630 (0.026)	7.030 (0.014)
average riffle depth	0.248 (0.806)	−0.350 (0.729)	ns	ns	ns	ns
average run depth	0.117 (0.908)	−0.372 (0.713)	ns	3.880 (0.059)	ns	ns
			2001			
Invertebrate community indices						
richness	1.610 (0.119)	2.030 (0.052)	2.370 (0.025)	ns (urb<nat low[c])	4.640 (0.040)	ns
EPT[d] taxa	1.970 (0.059)	1.460 (0.156)	2.610 (0.014)	ns (urb<nat low[c])	7.860 (0.009)	ns
EPT index (% EPT inds)	1.050 (0.301)	0.865 (0.394)	2.800 (0.009)	ns	4.090 (0.053)	ns
sensitive EPT taxa	2.280 (0.031)	−0.716 (0.480)	2.510 (0.018)	12.250 (0.002)	5.700 (0.031)	ns
Shannon diversity	1.340 (0.192)	−0.518 (0.609)	ns	7.620 (0.010)	ns	ns
percent dominant taxon	−0.986 (0.332)	0.629 (0.535)	ns	4.400 (0.045)	ns	ns
percent intolerant taxa (TV[e] 1-3)	0.858 (0.398)	−0.856 (0.399)	2.36 (0.026)	6.150 (0.019)	4.280 (0.048)	ns
percent tolerant taxa (TV 8-10)	1.450 (0.159)	−0.072 (0.943)	ns	3.360 (0.077)	ns	5.590 (0.025)

[a] *Piece-wise regression analyses had an urbanization cutoff of 8% between urban and natural streams and gradient as a continuous second factor. Two-way ANOVA factors included urbanization (natural and urban streams with 8% cutoff) and gradient (high- and low-gradient streams with median gradient of 3.5% as the cutoff). Nonsignificant results are listed as "ns" except for slope and intercept differences in the piece-wise regressions to further evaluate whether threshold differences are related to a "jump effect" or to a change in the slope of the relationship (see text for details).*

[b] *Slope difference measures whether the slope of the regression between urbanization and the dependent variable is significantly different between urban streams (>8% watershed urbanization) and natural streams (<8% urbanization). Intercept difference measures whether there is a significant difference between where the urban stream regression line and the natural stream regression line intercepts the vertical line of the cutoff, 8% watershed urbanization.*

[c] *Significant difference between urban and rural, low-gradient streams, bonferroni comparisons based on overall* $p = 0.05$.

[d] *Aquatic insect orders Ephemeroptera, Plecoptera, and Trichoptera.*

[e] *Tolerance values, a measure of sensitivity to disturbance and pollution with 0 being most sensitive and 10 most tolerant.*

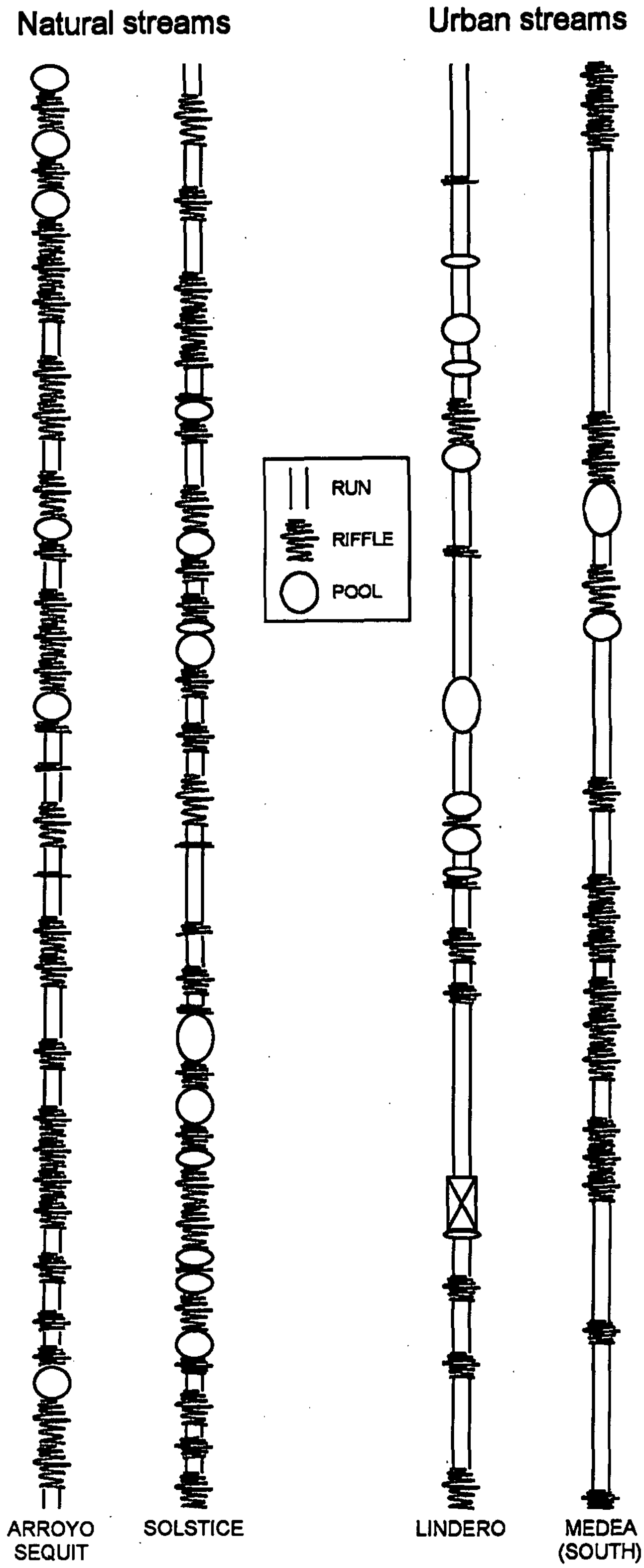

Figure 3. Schematic representation of habitat diversity (runs, riffles, and pools) in two urban and two natural streams in the Santa Monica Mountains and Simi Hills of southern California. The rectangle with an X on Lindero Creek represents a culvert.

Table 4. Stream permanence in urban and natural streams in the Santa Monica Mountains and Simi Hills, California.

Year and stream type	*Length of dry stream (%)*	*Streams with dry bed (%)*
2000		
urban	0.57	16.7 (2/12)
natural	8.22	33.3 (6/18)
2001		
urban	0.00	0 (0/12)
natural	5.79	30 (6/20)
2002		
urban	4.41	23.1 (3/13)
natural	38.11	68.2 (15/22)

introduced fishes are striking. Exotic crayfish also affect the abundance of Pacific treefrogs, the most widely distributed native amphibian. Macroinvertebrate communities were also less diverse and weighted toward tolerant species in urban streams. These faunal changes are most likely related to the significant differences in habitat structure, water quantity, and stream permanence associated with urban streams. The larger quantity of water in more urban streams is not surprising given increased water inputs in urban areas from, for example, watering lawns and gardens and washing cars and especially from increased runoff from impervious surfaces. These increased amounts of water most likely contribute to the changes in stream habitat structure that we saw, and both these factors have profound implications for populations of native and exotic species. In urban streams, habitat segments are longer and a greater percentage of the stream

Table 5. Macroinvertebrate community indices in urban and natural streams in the Santa Monica Mountains and Simi Hills, California.

	2001	
	urban (n = *13*)	*natural* (n = *20*)
Taxonomic richness	23.15[a]	29.40
EPT[b] taxa	5.08[a]	9.40
Percent EPT invertebrates	23.26	32.98
Percent senstive EPT (TV[c] = 0-2)	0.97[d]	13.33
Percent intolerant (TV = 0-3) organisms	1.03[e]	10.65
Percent tolerant (TV = 8-10) organisms	13.34[f]	9.90
Percent most dominant taxon	45.91[e]	33.69
Shannon diversity	1.65[d]	2.23

[a]*Significant difference between urban and rural, low-gradient streams, bonferroni comparisons based on overall* $p = 0.05$.
[b]*Aquatic insect orders Ephemeroptera, Plecoptera, and Trichoptera.*
[c]*Tolerance values, a measure of sensitivity to disturbance and pollution with 0 being most sensitive and 10 most tolerant.*
[d]*Significant difference between urban and rural streams at* $p < 0.01$
[e]*Significant difference between urban and rural streams at* $p < 0.05$.
[f]*Significant difference between urban and rural streams at* $p < 0.10$.

consists of runs. Overall, the result is fewer pools and a general decrease in habitat complexity (Fig. 3).

Determining the precise mechanisms behind the species distributions in these streams will require more detailed study, but there is already information about some of the important interactions in this system. For example, crayfish can negatively affect populations of native amphibians such as newts and treefrogs (Gamradt & Kats 1996; Goodsell & Kats 1999). For native species, a critical question is whether they would be present in the "urban" streams without the influences of development and exotic species. In the case of the California newt, it seems likely that they would be. In the Santa Monica Mountains and Simi Hills newts prefer pools for egg laying, and lower-gradient streams may have less pool habitat, but newts also lay eggs in slow-moving runs (Gamradt & Kats 1997). California newts breed in "ponds, reservoirs and slow-flowing streams" (Stebbins 1985), and in some parts of their range, newts will breed in cattle ponds and other bodies of water that are not particularly pristine (P. C. Trenham, personal communication).

At least three factors are detrimental to newt populations in urban streams. The increased quantity and flow of water and the concomitant increase in run habitat, decrease in pools, and decrease in habitat diversity reduce high-quality newt breeding habitat and negatively affect invertebrate prey communities. More permanent water in urban streams also allows increased presence and abundance of exotic predators, specifically crayfish. Although crayfish presence does not exclude newts, dense crayfish populations can reduce and even eliminate newt reproduction (Gamradt & Kats 1996). Finally, newts are highly visible, slow-moving animals that are easily collected by people. It is perhaps not surprising then that newts have been eliminated from virtually all urban streams in this area. At least 15 years ago, newts were present in two streams (Triunfo Canyon and Lower Malibu Creek), where we did not detect them (De Lisle et al. 1986). These streams were classified as urban in our study and now contain crayfish, introduced fishes, and in one case, bullfrogs.

The distribution of California treefrogs may be more strongly related to specific habitats, but urbanization may still play a role. Of the 14 streams with California treefrogs, the average gradient was 6.7%. All 14 had a gradient greater than the 3.5% median, and the two urban streams had gradients of 4.8% and 4.9%. California treefrogs prefer streams with large boulders and significant rock pool habitat (Cunningham 1964; Dole 1974; Harris 1975), both of which were typical of many of the higher-gradient streams. Nonetheless, the stream habitat alteration that appears to frequently accompany development, specifically an increase in run habitat and a decrease in pools, would be likely to negatively affect this species. California treefrogs are also very closely associated with stream habitat, in one study never moving more than 10 m from the stream, and only 5 m during the active season (Harris 1975); significant alteration of the streambed could reduce or eliminate populations. As with newts, we did not detect California treefrogs in the highly modified streams of Triunfo Canyon and Lower Malibu Creek, where they were found before 1985 (De Lisle et al. 1986).

Pacific treefrogs were present in every stream we surveyed, even those with the highest percentage of development in the watershed. Pacific treefrog density was also high in some of the most urban streams. It is not surprising that this species was the most prevalent amphibian in our surveys because it is a very widespread and adaptable frog that has not suffered the significant declines of other amphibians in California (e.g., Fisher & Shaffer 1996). Even Pacific treefrogs, however, were affected in this area: larval and egg mass densities were significantly lower in the presence of crayfish, and these exotic predators were more common in urban streams. Matthews et al. (2001) found that exotic trout species significantly restricted the distribution and reduced the abundance of Pacific treefrogs in the Sierra Nevada. Goodsell and Kats (1999) found Pacific treefrog tadpoles in 65% of the stomachs of exotic mosquitofish, and the presence of exotic fishes can reduce Pacific treefrog survival to near zero (Adams 2000). In the Washington studies, pond permanence by itself also reduced the survival and presence of native anurans (Adams 1999, 2000), a factor that could be leading to detrimental effects on this species in more permanent urban streams.

Our stream surveys were probably not the most effective tool for measuring the distribution and abundance of western toads. Toads often breed in ponds or small pools, and although we detected them in some of our streams, often we found them in only a few places or in a side pool, or we detected few individuals. Toads were most likely breeding in other pools and possibly human-made ponds (e.g., on golf courses) that we did not survey. Toads also can breed and develop quickly, so multiple visits within a year would be more effective for detection. Their association with urban streams, at least in 2001, may be related to an association with lower-gradient streams, where ephemeral pools may be more likely to form. Overall, stream gradient was significantly lower in streams with toads (0.025 with toads vs. 0.056 without toads, $t = 3.33$, df $= 32.8$, $p = 0.002$). Because of their more terrestrial habits, fast development time, and ability to breed in other, often ephemeral bodies of water, toads may be less affected than other native amphibians by the habitat and flow changes and introduced aquatic predators associated with urban streams. However, other effects of urbanization such as terrestrial habitat loss and fragmentation and the loss of ephemeral pools could negatively affect toads.

The presence of introduced species such as crayfish, exotic fishes, and bullfrogs generates two important questions: How did they get into a stream? Why do they persist? Most likely these species were dropped off by people using them as fish bait or releasing pets. Bait-bucket introductions are a common potential mechanism of introduction for many aquatic animals, but they are difficult to document. Although the cause of the introduction is important in terms of preventing future instances, the more critical issue is why these animals persist. Permanent water is almost certainly the most important factor in exotic persistence. The climate in southern California is characterized by a long, dry summer, and many of the natural streams in the area are ephemeral. The increased likelihood of permanent water in urban streams (Table 4) coupled with the increased likelihood of introductions because of the higher human density could explain why so many of the urban streams have exotic species. Trancas Creek, the one natural stream with crayfish, is the exception that proves the rule. At the top of Trancas Creek is the Malibu golf club. The golf club ponds have crayfish populations that provide a recurring source of propagules, and golf-course maintenance generates perennial water availability.

Benthic macroinvertebrate communities were also significantly altered in urban streams, where they were less diverse and consisted more of disturbance-tolerant species and less of sensitive EPT taxa. Although more intensive monitoring would be necessary to reliably measure water-quality differences and their potential effects on invertebrates, the habitat changes, specifically the decrease in stream habitat diversity, associated with urban streams would definitely adversely affect invertebrate communities.

Stream Gradient and Urbanization Threshold Effects

Stream gradient can be an important determinant of stream ecological characteristics, and this was true for macroinvertebrate communities in particular in streams in the Santa Monica Mountains (Table 3). For habitat variables, gradient was rarely significant, although lower-gradient streams generally had more runs and longer pools and runs in 2000.

A confounding problem in our study, and possibly in other studies of development and stream ecology, is that stream gradient and urbanization are strongly negatively correlated (see also Morley & Karr 2002). Because our goal was to survey the entire region, we did not select only the most comparable streams. Therefore it is difficult for us to conclude as much about the effects of urbanization on high-gradient streams because we had only two streams in this category. The strong negative correlation between urbanization and gradient is not surprising, given that it is much easier to build on ground with gradual slopes and people like to live and work near water. This trend is especially dangerous for organisms like amphibians that require intact aquatic systems.

The effects of urbanization on amphibian distribution, stream habitat, and macroinvertebrate communities appeared to be related to a threshold level of development within the watershed more than to the absolute level of development. Differences between urban and natural streams were often significant, but coefficients in the piecewise regression analyses were generally not. In other words, below about 8% watershed development, the effects of development may not yet be visible, but once this level of development was reached significant changes occurred and further effects were not as great as the jump across the threshold. Interestingly, the type of threshold effects may be different for macroinvertebrate communities than for habitat. For habitat the change around 8% urbanization seemed to be related more to a jump in the value of the variable rather than to a change in the slope or strength of the relationship. For invertebrates, the change in slope was generally more important than a jump effect. Two facts, that for a number of invertebrate indices the slope for natural streams was significantly different from zero, and that the natural slopes were always greater than the urban slopes, suggest that urban impacts on invertebrate communities may actually start below the 8% threshold apparent for habitat changes and amphibian and invasive species distributions.

The threshold effect of urbanization has been detected in other studies of urban streams (Paul & Meyer 2001), although in Santa Monica Mountain streams the threshold level appears to be at the low end of the 10–15% seen elsewhere. Stream communities in arid areas such as deserts or Mediterranean ecosystems may be particularly susceptible to urban impacts because the increased regularity of water flow increases stream permanence beyond that of natural conditions. In North Carolina the abundance of two plethodontid salamanders decreased with increasing watershed disturbance (including both agricultural and urban development), and for one species, the southern two-lined salamander (*Eurycea cirrigera*), there was a strong threshold effect at 20% disturbance (Willson & Dorcas 2003).

Conservation Management Implications

Land managers in urban areas should be aware that urban development can have profound implications for aquatic communities and that these effects may be manifested before they are expected. A relatively low level of development, as little as 10% or even 8%, as in our study, may be enough to significantly affect the system. Given the threshold nature of the effects, arresting watershed development just after the threshold is reached may be too late. Also, development does not have to be next to the riparian area itself, or even directly upstream, to have an effect; development within the watershed overall is the most significant factor. Directly addressing this issue for amphibians in the Southeast, Willson and Dorcas (2003) found that development within three different buffer zones regularly used in land-use planning had no effect on amphibian populations, whereas overall watershed development had a strong impact. Morley and Karr

(2002) also found that, while local effects can also be important, watershed development was a better predictor of stream changes than local development.

Those concerned with amphibian conservation must similarly be aware of the effects of urbanization on stream-dwelling species. Urban impacts on stream communities in general and on amphibian communities in particular may be especially severe and occur especially easily in arid environments, where the extra inputs of water in urban areas represent a great departure from the natural hydrological regime. Flow and permanence changes can then greatly facilitate the establishment of exotic species with the accompanying damage to native communities (e.g., Eby et al. 2003).

Our results indicate that monitoring for amphibians and exotics should be included as a regular component of stream-monitoring protocols. Although physical and chemical measures of stream conditions are clearly important, whenever possible it is desirable to measure biological conditions directly (Morley & Karr 2002). Frequently, biological conditions are evaluated by integrating multiple measures into an index of biological integrity, including measures of taxa such as algae, fish, and aquatic invertebrates. Both the evaluation of overall stream health and amphibian conservation would benefit greatly from including amphibians in the biological assessment of streams in general and of urban streams in particular.

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Appendix 7:
Index of Biological (IBI) Scores

7-A: CDFG, LA County, Ventura County, & Heal the Bay Data
7-B: CDFG IBI Study (Ode et al.)
7-C: Map of Low IBI Scores in Calleguas Creek Watershed

Appendix 7-A: Region 4 IBI Scores

REGION 4 CDFG IBI SCORES

Stream Name	Year	IBI Score[1,2]
Piru Creek	2000	31.46
Unknown Creek	2000	27.17
Revolon Slough	2001	11.44
Unnamed Creek	2001	28.6
Cattle Creek	2000	31.46
Boulder Creek	2001	31.46
Arroyo Conejo Creek	2001	22.88
NF Arroyo Conejo Creek	2001	21.45
Arroyo Simi Creek	2001	17.16
Bouquet Canyon Creek	2001	24.31
Beardsley Wash	2001	14.3
Conejo Creek	2001	27.17
Castaic Creek	2001	25.74
Calleguas Creek	2001	1.43
Piru Creek	2001	25.74
Revolon Slough	2001	5.72
Santa Clara River	2001	20.02
Santa Clara River	2001	37.18
Santa Clara River	2001	37.18
San Francisquito Creek	2001	31.46
Simi Las Posas Creek	2001	17.16
Tapo Canyon Tributary	2001	17.16

Table 1: IBI scores for Region 4 calculated in a CDFG study. Ode, P.R., A.C. Rehn and J.T. May., A Quantitative Tool for Assessing the Integrity of Southern Coastal California Streams, *Environmental Management*. 35:493-504 (2005).

1: IBI Scores are normalized
2: Only scores in "poor" and "very poor" ranges are presented.

LA COUNTY IBI SCORES

SAMPLING LOCATION	IBI SCORE (Oct-03)[1]	IBI SCORE (Oct-04)[1]
Santa Clara River - Station 1	30	27.14
Coyote Creek - Station 2	4.29	2.86
San Jose Creek - Station 3	11.43	18.57
San Gabriel River - Station 4	42.86	57.14
Walnut Channel - Station 5	10	8.57
Arroyo Seco - Station 6	NA	NA
Arroyo Seco - Station 7	15.71	12.86
Compton Creek - Station 8	1.43	4.29
Zone 1 Ditch - Station 9	28.57	NA
Eaton Wash - Station 10	NA	NA
Los Angeles River - Station 11	1.43	4.29
Los Angeles River - Station 12	15.71	12.86
Los Angeles River - Station 13	2.86	10
Ballona Creek - Station 14	8.57	14.29
Madea Creek - Station 15	4.29	7.14
Las Virgenes Creek - Station 16	NA	NA
Cold Creek - Station 17	60	74.29
Triunfo Creek - Station 18	31.43	NA
Dominguez Channel - Station 19	4.29	8.57

Table 2: IBI scores for LA County. Highlighted scores are in the "poor" or "very poor" ranges. Los Angeles County. Los Angeles County 1994-2005 Integrated Receiving Water Impacts Report, (2005).

1: Scores are normalized to a scale of 0-100
NA: not sampled due to dry conditions

VENTURA COUNTY IBI SCORES

SAMPLING LOCATION	IBI Score (2004/2005)
Ventura River - Main St Bridge	31
Ventura River - Foster Park	47
Ventura River - Below Matilija Dam	40
Ventura River - Santa Ana Rd	NA
Canada Larga - Below Grazing	NA
Canada Larga - Above Grazing	NA
San Antonio Creek - u/s Ventura Rv Confluence	NA
San Antonio Creek - Lion Canyon u/s San Antonio	NA
San Antonio Creek - u/s Lion Canyon	45
San Antonio Creek - Stewart Canyon u/s San Antonio	54
San Antonio Creek - u/s Steward Canyon Creek	53
North Fork Matilija Creek - u/s Ventura Rv Confluence	50
North Fork Matilija Creek - At gauging station	64
Matilija Creek - Below Community	39
Matilija Creek - Above Community	NA

Table 3: IBI scores for Ventura County. Highlighted scores are in the "poor" or "very poor" ranges. Ventura County Watershed Protection District, Ventura River Watershed 2004 Bioassessment Monitoring Report, (2005).

NA: not sampled due to dry conditions

MALIBU CREEK WATERSHED IBI SCORES

Site	Spring 2000	Fall 2000	Spring 200	Fall 2001	Spring 200	Fall 2002	Spring 200	Fall 2003
Mid-Malibu Creek -12		23	20	37	33	27	21	31
Mid-Las Virgenes Creek - 13			21	40	26	24	21	27
Malibu Creek Outlet -1	16	24	26	39	19		26	23
Outlet of Las Virgenes Creek - 5	29	34	33	33	39	26	20	29
Outlet of Madea Creek - 7	23	26	19	34	23	17	9	9
Mid-Malibu Creek - 15	33	17	24	43	40	24	34	23
Triunfo Creek - 17	20		19		19		4	

Table 4: IBI scores for Malibu Creek Watershed. Highlighted scores are in the "poor" or "very poor" ranges. Heal the Bay, Watershed Assessment of Malibu Creek: Final Report, (2005).

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A Quantitative Tool for Assessing the Integrity of Southern Coastal California Streams

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ABSTRACT / We developed a benthic macroinvertebrate index of biological integrity (B-IBI) for the semiarid and populous southern California coastal region. Potential reference sites were screened from a pool of 275 sites, first with quantitative GIS landscape analysis at several spatial scales and then with local condition assessments (in-stream and riparian) that quantified stressors acting on study reaches. We screened 61 candidate metrics for inclusion in the B-IBI based on three criteria: sufficient range for scoring, responsiveness to watershed and reach-scale disturbance gradients, and minimal correlation with other responsive metrics. Final metrics included: percent collector-gatherer + collector-filterer individuals, percent noninsect taxa, percent tolerant taxa, Coleoptera richness, predator richness, percent intolerant individuals, and EPT richness. Three metrics had lower scores in chaparral reference sites than in mountain reference sites and were scored on separate scales in the B-IBI. Metrics were scored and assembled into a composite B-IBI, which was then divided into five roughly equal condition categories. PCA analysis was used to demonstrate that the B-IBI was sensitive to composite stressor gradients; we also confirmed that the B-IBI scores were not correlated with elevation, season, or watershed area. Application of the B-IBI to an independent validation dataset (69 sites) produced results congruent with the development dataset and a separate repeatability study at four sites in the region confirmed that the B-IBI scoring is precise. The SoCal B-IBI is an effective tool with strong performance characteristics and provides a practical means of evaluating biotic condition of streams in southern coastal California.

Assemblages of freshwater organisms (e.g., fish, macroinvertebrates, and periphyton) are commonly used to assess the biotic condition of streams, lakes, and wetlands because the integrity of these assemblages provides a direct measure of ecological condition of these water bodies (Karr and Chu 1999). Both multimetric (Karr and others 1986; Kerans and Karr 1994; McCormick and others 2001; Klemm and others 2003) and multivariate (Wright and others 1983; Hawkins and others 2000; Reynoldson and others 2001) methods have been developed to characterize biotic condition and to establish thresholds of ecological impairment. In both approaches, the ability to recognize degradation at study sites relies on an understanding of the organismal assemblages expected in the absence of disturbance. Thus, the adoption of a consistent and quantifiable method for defining reference condition is fundamental to any biomonitoring program (Hughes 1995).

KEY WORDS: Benthic macroinvertebrates; B-IBI; Biomonitoring; Mediterranean climate

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Southern California faces daunting challenges in the conservation of its freshwater resources due to its aridity, its rapidly increasing human population, and its role as one of the world's top agricultural producers. In recent years, several state and federal agencies have become increasingly involved in developing analytical tools that can be used to assess the biological and physical condition of California's streams and rivers. For example, the US Environmental Protection Agency (EPA), the US Forest Service (USFS), and California's state and regional Water Quality Control Boards (WQCBs) have collected fish, periphyton and benthic macroinvertebrates (BMIs) from California streams and rivers as a critical component of regional water quality assessment and management programs. Together, these agencies have sampled BMIs from thousands of sites in California, but no analysis of BMI assemblage datasets based on comprehensively defined regional reference conditions has yet been undertaken. In the only other large-scale study within the state, Hawkins and others (2000) developed a predictive model of biotic integrity for third- to fourth-order streams on USFS lands in three montane regions in northern California. This ongoing effort (Hawkins unpublished) is an important contribution to bioassessment in the state, but the emphasis of this work has been concentrated on logging impacts within USFS lands. The lack of a broadly defined context for interpretation of BMI-based bioassessment remains the single largest impediment to the development of biocriteria for the majority of California streams and rivers. This article presents a benthic index of biotic integrity (B-IBI) for wadeable streams in southern coastal California assembled from BMI data collected in the region by the USFS, EPA, and state and regional WQCBs between 2000 and 2003.

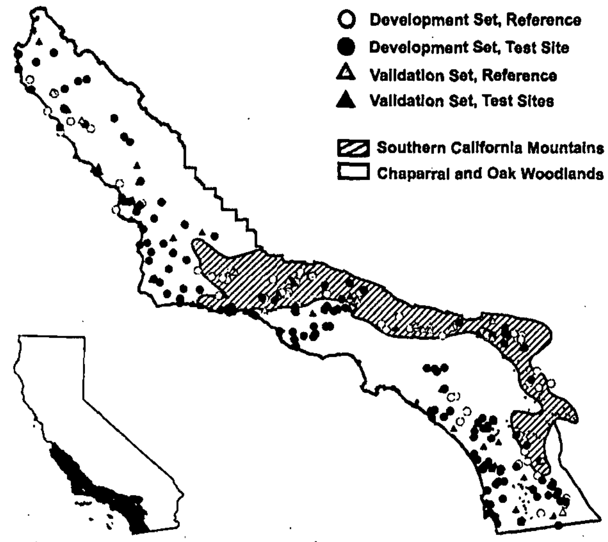

Figure 1. Map of study area showing the location of the study area within California, the distribution of test and reference sites and development and validation sites, and the boundaries of the two main ecoregions in the study area.

Methods

Study Area

The Southern Coastal California B-IBI (SoCal B-IBI) was developed for the region bounded by Monterey County in the north, the Mexican border in the south, and inland by the eastern extent of the southern Coast Ranges (Figure 1). This Mediterranean climate region comprises two Level III ecoregions (Figure 1; Omernik 1987) and shares a common geology (dominated by recently uplifted and poorly consolidated marine sediments) and hydrology (precipitation averages 10–20 in./year in the lower elevations and 20–30 in./year in upper elevations, reaching 30–40 in./year in the highest elevations and in some isolated coastal watersheds (Spatial Climate Analysis Service, Oregon State University, www.climatesource.com). The human population in the region was approximately 20 million in 2000 and is projected to exceed 28 million by 2025 (California Department of Finance, Demographic Research Unit, www.dof.ca.gov).

Field Protocols and Combining Datasets

The SoCal B-IBI is based on BMI and physical habitat data collected from 275 sites (Figure 1) using the 3 protocols described in the following subsections. Sites were sampled during base flow periods between April and October of 2000–2003.

California Stream Bioassessment Protocol (CSBP, 144 sites). Several of the regional WQCBs in southern coastal California have implemented biomonitoring programs in their respective jurisdictions and have collected BMIs according to the CSBP (Harrington 1999). At CSBP sites, three riffles within a 100-m reach were randomly selected for sampling. At each riffle, a transect was established perpendicular to the flow, from which three separate areas of 0.18 m^2 each were sampled upstream of a 0.3-m-wide D-frame net and composited by transect. A total of 1.82 m^2 of substrate was sampled per reach and 900 organisms were subsampled from this material (300 organisms were processed separately from each of 3 transects). Water chemistry data were collected in accordance with the protocols of the different regional WQCBs (Puckett 2002) and qualitative physical habitat characteristics were measured according to Barbour and others (1999) and Harrington (1999).

USFS (56 sites). The USFS sampled streams on national forest lands in southern California in 2000 and 2001 using the targeted riffle protocol of Hawkins and others (2001). All study reaches were selected nonrandomly as part of a program to develop an interpretive (reference) framework for the results of stream biomonitoring studies on national forests in California. BMIs were sampled at study reaches (containing at least four fast-water habitat units) by disturbing two separate 0.09-m^2 areas of substrate upstream of a 0.3-m-wide D-frame net in each of four separate fast-water units; a total of 0.72 m^2 was disturbed and all sample material from a reach was composited. Field crews used a combination of qualitative and quantitative measures to collect physical habitat and water chemistry data (Hawkins and others 2001). A 500-organism subsample was processed from the composite sample and identified following methods described by Vinson and Hawkins (1996).

Environmental Monitoring and Assessment Program (EMAP, 75 sites). The EPA sampled study reaches in southern coastal California from 2000 through 2003 as part of its Western EMAP pilot project. A sampling reach was defined as 40 times the average stream width at the center of the reach, with a minimum reach length of 150-m and maximum length of 500-m. A BMI sample was collected at each site using the USFS methodology described earlier (Hawkins and others 2001) in addition to a standard EMAP BMI sample (not used in this analysis). A 500-organism subsample was processed in the laboratory according to EMAP standard taxonomic effort levels (Klemm and others 1990). Water chemistry samples were collected from the midpoint of each reach and analyzed using EMAP protocols (Klemm and Lazorchak 1994). Field crews recorded physical habitat data using EPA qualitative methods (Barbour and others 1999) and quantitative methods (Kaufmann and others 1999).

As part of a methods comparison study, 77 sites were sampled between 2000 and 2001 with both the CSBP and USFS protocols. The two main differences between the methods are the area sampled and the number of organisms subsampled (discussed earlier). To determine the effect of sampling methodology on assessment of biotic condition, we compared the average difference in a biotic index score between the two methods at each site. Biotic index scores were computed with seven commonly used biotic metrics (taxonomic richness, Ephemoptera, Plecoptera, and Trichoptera (EPT) richness, percent dominant taxon, sensitive EPT individuals, Shannon diversity, percent intolerant taxa, and percent scraper individuals) according to the following equation:

$$Score = \sum (x_i - \bar{x})/sem_i$$

where x_i is the site value for the *i*th metric, x is the overall mean for the *i*th metric, and SEM_i is the standard error of the mean for the *i*th metric. A score of zero is the mean value.

Because USFS-style riffle samples were collected at all EMAP sites, only two field methods were combined in this study. All EMAP and CSBP samples were collected and processed by the California Department of Fish and Game's Aquatic Bioassessment Laboratory (ABL) and all USFS samples were processed by the US Bureau of Land Management's Bug Lab in Logan, Utah. Taxonomic data from both labs were combined in an MS Access© database application that standardized BMI taxonomic effort levels and metric calculations, allowing us to minimize any differences between the two labs that processed samples. Taxonomic effort followed standards defined by the California Aquatic Macroinvertebrate Laboratory Network (CAMLnet 2002; www.dfg.ca.gov/cabw/camlnetste.pdf). Sites with fewer than 450 organisms sampled were omitted from the analyses.

Screening Reference Sites

We followed an objective and quantitative reference site selection procedure in which potential reference sites were first screened with quantitative Geographical Information System (GIS) land-use analysis at several spatial scales and then local condition assessments (instream and riparian) were used to quantify stressors acting within study reaches. We calculated the proportions of different land-cover classes and other measures of human activity upstream of each site at four spatial scales that give unique information about potential stressors acting on each site: (1) within polygons delimiting the entire watershed upstream of each sampling site, (2) within polygons representing local regions (defined as the intersection of a 5-km-radius circle around each site and the primary watershed polygon), (3) within a 120-m riparian zone on each side of all streams within each watershed, and (4) within a 120-m riparian zone in the local region. We used the ArcView® (ESRI 1999) extension ATtILA (Ebert and Wade 2002) to calculate the percentage of various land-cover classes (urban, agriculture, natural, etc.) and other measures of human activity (population density, road density, etc.) in each of the four spatial areas defined for each site. Two satellite imagery datasets from the mid-1990s were combined for the land-cover analyses: California Land Cover Mapping & Monitoring Program (LCMMP) vegetation data (CalVEG) and a recent dataset produced by the Central Coast Watershed Group (Newman and Watson 2003). Population data were derived from the 2000 migrated TIGER dataset (California Department of Forestry and Fire Protection, www.cdf.ca.gov). Stream layers were obtained from the US Geological Survey (USGS) National Hydrography Dataset (NHD). The road network was obtained from the California Spatial Information Library (CaSIL, gis.ca.gov) and elevation was based on the USGS National Elevation Dataset (NED). Frequency histograms of land-use percentages for all sites were used to establish subjective thresholds for elim-

Table 1. List of minimum or maximum landuse thresholds used for rejecting potential reference sites

Stressor metric	Definition	Threshold
N_index_L	Percentage of natural land use at the local scale	≤ 95%
Purb_L	Percental of urban land use at the local scale	> 3%
Pagt_L	Percentage of total agriculture at the local scale	> 5%
Rddens_L	Road density at the local scale	> 2.0 km/km^2
PopDens_L	Population density (2000 census) at the local scale	> 150 indiv./km^2
N_index_W	Percentage of natural landuse at the watershed scale	≤ 95%
Purb_W	Percentage of urban landuse at the watershed scale	> 5%
Pagt_W	Percentage of total agriculture at the watershed scale	> 3%
Rddens_W	Road density at the watershed scale	> 2.0 km/km^2
PopDens_W	Population density (2000 census) at the watershed scale	> 150 indiv./km^2

inating sites from the potential reference pool (Table 1). Sites were further screened from the reference pool on the basis of reach-scale conditions (obvious bank instability or erosion/ sedimentation problems, evidence of mining, dams, grazing, recent fire, recent logging).

Eighty-eight sites passed all the land-use and local condition screens and were selected as reference sites, leaving 187 sites in the test group. We randomly divided the full set of sites into a development set (206 sites total: 66 reference/140 test) and a validation set (69 sites total: 22 reference/47 test). The development set was used to screen metrics and develop scoring ranges for component B-IBI metrics; the validation set was used for an independent evaluation of B-IBI performance.

Screening Metrics and Assembling the B-IBI

Sixty-one metrics were evaluated for possible use in the SoCal B-IBI (Table 2). A multistep screening process was used to evaluate each metric for (1) sufficient range to be used in scoring, (2) responsiveness to watershed-scale and reach-scale disturbance variables, and (3) lack of correlation with other responsive metrics.

Pearson correlations between all watershed-scale and reach-scale disturbance gradients were used to define the smallest suite of independent (nonredundant) disturbance variables against which to test biological metric response. Disturbance variables with correlation coefficients $|r| \geq 0.7$ were considered redundant. Responsiveness was assessed using visual inspection of biotic metric versus disturbance gradient scatterplots and linear regression coefficients. Metrics were selected as responsive if they showed either a linear or a "wedge-shaped" relationship with disturbance gradients. Biological metrics often show a "wedge-shaped" response rather than a linear response to single disturbance gradients because the single gradient only defines the upper boundary of the biological response; other independent disturbance gradients and natural limitations on species distributions might result in lower metric values than expected from response to the single gradient. Biotic metrics and disturbance gradients were log-transformed when necessary to improve normality and equalize variances. Metrics that passed the range and responsiveness tests were tested for redundancy. Pairs of metrics with product–moment correlation coefficients $|r| \geq 0.7$ were considered redundant and the least responsive metric of the pair was eliminated.

Scoring ranges were defined for each metric using techniques described in Hughes and others (1998), McCormick and others (2001), and Klemm and others (2003). Metrics were scored on a 0–10 scale using statistical properties of the raw metric values from both reference and nonreference sites to define upper and lower thresholds. For positive metrics (those that increase as disturbance decreases), any site with a metric value equal to or greater than the 80th percentile of reference sites received a score of 10; any site with a metric value equal to or less than the 10th percentile of the nonreference sites received a score of 0; these thresholds were reversed for negative metrics (20th percentile of reference and 90th percentile of nonreference). In both cases, the remaining range of intermediate metric values was divided equally and assigned scores of 1 through 9. Before assembling the B-IBI, we tested whether any of the final metrics were significantly different between chaparral and mountain reference sites in the southern California coastal region, in which case they would require separate scoring ranges in the B-IBI. Finally, an overall B-IBI score was calculated for each site by summing the constituent metric scores and adjusting the B-IBI to a 100-point scale.

Table 2. The 61 BMI metrics screened for use in the SoCal IBI

Candidate metrics	Disturbance variables: U_index_W	Pagt_W	Purb_L	RdDens_L	Channel Alteration	Bank Stability	Percent Fines	Total Dissolved Solids	Total Phosphorus	Total Nitrogen	Range Test
Taxonomic group metrics											
Coleoptera richness*	M	w	M	S	S	—	—	—	—	—	P
Crustacea + Mollusca richness	—	—	—	—	—	—	—	—	—	—	F
Diptera richness	—	—	—	—	—	—	—	—	—	—	P
Elmidae richness	w	—	w	M	S	M	S	M	—	—	F
Ephemerellidae richness					S	M	M	S	—	M	F
Ephemeroptera richness	S	S	M	S	w	M	S	S	—	S	P
EPT richness*	S	S	S	S	S	S	S	S	—	S	P
Hydropsychidae richness	—	—	w	—	S	—	—	—	—	—	F
Percent Amphipoda individuals	—	—	—	—	—	—	—	—	—	—	P
Percent Baetidae individuals	—	—	—	—	w	—	—	—	—	—	P
Percent Chironomidae individuals	—	—	—	—	—	—	—	—	M	—	P
Percent Corbicula individuals	—	—	—	—	—	—	—	—	—	—	P
Percent Crustacea individuals	—	—	—	—	—	—	—	—	—	—	P
Percent Diptera individuals	—	w	—	—	—	—	—	—	—	—	P
Percent Elmidae individuals	—	—	—	w	M	S	S	w	—	M	P
Percent Ephemeroptera individuals	—	w	w	—	M	w	—	—	—	—	P
Percent EPT individuals	—	—	M	M	M	M	—	—	—	—	P
Percent Gatropoda individuals	—	—	—	w	—	—	—	—	—	—	P
Percent Glossosomatidae individuals	—	—	—	—	w	—	—	—	—	M	F
Percent Hydropsychidae individuals	—	—	—	M	w	M	—	—	—	—	P
Percent Hydroptilidae individuals	—	—	—	M	—	w	—	—	—	—	F
Percent Mollusca individuals	—	—	—	w	w	—	—	—	—	—	P
Percent non-*Baetis/Fallceon* Ephemeroptera individuals	w	w	—	M	w	M	—	—	w	—	P
Percent non-*Hydropsyche* Hydropsychidae individuals	—	—	—	M	w	w	—	—	—	—	F
Percent non-*Hydropsyche/Cheumatopsyche* Trichoptera individuals	w	w	—	M	w	M	M	w	—	—	P
Percent non-insect Taxa*	M	w	M	M	w	—	—	—	w	M	F
Percent Oligochaeta individuals	—	—	—	—	w	—	—	—	—	—	P
Percent Perlodidae individuals	—	—	—	w	w	—	—	—	—	—	F
Percent Plecoptera individuals	—	—	—	M	M	M	M	M	w	S	P
Percent Rhyacophilidae individuals	—	—	—	w	S	S	w	—	—	M	F
Percent Simuliidae individuals	—	w	—	w	S	w	—	—		—	P
Percent Trichoptera	w	—	—	M	M	M	M	w	w	—	P
Plecoptera richness	M	S	w	M	w	w	M	S	—	S	F
Total taxa richness	M	M	w	S	w	w	w	w	w	M	P
Trichoptera richness	S	S	S	S	S	M	S	w	—	w	P

Table 2. Continued.

Candidate metrics	U_index_W	Pagt_W	Purb_L	RdDens_L	Channel Alteration	Bank Stability	Percent Fines	Total Dissolved Solids	Total Phosphorus	Total Nitrogen	Range Test
	Disturbance variables										
Functional feeding metrics											
Collector (filterers) richness	w	—	M	S	S	M	w	—	—	—	F
Collector (gatherers) richness	—	—	—	—	—	—	—	—	—	w	P
Percent collector (filterer) + collector (gatherer) individuals*	M	—	—	S	—	w	—	M	w	M	P
Percent collector (filterer) individuals	—	—	—	w	M	M	w	—	—	—	P
Percent collector (gatherer) individuals	—	—	—	w	M	—	—	w	M	w	P
Percent predator individuals	—	—	—	w	M	—	—	—	—	—	P
Percent scraper individuals	w	w	—	M	M	w	w	—	—	—	P
Percent scraper minus snails individuals	—	—	—	w	—	w	—	—	—	—	P
Percent shredder individuals	—	—	—	w	w	—	—	—	—	—	P
Predator richness*	S	S	w	M	w	—	—	S	—	M	P
Scraper richness	S	M	M	S	S	S	S	S	—	S	P
Shredder richness	M	M	—	M	S	—	—	—	—	M	F
Tolerance metrics											
Average tolerance value	M	w	w	S	w	—	M	—	—	w	P
Intolerant EPT richness	M	w	w	M	S	—	S	S	—	S	P
Intolerant taxa richness	M	w	w	M	S	M	S	S	—	S	P
Percent intolerant Diptera individuals	—	—	—	—	—	—	—	—	—	—	F
Percent intolerant individuals*	M	w	—	M	S	M	M	S	—	M	P
Percent intolerant scraper individuals	—	—	—	w	M	w	w	w	—	—	P
Percent of intolerant Ephemeroptera individuals	—	—	—	w	w	—	w	w	—	—	P
Percent of intolerant Trichoptera individuals	—	w	—	—	w	w	w	w	—	—	P
Percent sensitive EPT individuals	w	w	—	M	M	M	M	M	w	M	P
Percent tolerant individuals	—	—	—	—	—	—	w	w	—	—	P
Percent tolerant taxa*	w	—	w	M	—	—	—	w	—	M	P
Tolerant taxa richness	—	—	—	—	—	M	—	—	—	—	P
Others											
Percent dominant taxon	—	—	—	—	—	—	—	—	—	—	P
Shannon Diversity Index	w	w	w	M	M	w	—	w	w	w	P

Note: Each metric is indicated as having either no response (—), weak response (w), moderate response (M), or strong response (S) to each of eleven minimally correlated disturbance variables and whether each metric passed (P) or failed (F) the range test. The final seven minimally correlated metrics are indicated with an asterisk (*).

Table 3. Scoring ranges for seven component metrics in the SoCal B-IBI

Metric score	Coleoptera taxa (all sites)	EPT taxa 6	EPT taxa 8	Predator taxa (all sites)	% Collector individuals 6	% Collector individuals 8	% Intolerant individuals 6	% Intolerant individuals 8	% Noninsect taxa (all sites)	% Tolerant taxa (all sites)
10	>5	>17	>18	>12	0–59	0–39	25–100	42–100	0–8	0–4
9		16–17	17–18	12	60–63	40–46	23–24	37–41	9–12	5–8
8	5	15	16	11	64–67	47–52	21–22	32–36	13–17	9–12
7	4	13–14	14–15	10	68–71	53–58	19–20	27–31	18–21	13–16
6		11–12	13	9	72–75	59–64	16–18	23–26	22–25	17–19
5	3	9–10	11–12	8	76–80	65–70	13–15	19–22	26–29	20–22
4	2	7–8	10	7	81–84	71–76	10–12	14–18	30–34	23–25
3		5–6	8–9	6	85–88	77–82	7–9	10–13	35–38	26–29
2	1	4	7	5	89–92	83–88	4–6	6–9	39–42	30–33
1		2–3	5–6	4	93–96	89–94	1–3	2–5	43–46	34–37
0	0	0–1	0–4	0–3	97–100	95–100	0	0–1	47–100	38–100

Note: Three metrics have separate scoring ranges for the two Omernik Level III ecoregions in southern coastal California region (6 = chaparral and oak woodlands, 8 = Southern California mountains).

Validation of B-IBI and Measurement of Performance Characteristics

To test whether the distribution of B-IBI scores in reference and test sites might have resulted from chance, we compared score distributions in the development set to those in the validation set. We also investigated a separate performance issue that ambient bioassessment studies often neglect: spatial variation at the reach scale. Although our use of a validation dataset tests whether the B-IBI scoring range is repeatable (Fore and others 1996; McCormick and others 2001), we designed a separate experiment to explicitly measure index precision. Four sites were resampled in May 2003. At each site, nine riffles were sampled following the CSBP, and material from randomly selected riffles was combined into three replicates of three riffles each. B-IBI scores were then calculated for each replicate. Variance among these replicates was used to calculate the minimum detectable difference (MDD) between two B-IBI scores based on a two-sample *t*-test model (Zar 1999). The index range can be divided by the MDD to estimate the number of stream condition categories detectable by the B-IBI (Doberstein and others 2000; Fore and others 2001).

Results

Combining Datasets

Unmodified CSBP samples (900 count) had significantly higher biotic condition scores ($t = -6.974$, $P < 0.0001$) than did USFS samples (500 count). However, there was no difference in biotic condition scores between USFS samples and CSBP samples that were randomly subsampled to reduce the 900 count to 500 ($t = -0.817$, $P = 0.416$). Thus, data from both targeted-riffle protocols were combined in B-IBI development.

Selected Metrics

Ten nonredundant stressor gradients were selected for metric screening: percent watershed unnatural, percent watershed in agriculture, percent local watershed in urban, road density in local watershed, qualitative channel alteration score, qualitative bank stability score, percent fine substrates, total dissolved solids, total nitrogen, and total phosphorous. Twenty-three biotic metrics that passed the first two screens (range and dose response) were analyzed for redundancy with Pearson product–moment correlation, and a set of seven minimally correlated metrics was selected for the B-IBI: percent collector-gatherer + collector-filterer individuals (% collectors), percent noninsect taxa, percent tolerant taxa, Coleoptera richness, predator richness, percent intolerant individuals, and EPT richness (Table 3). All metrics rejected as redundant were derived from taxa similar to those of selected metrics, but they had weaker relationships with stressor gradients. Dose–response relationships of the selected metrics to the 10 minimally correlated stressor variables are shown in Figure 2 and reasons for rejection or acceptance of all metrics are listed in Table 2. Regression coefficients were significant at the $P \leq 0.0001$ level among all seven selected metrics and at least two stressor gradients: percent watershed unnatural and road density in local watershed (Table 4). The final seven metrics included several metric types: richness, composition, tolerance measures, and func-

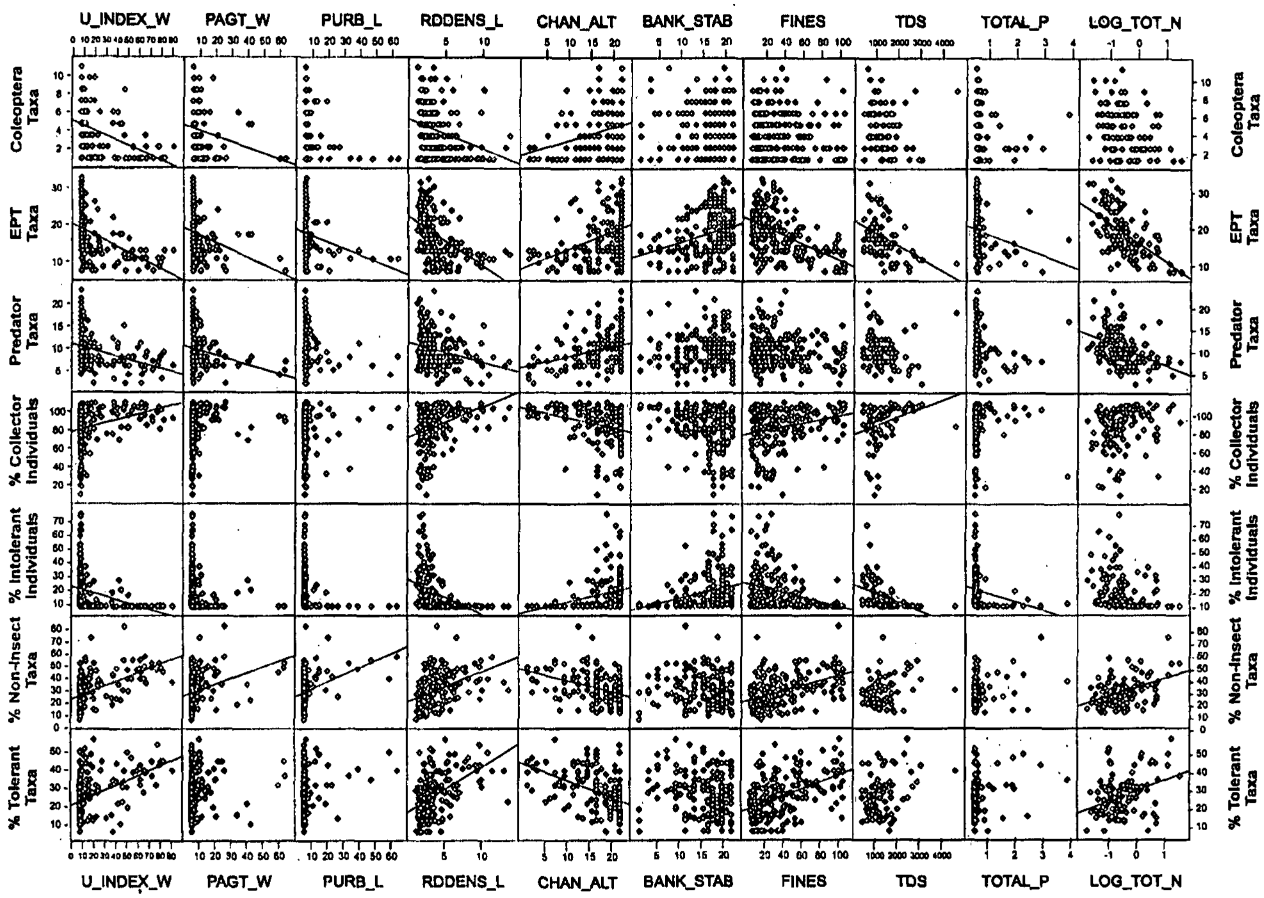

Figure 2. Scatterplots of dose–response relationships among 10 stressor gradients and 7 macroinvertebrate metrics (lines represent linear "best-fit" relationships; see text for abbreviations).

Table 4. Significance levels of linear regression relationships among 10 stressor metrics and 7 biological metrics

Metric	Coleoptera taxa	EPT taxa	Predator taxa	% Collector individuals	% Intolerant individuals	% Noninsect taxa	% Tolerant taxa
Bank Stability	0.813	**<0.0001**	0.3132	0.0009	0.0001	0.1473	0.0013
Fines	0.0017	**<0.0001**	0.0171	**0.0003**	**<0.0001**	**<0.0001**	**<0.0001**
Chan_Alt	**<0.0001**	**<0.0001**	**<0.0001**	**0.0003**	**<0.0001**	**<0.0001**	**<0.0001**
Log_U_Index_W	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**
Log_PAgT_W	**0.0007**	**<0.0001**	**0.0004**	0.0054	0.0014	**<0.0001**	0.0012
Log_PUrb_L	0.0367	**0.0007**	0.0344	0.6899	0.0045	**0.0002**	0.0215
Log RdDens_L	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**
Log_TDS	0.0094	**<0.0001**	0.0035	**0.0005**	**<0.0001**	0.0271	0.004
Log_Tot_N	0.0019	**<0.0001**	**<0.0001**	0.0078	0.0019	**<0.0001**	**<0.0001**
Log_Tot_P	0.062	**<0.0001**	0.0085	0.0162	**0.0001**	0.0018	0.0059

Note: Significant *P*-values corrected for 70 simultaneous comparisons ($P < 0.0007$) are highlighted in bold. Abbreviations are defined in Table 1 and in the text.

tional feeding groups. Because there are only seven metrics in the B-IBI, final scores calculated using this IBI are multiplied by 1.43 to adjust the scoring range to a 100-point scale.

The B-IBI scores were lower in chaparral reference sites than in mountain reference sites when calculated using unadjusted metric scores (Mann–Whitney *U*-test; $P = 0.02$). Although none of the final seven metrics

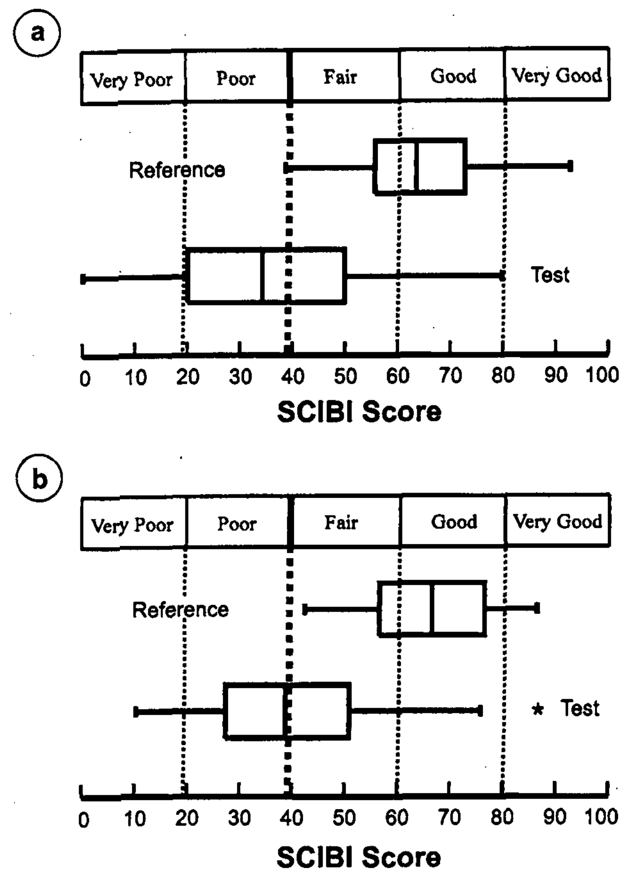

Figure 3. Box plots of B-IBI site scores for reference and test groups showing B-IBI scoring categories: (a) development sites and (b) validation sites. Dotted lines indicate condition category boundaries and heavy dotted lines indicate impairment thresholds.

were significantly different between chaparral reference sites and mountain reference sites at the $P = 0.05$ level ($P < 0.007$ after Bonferroni correction), scores for three metrics (EPT richness, percent collector-gatherer + collector-filterer individuals, and percent intolerant individuals) were substantially lower in chaparral reference sites than in mountain reference sites. We adjusted for this difference by creating separate scoring scales for the three metrics in the two ecoregions (Table 3). There was no difference in B-IBI scores between reference sites in the two ecoregions after the adjustment (Mann–Whitney *U*-test, $P = 0.364$).

Validation of B-IBI and Measurement of Performance Characteristics

The distribution of B-IBI scores at reference and nonreference sites was nearly identical between the development and validation data sets (Figure 3), indicating that our characterization of reference conditions and subsequent B-IBI scoring was repeatable and not likely due to chance. Based on a two-sample *t*-test model (setting $\alpha = 0.05$ and $\beta = 0.20$), the MDD for the SoCal IBI is 13.1. Thus, we have an 80% chance of detecting a 13.1-point difference between sites at the $P = 0.05$ level. Dividing the 100-point B-IBI scoring range by the MDD indicates that the SoCal B-IBI can detect a maximum of seven biological condition categories, a result similar to or more precise than other recent estimates of B-IBI precision (Barbour and others 1999; Fore and others 2001). We used a statistical criterion (two standard deviations below the mean reference site score) to define the boundary between "fair" and "poor" conditions, thereby setting B-IBI = 39 as an impairment threshold. The scoring range below 39 was divided into two equal condition categories, and the range above 39 was divided into three equal condition categories: 0–19 = "very poor", 20–39 = "poor", 40–59 = "fair", 60-79 = "good", and 80–100 = "very good" (Figure 3).

We ran two principle components analyses (PCAs) on the environmental stressor values used for testing metric responsiveness: 1 that included all 275 sites for which we calculated 4 watershed scale stressor values and another based on 124 sites for which we had measurements of 9 of the 10 minimally correlated stressor variables. We plotted B-IBI scores as a function of the first multivariate stressor axis from each PCA. We log-transformed percent watershed unnatural, percent watershed in agriculture, percent local watershed in urban, road density in local watershed, total nitrogen, and total phosphorous. Only PCA Axis 1 was significant in either analysis, having eigenvalues larger than those predicted from the broken-stick model (McCune and Grace 2002). In both PCAs, the B-IBI score decreased with increasing human disturbance (Figure 4) and was correlated (Spearman ρ) with PCA Axis 1 ($r = -0.652$, $P < 0.0001$ for all 275 sites; $r = -0.558$, $P \leq 0.0001$ for 124 sites). In the analysis of all 275 sites, all 4 watershed-scale stressors had high negative loadings, with percent watershed unnatural and local road density being the highest (Figure 5a). In the analysis of 124 sites, percent watershed unnatural, percent watershed in agriculture, and local road density had the highest negative loadings on the first axis, and channel alteration had the highest positive loading (Figure 4b).

Finally, we found no relationship between B-IBI scores and ecoregion (Mann–Whitney U, $P = 0.364$), Julian date ($R^2 = 0.01$, $P = 0.349$), watershed area ($R^2 = 0.002$, $P = 0.711$), or elevation ($R^2 = 0.01$, $P = 0.349$), indicating that the B-IBI scoring is robust with respect to these variables (Figure 5). Our ecoregion scoring adjustment probably corrects for the

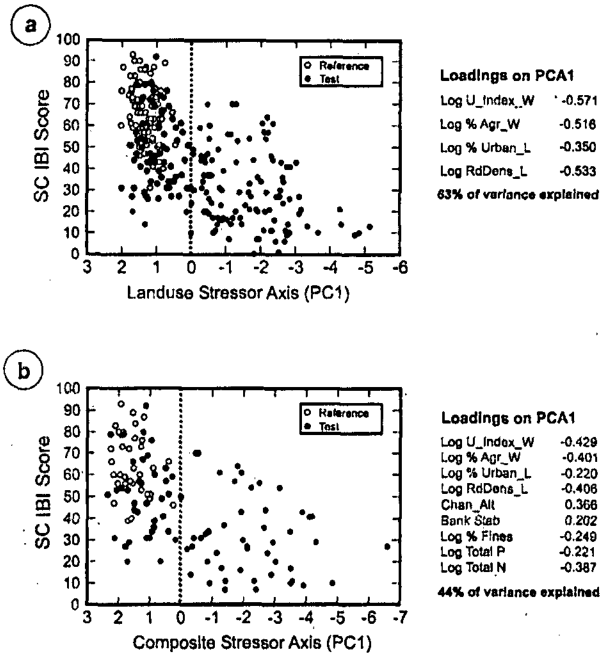

Figure 4. Scatterplots of SoCal B-IBI scores against two composite stressor axes from PCA: (a) values for all 275 sites; composite axis includes 4 land-use gradients; (b) values for 124 sites; composite axis includes 9 local and watershed scale stressor gradients.

strongest elevation effects, but there is no evidence that B-IBI scores are related to elevation differences within each ecoregion.

Discussion

The SoCal B-IBI is the most comprehensive assessment to date of freshwater biological integrity in California. As in other Mediterranean climate regions, the combination of aridity, geology, and high-amplitude cycles of seasonal flooding and drying in southern coastal California makes its streams and rivers particularly sensitive to disturbance (Gasith and Resh 1999). This sensitivity, coupled with the burgeoning human population and vast conversion of natural landscapes to agriculture and urban areas, has made it the focus of both state and federal attempts to maintain the ecological integrity of these strained aquatic resources.

Unfortunately, growing interest in biomonitoring is unmatched by financial resources available for this monitoring. Thus, combination of data among programs is very desirable, although this goal is rarely achieved in practice. We demonstrated that macroinvertebrate bioassessment data from multiple agencies could be successfully combined to produce a regional index that is useful to all agencies involved. This index is easy to apply, its fundamental assumptions are transparent, it provides precise condition assessments, and it is demonstrated to be responsive to a wide range of anthropogenic stressors. The index can also be applied throughout a long index period (mid-spring to mid-fall): Just as biotic factors tend to have more influence on assemblage structure during the summer dry period of Mediterranean climates than during the wet season when abiotic factors dominate (Cooper and others 1986; Gasith and Resh 1999), it is likely that our biotic index is more sensitive to anthropogenic stressors during the summer dry period. Because of these qualities, we expect the SoCal B-IBI to be a practical management tool for a wide range of water quality applications in the region.

This B-IBI is a regional adaptation of an approach to biotic assessment developed by Karr (1981) and subsequently extended and refined by many others (Kerans and Karr 1994; Barbour and others 1996; Fore and others 1996; Hughes and others 1998). We drew heavily upon recent refinements in multimetric index methodology that improve the objectivity and defensibility of these indices (McCormick and others 2001; Klemm and others 2003). A central goal of bioassessment is to select metrics that maximize the detection of anthropogenic stress while minimizing the noise of natural variation. One of the most important recent advances in B-IBI methods is the emphasis on quantitative screening tools for selecting appropriate metrics. We also minimized sources of redundancy in the analysis: (1) between watershed and local-scale stressor gradients for dose–response screening of biotic metrics and (2) in the final selection of metrics. The former guards against a B-IBI that is biased toward a set of highly correlated stressors and is, therefore, of limited sensitivity; the latter assures a compact B-IBI with component metrics that contribute independent information about stream condition. Combined with an assessment of responsiveness to specific regional disturbance gradients, these screening tools minimize the variability of B-IBI scores and improve its sensitivity.

The seven component metrics used in this B-IBI are similar to those selected for other B-IBIs (DeShon 1995; Barbour and others 1995, 1996; Fore and others 1996; Klemm and others 2003), but some of the metrics are either unique or are variations on other commonly used metrics. Like Klemm and others (2003), we found noninsect taxa to be responsive to human stressors, but richness was more responsive than percent of individuals. Some authors have separated the EPT metric into two or three metrics based on its component orders because the orders provided unique signals (Clements 1994; Fore and others 1996; Klemm

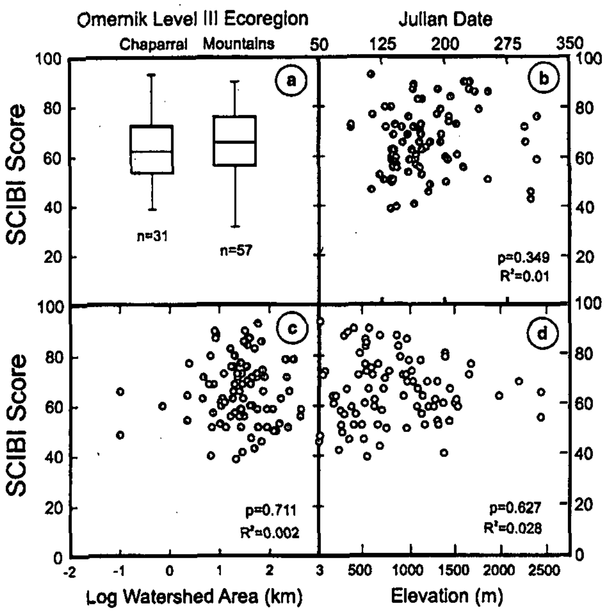

Figure 5. Relationship between B-IBI scores at 88 reference sites and (a) Omernik Level III ecoregion, (b) Julian date, (c) log watershed area, and (d) elevation.

and others 2003), but we found very similar patterns in these orders' response to various stressors we measured. To our knowledge, Coleoptera richness has not previously been included in a B-IBI, but beetle taxa might be a good indicator of the effects of fine sediments at impaired sites in this region (Brown 1973). A recent study of benthic assemblages in North Africa noted a high correspondence between EPT and EPTC (EPT + Coleoptera) (Beauchard and others 2003), but these orders were not highly correlated in our dataset. Feeding groups appear less often in B-IBIs than other metric types (Klemm and others 2003), but they were represented by two metrics in this B-IBI: predator richness and percent collectors (gatherers and filterers combined). Scraper richness was also responsive, but was rejected here because it was highly correlated with EPT richness.

The SoCal IBI should prove useful as a foundation for state and regional ambient water quality monitoring programs. Because the 75 EMAP sites were selected using a probabilistic statistical design, it will also be possible to use those samples to estimate the percentage of stream miles that are in "good", "fair", and "poor" condition in the southern California coastal region. These condition estimates, combined with stressor association techniques, have great potential to serve as a scientifically defensible basis for allocating precious monitoring resources in this region.

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Appendix 7-C: Calleguas Creek Locations with IBI Scores <39