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January 25, 2013

Cindy Lin, PhD (WTR-2)
U.S. Environmental Protection Agency (U.S. EPA)
Southern California Field Office
600 Wilshire Blvd., Suite 1460
Los Angeles, CA 90017

Subject: COMMENTS ON DRAFT MALIBU CREEK & LAGOON TMDL FOR SEDIMENTATION AND NUTRIENTS TO ADDRESS BENTHIC COMMUNITY IMPAIRMENTS, DATED DECEMBER 2012

Dear Dr. Lin:

The County of Ventura (County) and Ventura County Watershed Protect District (District) appreciate the opportunity to provide comments on the Draft Malibu Creek and Lagoon TMDL for Sedimentation and Nutrients to Address Benthic Community Impairments dated December 2012 (hereafter referred to as the "Draft Malibu Benthic TMDL"). We support similar comments being submitted by the City of Thousand Oaks. In general, we share U.S. EPA's goal of protecting in-stream biology and habitat and would like to work with the U.S. EPA to improve the Draft Malibu Benthic TMDL so that it can better achieve its objectives. However, we are concerned with several aspects of the Draft Malibu Benthic TMDL that we feel are precedent setting, and ahead of science and policies being developed by the State of California. We believe the Draft Malibu Benthic TMDL could result in significant expenditure of public resources for dischargers in the Malibu Creek watershed that are not justified by the information and science presented in the Draft Malibu Benthic TMDL.

The intent of this letter is to request and provide technical support for the following requests:

I. Removal of the sedimentation waste load allocations (WLAs) for the Ventura County MS4s,

II. Removal or modification of the nutrient WLAs for the Ventura County MS4s,

III. Removal of benthic macroinvertebrate targets and allocations for Malibu Creek and Malibu Lagoon, and

IV. Additional clarifications.

To support these requests, we have included three technical attachments to this letter and summarized the key points below,

I. Removal of the Sedimentation WLAs Comment 6-1

As discussed in Attachment A, we are requesting that sediment WLAs for Ventura County MS4s be removed from the Draft Malibu Benthic TMDL. The request is made based on the belief that MS4 WLAs controlling for sediment supply in the upper watershed will not address any sedimentation impairment in main stem Malibu Creek because:

1. Ventura County MS4s contribute only a minor fraction (significantly less than 10%) of total sediment loading in the watershed annually;

2. County unincorporated area (UA) and the City of Thousand Oaks MS4s are located in the upstream reaches of the Malibu Creek Watershed and sediment loading to main stem Malibu Creek from such MS4s is disrupted by a sequence of dams which obstruct downstream sediment transport; and

3. Post-construction/hydromodification requirements in the Ventura MS4 NPDES Stormwater Permit, with which Ventura County MS4s must comply, address the potential impacts of urban development on increases to in-stream work, which is a key cause of the sedimentation and habitat/biota impairments based on the Draft Malibu Benthic TMDL stressor analysis.

In addition, there are several inaccuracies in the technical approach to developing sedimentation WLAs that are not consistent with the state of the practice for hydromodification management (Hydromodification Assessment and Management in California, SCCWRP Technical Report 667, April 2012, Managing Runoff to Protect Natural Streams: the Latest Development on Investigation and Management of Hydromodification in California, Stein et al, 2005). Most notably that WLAs which require a reduction in supply to a reach where in-stream erosion is occurring will exacerbate sedimentation by starving already hungry water of its sediment transport capacity; open space sources are significant and should be accounted for; evidence providing a link between MS4s and the sedimentation impairment is not provided; work associated with instantaneous peak flows is not reflective of "effective" work; and the change in instantaneous work at one cross-section is not reflective of changes to the sediment regime of a watershed. These are discussed in more detail in Attachment A.

REQUESTED ACTION: We kindly request that sediment WLAs for Ventura County MS4s be removed from the Draft Malibu Benthic TMDL.

II. Removal or Modification of the Nutrient WLAs for the Ventura County MS4s

Comment 6-2

As outlined in Attachment B, we are requesting the removal of the nutrient WLAs (or replacement of the proposed targets and WLAs for Ventura County MS4s with the 2003 Malibu Nutrient TMDL values). For the same reasons as outlined in Attachment A for sediment, transportation of particulate nutrients downstream to the main stem of Malibu Creek and Malibu Lagoon is disrupted by a sequence of dams. These dams also prevent significant dry weather flows that could transport dissolved nutrients from reaching the main stem. As a result, including new allocations for the Ventura County MS4s is not warranted.

The Ventura County MS4s are concerned with the analysis done to justify changes to the nutrient targets and allocations established in the 2003 TMDL for Nutrients in the Malibu Creek Watershed (2003 Malibu Nutrient TMDL). Based on our review of the Draft Malibu Benthic TMDL, it appears the basis for the need to include lower total nitrogen targets and allocations in the Draft Malibu Benthic TMDL and to apply both the total phosphorus and total nitrogen targets and allocations year round were the following:

1. A case study conducted in support of the development of nutrient numeric endpoints (NNE) policy being developed by the State of California that was updated to support analysis for this Draft Malibu Benthic TMDL. The analysis implied that lower nutrient targets were required to achieve the targeted concentrations of algal biomass in the watershed.
2. Analysis of additional reference reach data collected since 2003 demonstrated that reference reach concentrations were lower than those presented in the 2003 Malibu Nutrient TMDL.
3. The 2003 Malibu Nutrient TMDL targets are being achieved and the percent cover of algae is not yet meeting the TMDL targets.
4. The Draft Malibu Benthic TMDL stressor analysis identified algal percent cover as a potential cause of the benthic macroinvertebrate impairments being addressed in the Draft Malibu Benthic TMDL.

Again, we are concerned with establishment of new requirements based on analysis associated with a State Policy still under development. Additionally, we feel technical support and rationale for the modifications to the targets and allocations from the 2003 Malibu Nutrient TMDL are inadequate for the following reasons (as detailed in the attached technical comments, Attachments A through C):

1. The nutrient analysis provided in the Draft Malibu Benthic TMDL does not justify lowering the targets and allocations at this time. The Draft Malibu Benthic TMDL incorrectly determines that the watershed is already meeting the 2003 Malibu Nutrient TMDL's nutrient targets and therefore lower targets are necessary to reduce algal biomass. Additionally, the linkage between reducing nutrient concentrations and reducing algal biomass is not established in the Draft Malibu Benthic TMDL.

2. The Draft Malibu Benthic TMDL does not provide sufficient linkage between nutrient concentrations and the benthic macroinvertebrate (BMI) impairments. The stressor analysis that was conducted to determine that elevated mat algal coverage resulting from excess nutrients as a major stressor causing impairment to the BMI communities in Malibu Creek fails on several counts.
    a. The Draft Malibu Benthic TMDL cites results that there was no significant correlation of IBI scores with macroalgal cover and one study found that IBI scores increased with microalgal cover.
    b. The Draft Malibu Benthic TMDL states there is "almost no correlation between algae coverage and either inorganic N or inorganic P concentrations."
    c. The stressor analysis diminishes or dismisses the impacts of natural watershed conditions, invasive species, and other potential toxicants, such as pyrethroid pesticides, as stressors that could be significant contributing factors.

3. The NNE analysis conducted is flawed and does not support the need to lower the allocations. The modeling tools used for the analysis have some inherent biases and other technical issues that could influence the results and the results do not appear to accurately predict conditions in the Malibu Creek watershed.

4. The data from reference reaches is not sufficient to demonstrate the need for lower values nor does it appropriately account for true reference conditions in the watershed.

5. The Draft Malibu Benthic TMDL does not provide any technical justification for including winter season or wet weather allocations. The only references to the need for year round and wet season allocations are statements that Malibu Lagoon is most sensitive to nutrient loads delivered during winter storms and stored within the estuary and that algal coverage is high year round. However, no technical information is provided to link the selected targets and allocations to the nutrient loads delivered to the lagoon that may be of concern or to the biological impairments addressed by the Draft Malibu Benthic TMDL. Additionally, no algal biomass or percent cover data is presented to demonstrate an impairment in wet weather nor is any technical analysis provided to show that additional reductions in nutrients are required during the winter season, and particularly during wet weather.

6. The proposed nutrient targets and allocations are likely unachievable and thus are infeasible with available technology for stormwater treatment (See Attachment C).

Furthermore, the Draft Malibu Benthic TMDL does not provide sufficient technical information to justify the additional nutrient reductions will result in improvements to the benthic community impairments, or provide analysis that shows lower allocations for Ventura County MS4s are necessary to address any downstream impairments. On page 9-12, the Draft Malibu Benthic TMDL acknowledges that "nutrient concentrations were not limiting on algal growth in Malibu Creek" and the discussion above shows that the linkage between algal biomass and benthic community impacts is flawed. As a result, we believe it is an inappropriate use of public funds to require significant expenditures to address nutrient reductions that the Draft Malibu Benthic TMDL does not demonstrate will result in achievement of the goals of improving benthic community conditions, particularly when another TMDL, i.e. 2003 Malibu Nutrient TMDL, already exists to control nutrient discharges in the watershed. This makes this proposed TMDL duplicative and unnecessary.

REQUESTED ACTION: We kindly request that the proposed nutrient allocations and targets be removed from the Malibu Benthic TMDL. Alternatively, that the allocations and targets from the 2003 Malibu Nutrient TMDL be substituted in the Malibu Benthic TMDL.

III. Removal of Benthic Macroinvertebrate Targets and Allocations for Malibu Creek and Malibu Lagoon Comment 6-3

Our final concern is that the Draft Malibu Benthic TMDL is setting targets and allocations for benthic macroinvertebrates that are inconsistent with the direction the State Water Resources Control Board is going with the development of the Biological Objectives for the State of California. While we recognize that the policy is not yet developed, the State has made some determinations and developed scientific information that are relevant and were not considered as part of the Malibu Benthic TMDL development. These elements include:

1. The SC-IBI is not appropriate for setting biologically based objectives due to the lack of appropriate reference sites and conditions for many locations in California, including the Malibu Creek watershed.
2. The scientific advisory group for the biological objectives is currently recommending that a multi scoring tool approach be used that does not rely solely on one index (such as the O/E).

3. The science advisory group is recommending consideration of a "grey area" for setting thresholds for biological objectives within which additional data would be collected before determining whether an impairment exists.

The Draft Malibu Benthic TMDL sets two separate targets based on the SC-IBI and O/E, neither of which are currently being recommended for the biological objectives for California. Additionally, the analysis in the Draft Malibu Benthic TMDL is based on reference conditions that do not adequately represent the conditions in the Malibu Creek watershed, particularly the presence of the Modelo formation.

Additionally, we feel it is inappropriate to include targets for benthic macroinvertebrates in the Draft Malibu Benthic TMDL, since they are not pollutants as defined under the Clean Water Act. The U.S. District Court for the Eastern District of Virginia recently ruled that U.S. EPA exceeded its authority in establishing a flow-based TMDL[1]. This case ruled that U.S. EPA cannot use surrogates in place of regulating pollutants. According to the case, U.S. EPA is charged with "establishing TMDLs for appropriate pollutants; that does not give them the authority to regulate nonpollutants." The term "pollutant" is defined in the CWA as "dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water." 33 U.S.C., § 1362(6). Benthic macroinvertebrates are not defined as pollutants by the Clean Water Act.

However, there are benthic macroinvertebrate targets in the Draft Malibu Benthic TMDL and those targets are additionally assigned as in-stream allocations that are required to be included in the NPDES permits for dischargers. On page 10-13, the Draft Malibu Benthic TMDL states "The biological response numeric targets for Malibu Creek and Lagoon are directly linked to the allocations and should be placed into the applicable regulatory mechanism (i.e., NPDES permit) in order to ensure that the benthic community condition achieves the water quality objectives". As result, this Draft Malibu Benthic TMDL is inappropriately regulating nonpollutants through the inclusion of benthic macroinvertebrate targets and corresponding in-stream allocations. By extension, it is also arguable that listings for such non-pollutant based impairments are also inappropriate under the Clean Water Act. Thus, the original listing is inappropriate, and therefore improperly the subject of this TMDL.

[1] Virginia DOT v. EPA, E.D. Va., No. 1:12-cv-775, 1/3/13

We feel that the establishment of benthic macroinvertebrate targets at this time could lead to confusion and conflict with the policies being developed by the State of California, the inability to develop a true assessment of problems and impairments in the watershed using science being developed by the State, and could result in significant expenditures of public resources to address a problem that may not exist or may be caused by the natural conditions in the watershed.

REQUESTED ACTION: We kindly request the removal of the SC-IBI, O/E and species richness targets for Malibu Creek and Malibu Lagoon from this TMDL.

IV. Additional Clarifications

In addition to the three major points discussed above, the Draft Malibu Benthic TMDL includes a number of inconsistencies, confusing statements and other items that need to be clarified. A detailed list of these items is included in Attachment B. However, here are the key points that we feel require clarification:

1. The Draft Malibu Benthic TMDL should clarify that the entire watershed is not under the jurisdiction of an MS4 permit. MS4s do not have responsibility for or jurisdiction over agricultural and open space discharges, or areas that do not drain through an MS4 system. Comment 6-4
2. The Draft Malibu Benthic TMDL should clearly identify the impairments and reaches covered by the TMDL. TMDL targets should only apply to the main stem of Malibu Creek and Malibu Lagoon, and in-stream allocations should only apply to those reaches. Comment 6-5
3. The in-stream allocations should clearly be identified as not applying as end-of-pipe limits and that permit limits need to be developed by translating the in-stream values to applicable effluent limitations. Additionally, the requirement to include permit limitations for the biological and algal response targets should be removed. Comment 6-6

REQUESTED ACTION: We kindly request the clarifications listed above, and in Section 8 of Attachment B be made to the Draft Malibu Benthic TMDL.

SUMMARY

We appreciate your consideration of these comments and requests as outlined above in our letter. We hope these comments are viewed in a constructive manner, and we want to assure you we are available to meet with you at your convenience to discuss them, and any potential options to resolve some of our concerns. We value our on-going relationship, and work with U.S. EPA staff in protection of the environment and water quality in Ventura County. If you have any questions, please feel free to contact me at 805-654-5051 or email at Gerhardt.Hubner@ventura.org

Sincerely,

Gerhardt Hubner
Deputy Director

Attachments:

A. Discussion Supporting Removal of Sediment WLAs for Ventura County MS4s
B. Discussion Supporting Removal and Adjustment of Nutrient Targets and WLAs for Ventura County MS4s and Removal of Benthic Macroinvertebrate Targets and Allocations
C. Technical Achievability Assessment of the Malibu Creek and Ventura River Nutrient TMDLs

Cc: Tully Clifford, Director Ventura County Watershed Protection District
Jeff Pratt, Director, Ventura County Public Works
Al Boada, Assistant County Counsel, County of Ventura
Ewelina Mutkowska, Stormwater Program Manager, County of Ventura
Sam Unger, Executive Officer, Los Angeles Regional Water Quality Control Board
Alexis Strauss, Assistant Regional Director, U.S. EPA Region IX
Bob Carson, Environmental Programs Administrator, City of Thousand Oaks
Geremew Amenu, Program Manager, County of Los Angeles
Henry Graumlich, Chair, Calleguas Creek Watershed Committee
Joe Bellomo, Chair, Malibu Creek Watershed Committee

ATTACHMENT A

Discussion Supporting Removal of Sediment WLAs for Ventura County MS4s

This attachment provides technical support for the request to remove sedimentation waste load allocations (WLAs) for unincorporated Ventura County and City of Thousand Oaks MS4s. The request is made based on the belief that MS4 WLAs controlling for sediment supply in the upper watershed will not address the excess sedimentation impairment in main stem Malibu Creek because:

1. Ventura County MS4s contribute only a minor fraction (significantly less than 10%) of total sediment loading in the watershed annually.

2. Unincorporated Ventura County and the City of Thousand Oaks MS4s are located in the upstream reaches of the Malibu Creek Watershed and sediment loading to main stem Malibu Creek from such MS4s is disrupted by a sequence of dams which obstruct downstream sediment transport.

3. Post-construction/hydromodification requirements in the Ventura County MS4 NPDES permit, with which unincorporated Ventura County and the City of Thousand Oaks must comply, address the potential impacts of urban development on increases to in-stream work, which is a key cause of the sedimentation and habitat/biota impairments based on the Draft TMDL stressor analysis.

Furthermore, it is likely that sedimentation impairments result from hydromodification (i.e., the alteration of watershed processes such as water balance, surface and near surface runoff, groundwater recharge, and sediment delivery and transport associated with changes in land use) and therefore should be managed as such. Hydromodification is statutorily considered pollution rather than a pollutant, and would therefore not be subject to regulation through TMDLs. Lastly, there are several inaccuracies in the technical approach to developing sedimentation WLAs that are not consistent with the state of the practice for hydromodification management (Hydromodification Assessment and Management in California, SCCWRP Technical Report 667, April 2012, Managing Runoff to Protect Natural Streams: the Latest Development on Investigation and Management of Hydromodification in California, Stein et al, 2005), most notably that WLAs which require a reduction in supply to a reach where in-stream erosion is occurring will exacerbate sedimentation by starving already hungry water of its sediment transport capacity. Justification for the removal of sedimentation WLAs for the unincorporated Ventura County and City of Thousand Oaks with respect to the above points is provided below in addition to notes on the inaccuracies of the technical approach used to develop WLAs.

Detailed Discussion and TMDL Comments

Ventura County MS4s Contribute Minor Fraction of Total Sediment Loading and Work: The Draft TMDL designates WLAs to MS4s for sedimentation and nutrients which are intended to address, in part, the listing of Malibu Creek on the 303(d) list for sedimentation and benthic macroinvertebrates impairments. The TMDL does not provide sufficient evidence linking the sedimentation impairment to MS4s and in fact, there is a wide body of evidence available suggesting that MS4s contribute only a minor fraction of the total watershed sediment load.

The table below summarizes lognormal mean total suspended solids (TSS) event-mean concentrations (EMCs) developed based on land use monitoring throughout Los Angeles and Ventura Counties. These data indicate that the average EMC (not accounting for site-specific land use distributions) for urban land uses which fall under the jurisdiction of MS4s is 105 mg/L. This is far below the average EMC for non-urban land uses, such as agriculture and vacant/open space land uses, which is 608 mg/L.

Furthermore, estimates of TSS loading based on the default EMCs and runoff coefficients in the LARWQCB-approved Structural BMP Prioritization and Analysis Tool[1] (SBPAT) (Geosyntec, 2008), Southern California Associations of Governments (SCAG, 2005) land use and mean watershed precipitation values, indicates that areas draining to or through unincorporated Ventura County or City of Thousand Oaks MS4s contribute only 10% of the total TSS load to the downstream dams[2]. Moreover, if it is considered that dams trap between 90 and 100 percent (Mount, 1995) of the sediment load that is supplied to them, the percentage contribution by unincorporated Ventura County and City of Thousand Oaks MS4s to the downstream impaired reach of Malibu Creek then the 10% would be further significantly reduced.

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[1] SBPAT was developed for Los Angeles County, City of Los Angeles, Heal the Bay, State Water Resources Control Board, and the Los Angeles Regional Water Quality Control Board.

[2] This estimate is based on land-use based water quality modeling of the 85th percentile 24-hour storm event and does not include open space and agricultural land uses draining to or through modeled MS4s. It is recognized that there are more comprehensive analyses that can be conducted to estimate watershed sediment yield (e.g. sediment yield analyses such as GLU, RUSLE) however SBPAT was used based on model availability to get a rough estimate of MS4 contributions, relative to total drainage area loads.

Land Use	Log-transformed Arithmetic Mean* EMC (mg/L)[3]
Commercial	67
Industrial	219
Transportation	78
Education	100
Multi-Family Residential	40
Single-Family Residential	124
Agriculture	999
Vacant/Open Space	217

* most land use EMC datasets are most closely represented by the lognormal distribution, therefore log-mean computations are conducted in log-space and transformed back to arithmetic space for reporting purposes.

Dams Disconnect Impaired Reach from Ventura County MS4s: The dams located between unincorporated Ventura County and City of Thousand Oaks MS4 outfalls and the main stem of Malibu Creek act as a partial obstruction to downstream sediment transport, thereby both 1) limiting the sediment supplied by the upper watershed to the main stem of Malibu Creek (as it is initially discharged into the channel in the upper reaches of the watershed, but enters the main stem of Malibu Creek only after downstream transport by channel flows), and 2) exacerbating in-stream erosion downstream.

The impacts of dams on the hydrologic and sediment regimes of creeks have been well documented (see Chapter 16 of California Rivers and Streams, "The Daming of California's Rivers", Jeffrey Mount, 1995). In general, the construction of dams is accompanied by ***reductions in the size and quantity of sediment supply*** and decreases in peak and total discharge to downstream reaches. It is estimated that large dams ***trap between 90 and 100 percent of the sediment load*** that is supplied to them (Mount, 1995). These impacts in turn affect channel morphology typically resulting in aggradation upstream and ***erosion downstream of the dam***, hydraulic readjustments related to changes to the flow regime, and changes to bed and bank materials (i.e., dams prevent the downstream movement of coarse bedload).

[3] These data are primarily based on a study conducted by Los Angeles County for which they monitored eight land use stations. Details on the Los Angeles County study can be found in the Los Angeles County 1994-2000 Integrated Receiving Water Impacts Report, 2000 and Los Angeles County 2000-2001 Stormwater Monitoring Report, 2001. It was supplemented by agricultural runoff data from Ventura County Flood Control District NPDES monitoring efforts (VCFCD, 1997-2003).

There are several dams and lakes in the watershed that were constructed for water supply and recreation including Eleanor Dam, Sherwood Dam, Malibou Dam, Century Dam, Westlake Dam, Rindge Dam, Potrero Dam and Lindero Dam. Approximately 97% of the Malibu Creek watershed drains through a dam prior to discharge into Malibu Lagoon. The unincorporated Ventura County (and by reference, Ventura County Watershed Protection District [VCWPD]) and City of Thousand Oaks urban areas, which would be regulated under their MS4 WLAs, all drain through at least one dam prior to being discharged into the main stem of Malibu Creek, and some drain through up to three dams prior to being discharged into the main stem.

These dams have significantly modified the flow and sediment regime of Malibu Creek. Because there are so many dams in sequence, Malibu Creek has become a highly compartmentalized system, composed of numerous localized flow and sediment regimes, not significantly impacted by process changes in upstream or downstream segments. For example, while main stem Malibu Creek is considered a perennial stream, some reaches have been observed to be seasonally dry, including the reaches associated with monitoring locations MC-12, R-9 and MC-1. Such reaches are immediately downstream of Century Dam (MC-12 and R-1) and Rindge Dam (MC-1), which likely restrict flows from discharging to downstream reaches under some conditions resulting in intermittent flows in these reaches.

Furthermore, it is estimated that Rindge Dam itself has sequestered 52,000 tons of sediment since construction (Preliminary Malibu Creek Environmental Restoration Feasibility Study documents). That is the equivalent of 604 tons per year, which is more than the loading estimated from unincorporated Ventura County and City of Thousand Oaks combined (approximately 420 tons/year based on land use-based modeling discussed above) and 10% of the natural average annual total watershed sediment load estimated by the TMDL. These numbers do not include the sediment sequestered by the seven other dams in the watershed. While it seems like this sediment removal from the system would help the excess sedimentation impairment, studies have shown that sediment sequestration behind dams leaves dam discharges looking for sediment to maintain transport capacity, resulting in downstream channel bed and bank erosion, thereby exacerbating the excessive sedimentation issue in areas downstream of dams (see Chapter 16 of California Rivers and Streams, "The Damming of California's Rivers", Jeffrey Mount, 1995).

MS4 Sediment Loading is Addressed by Existing Programs: Furthermore, new requirements included into Order No. 09-0057 NPDES Permit No. CAS004002 Waste Discharge Requirements for Storm Water (Wet Weather) and Non Storm Water (Dry Weather) Discharges from the MS4 within the Ventura County Watershed Protection District, County of Ventura, and Incorporated Cities Therein (Ventura County MS4 NPDES Permit), with which both unincorporated Ventura County and the City of Thousand Oaks must comply, address the impacts of land use changes on watershed processes such as the channel flow and sediment

transport regimes. Under the Planning and Land Development Program portion of the Ventura County MS4 NPDES Permit, permittees are required to ensure that qualifying project applicants:

- Lessen the water quality impacts of development by using smart growth practices such as compact development, directing development towards existing communities via infill or redevelopment, safeguarding of environmentally sensitive areas, mixing of land uses (e.g., homes, offices, and shops), transit accessibility, and better pedestrian and bicycle amenities.

- Minimize the adverse impacts from storm water runoff on the biological integrity of Natural Drainage Systems and the beneficial uses of waterbodies in accordance with requirements under CEQA (Cal. Pub. Resources Code § 21100).

- Minimize the percentage of effective impervious surfaces on land developments to mimic predevelopment water balance through infiltration, evapotranspiration and reuse.

- Minimize pollutant loadings from impervious surfaces such as roof-tops, parking lots, and roadways through the use of properly designed, technically appropriate BMPs (including Source Control BMPs such as good housekeeping practices), Low Impact Development Strategies, and Treatment Control BMPs.

- Properly select, design and maintain Treatment Control BMPs and Hydromodification Control BMPs to address pollutants that are likely to be generated, assure long-term function, and to avoid the breeding of vectors.

- Prioritize the selection of BMPs suites to remove storm water pollutants, reduce storm water runoff volume, and beneficially reuse storm water to support an integrated approach to protecting water quality and managing water resources in the following order of preference: 1) infiltration BMPs, 2) BMPs that store and reuse storm water runoff, 3) BMPs that incorporate vegetation to promote pollutant removal and runoff volume reduction and integrate multiple uses, 4) BMPs which percolate runoff through engineered soil and allow it to discharge downstream slowly, 5) approved modular, proprietary treatment control BMPs that are based on LID concepts that meet pollution removal goals.

Such requirements address the impacts of land use changes on the flow and sediment regime of Malibu Creek Watershed through the control for and mitigation of potential flow modifications which result from increases in imperviousness. In this way, they serve as a clear, logical

regulatory structure that is already in place and, over time, will support the objectives of the Draft TMDL more directly and effectively than the MS4 sedimentation WLAs.

Additional Technical Considerations: Lastly, in review of the methods used to develop the sedimentation WLAs, the following technical inaccuracies are noted, given the current state of the practice as described in Hydromodification Assessment and Management in California, SCCWRP Technical Report 667 (SCCWRP, 2012). Much of the data required to bring the analysis up to practice standards are available and are discussed in Preliminary Draft documents related to the Malibu Creek Restoration Feasibility Study.

In-stream erosion will be exacerbated if Draft sediment WLAs are implemented: The Draft TMDL, in discussion of sedimentation as a major stressor states that, "Increased sedimentation can arise from both upland and in-channel sources; however, it is most strongly associated with *changes in the flow regime* that cause channel instability". Average annual sediment load-based WLAs, (i.e., Ventura County MS4 is allocated a specific load of sediment that they can discharge on an annual basis[4]), as currently defined, will not effectively address the excess sedimentation stressor, defined as in-stream erosion, which is dependent both on stream work and sediment availability. By requiring only a reduction in supply to a reach where in-stream erosion is occurring, the TMDL is expected to exacerbate sedimentation by starving already hungry water of its sediment transport capacity. Therefore, MS4 sediment load-based WLAs should be removed from the TMDL and the TMDL should instead state that this 303(d) listing is being addressed by existing programs (Ventura County MS4 NPDES Permit).

Open space sources are significant and should be accounted for: Currently, the Draft TMDL designates permitted MS4s as the only parties responsible for addressing the sediment impairment. This list does not seem comprehensive and should include those organizations that conduct roadside maintenance activities and brush clearing practices (i.e. National Park Service, California State Parks) to manage sediment supply from "natural" areas to the extent practical. Based on the land use-based modeling described above, open space land uses contribute approximately 50% of the total TSS load supplied to the impaired reach. Furthermore, much of Malibu Creek's soils are considered highly erodible and it is likely that sediment loads to receiving waters have increased due to brush clearing and roadside maintenance activities where dirt and debris are left on the side of the road or up-slope of creeks. Open space contributions likely comprise even more than 50% of total TSS loads to the impaired reach since the estimate does not account for erosion resulting from the large expanses of natural areas with dirt roads and fire hazards.

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[4] Although this maximum sediment mass-based WLA was set based on an annual *average* value (i.e., roughly half of the years could exceed this while still meeting EPA's estimated pre-development-based loading capacity, over a longer period of time), no allowable WLA exceedances are currently permitted in the draft TMDL.

Evidence providing a link between MS4s and the sedimentation impairment is not provided: Sedimentation WLAs are allocated to permitted MS4s draining urbanized areas within the watershed based on imperviousness. The conceptual model presented in Section 9 indicates that MS4s are related to sedimentation, which is associated with reduced habitat quality, which itself is related to impaired biology. However, in discussion of reduced habitat quality due to sedimentation, the TMDL states that physical habitat scores throughout the watershed are "generally acceptable and do not appear to correlate with the SC-IBI scores" suggesting that there is no relationship between impaired biology and reduced habitat quality. Furthermore, evidence is not presented which suggests a relationship between imperviousness and sedimentation. While data presented suggests a relationship between low SC-IBI scores and imperviousness, there is no data which directly links imperviousness to sedimentation Therefore, data is presented indicating a relationship between low SC-IBI scores and upstream imperviousness and literature is cited which indicates a relationship between sedimentation and reduced habitat quality however a linkage between the sedimentation impairment and urban areas draining through MS4s is not drawn.

Work associated with instantaneous peak flows is not reflective of "effective" work: To measure the impact of urbanization on watershed hydrology and morphology, the Draft TMDL attempts to compare the "effective" work in the channel prior to and following development, intended to represent the cumulative forces resulting in downstream sediment movement. To do this, the instantaneous work at one channel cross-section (LADPW F-130 gage) is calculated for the pre-development and post-development 2-year and 10-year peak flows. This approach does not reflect the state of the practice for hydromodification management (SCCWRP Technical Report 667, April 2012; Stein et al, 2005) and oversimplifies the impacts of urbanization on watershed hydrology and channel morphology. While urbanization has been shown to increase the magnitude of stormflows, it has also been shown to increase the frequency of flood events, decrease the lag time to peak flow and quicken the flow recession, the combined effects of which modify the living conditions for in-stream biota as well as the morphologic regime and in-stream biota habitat structure (SCCWRP Technical Report 667, April 2012). While it may not be practical to address all such variables, the state of the practice for hydromodification assessment suggests that "effective" work is best estimated based on flow durations (available based on USGS gage data for one location and published in Pre-Draft), which is state of the practice for hydromodification assessment (SCCWRP Technical Report 667, April 2012), instead of instantaneous peak flows.

The change in instantaneous work at one cross-section is not reflective of changes to the sediment regime of a watershed: Currently, post-development impacts are evaluated for a 10 mile reach based on the change in work associated with the 2 and 10 year peak flows prior to and following development at one cross-section which does not effectively address the range of conditions throughout the reach. Furthermore, the post-development impacts analysis was made

based on the marriage of hydrology from one-channel location, located approximately 5 miles upstream of the lagoon, with channel geometry data from a location immediately upstream of the lagoon. In-stream work is a site-specific parameter, dependent on hydrology and morphology from the same location. The use of hydrology and morphology from different locations in the calculation of work at one location greatly reduces its validity.

Thank you for the opportunity to review and comment on the Draft TMDL. We appreciate your consideration of removal of sedimentation WLAs for at least the upper watershed MS4 permittees based on the above. We would be happy to collaborate with you in further development of this TMDL to address our joint concerns using an analytical approach reflective of the state of the practice and inclusive of existing efforts. If you have any questions, please feel free to contact Ewelina Mutkowska at the County of Ventura Watershed Protection District at (805) 645-1382 or Ewelina.Mutkowska@ventura.org.

ATTACHMENT B

Discussion Supporting Removal and Adjustment of Nutrient Targets and WLAs for Ventura County MS4s and Removal of Benthic Macroinvertebrate Targets and Allocations

This attachment provides technical support for the request to remove or modify the nutrient WLAs for unincorporated Ventura County, Ventura County Watershed Protection District and City of Thousand Oaks MS4s (Ventura County MS4s) and the request to remove the benthic macroinvertebrate targets and allocations for Malibu Creek and Malibu Lagoon. In addition, the attachment provides support for additional recommended changes to clarify the Draft TMDL. The technical justifications for these requests are organized as follows:

1. We request that wasteload allocations for Ventura County MS4s be removed from the Draft TMDL. The Draft TMDL does not identify any impairments in reaches to which the MS4s discharge that are not already addressed by the 2003 Nutrient TMDL and does not provide a linkage as to how discharges from Ventura County MS4s are impacting the main stem of Malibu Creek or Malibu Lagoon.
2. The information provided for the revisions to the nutrient targets and allocations are insufficient to justify lower targets and allocations for total nitrogen and total phosphorus than are outlined in the 2003 Malibu Creek Nutrient TMDL.
   a. The nutrient analysis provided in the Draft TMDL does not justify lowering the targets and allocations at this time.
   b. The Draft TMDL does not provide sufficient linkage between nutrient concentrations and the BMI impairments.
   c. The NNE analysis is flawed and does not support the need to lower the allocations.
   d. The data from reference reaches is not sufficient to demonstrate the need for lower values nor does it appropriately account for true reference conditions in the watershed.
   e. The need for lower wet season targets is not justified in the Draft TMDL.
   f. The proposed nutrient targets and allocations are likely unachievable with available technology for stormwater treatment.
3. The Draft TMDL presents macroinvertebrate targets that are inconsistent with the approach being developed by the State Board for biological objectives. Additionally, recent court decisions have clarified that TMDLs may not regulate non-pollutants. As a result, we feel the benthic macroinvertebrate targets and in-stream allocations should be removed from the Draft TMDL.
4. The discussion regarding MS4 jurisdictions in the Draft TMDL needs to be clarified. MS4s do not have responsibility for or jurisdiction over agricultural and open space discharges or areas that do not drain through an MS4 system.
5. The Draft TMDL targets and allocations should only apply to the main stem of Malibu Creek and Malibu Lagoon as these are the only listings being addressed by this Draft TMDL.
6. The Draft TMDL allocations section should clarify the meaning of in-stream allocations and remove requirements to include biological and algal response targets in NPDES permits.
7. The TMDL includes a number of other elements that should be clarified.

1 WASTELOAD ALLOCATIONS FOR THE VENTURA COUNTY MS4S SHOULD BE REMOVED FROM THE DRAFT TMDL Comment 6-7

As discussed in Attachment A, approximately 97% of the Malibu Creek watershed drains through a dam prior to discharge into Malibu Lagoon. The Ventura County MS4s all drain through at least one dam prior to being discharged into the main stem of Malibu Creek, and some drain through up to three dams prior to being discharged into the main stem. These dams act as barriers to the transport of sediment and nutrients to the main stem of Malibu Creek during both dry and wet weather.

Additionally, as discussed in Attachment A, because there are so many dams in sequence, Malibu Creek has become a highly compartmentalized system, composed of numerous localized flow and sediment regimes, not significantly impacted by process changes in upstream or downstream segments. For example, while main stem Malibu Creek is considered a perennial stream, some reaches have been observed to be seasonally dry, including the reaches associated with monitoring locations MC-12, R-9 and MC-1. This observation is confirmed by Table 6-2 on page 6-4 of the Draft TMDL. The table shows that average flows in Malibu Creek are zero during most of the algae growing season. Additionally, Page 1-3 states *"Historically, there is little flow in the summer months; much of the natural flow that does occur in the summer in the upper tributaries comes from springs and seepage areas."* If there is no flow, how can nutrients from upstream discharges be impacting algal growth in Malibu Creek or Malibu Lagoon?

Given the hydrologic disconnect between Ventura County MS4s and the main stem, including allocations for addressing impairments in the main stem is not appropriate. The Draft TMDL does not provide any evidence that discharges from Ventura County MS4s are linked to the impairments in the main stem. Additionally, as will be discussed in detail in the remaining portions of the letter, a TMDL for nutrients already exists in the Malibu Creek Watershed. In order to justify modifications to the 2003 Nutrient TMDL for the Ventura County MS4s, the Draft Benthic TMDL would need to provide information demonstrating that lower allocations and targets are required in Ventura County to address the impairments in the main stem of Malibu Creek. We do not feel that linkage has been made in the Draft TMDL.

The Draft Benthic TMDL includes an analysis of IBI and O/E scores throughout the Malibu Creek Watershed. Two of the sites evaluated are located within Ventura County, LV-9 and PC-8. Both of these sites have median IBIs over the Draft TMDL's proposed threshold for defining impairment (40). Although we recognize these sites are not downstream of MS4 discharges, there are no other sites located within Ventura County that demonstrate an impairment due to Ventura County MS4 discharges. The majority of sites where benthic macroinvertebrate data were collected are below dams that would significantly moderate the influence of discharges from Ventura County and all sites are downstream of significant urban areas within Los Angeles County. As the Draft TMDL does not provide any modeling to show nutrient discharges from Ventura County are being transported to the main stem and no monitoring sites demonstrate impairments within Ventura County, a linkage between Ventura County MS4s and the impairments being addressed by the Draft TMDL has not been demonstrated.

Additionally, no data were presented in the Draft TMDL that demonstrated exceedances of algal coverage in Ventura County. An excel file of the algal percent coverage data used in the Draft TMDL analysis was obtained from USEPA. Although we have concerns about the use of this

data for evaluating algal impairments in the watershed (as discussed in more detail later in these comments), these data were used in the Draft TMDL analysis and are the only data available for consideration. A review of the data showed that no percent cover observations were collected in Ventura County since 2006. The only site that could receive discharges from Ventura County MS4s that has recent percent cover observations is on Triunfo Creek at Kanan Road, which is downstream of Westlake Lake. At this site, no observations of mat algal percent cover greater than 60% or floating algal cover over 30% were recorded since 2006 (though observations do not appear to have been made in 2007 and 2008). These data do not support requiring allocations in this Draft TMDL for Ventura County MS4s since the only monitoring site downstream of Ventura County MS4 discharges with recent observations is meeting the 2003 Nutrient TMDL algal percent cover targets.

Given that a TMDL already exists that assigns nutrient WLAs to the Ventura County MS4s, the majority of the Ventura County MS4 discharges pass through one or more dams prior to being discharged to the main stem of Malibu Creek, and no information has been provided that demonstrates a linkage specifically between the Ventura County MS4 discharges and benthic impairments, we request that the Ventura County MS4 WLAs for nutrients be removed from this Draft TMDL or replaced by the WLAs included in the 2003 Nutrient TMDL. Further justification for this request is included in Section 2.

2 THE NUTRIENT TARGETS AND ALLOCATIONS SHOULD BE REMOVED OR SET EQUAL TO THE 2003 NUTRIENT TMDL TARGETS AND ALLOCATIONS

A TMDL to address impairments due to excessive algal growth due to nutrients is already in effect in the Malibu Creek watershed (2003 Nutrient TMDL). The Draft Benthic TMDL provides a number of analyses to justify the inclusion of lower, year round targets and allocations for nutrients. However, we feel that the arguments are not justified and a linkage to discharges from Ventura County MS4s has not been provided. The following arguments demonstrate that:

1. The Draft TMDL targets established in the 2003 TMDL are not yet met and therefore it is too soon to determine additional reductions are necessary.
2. The Draft TMDL does not establish clear linkages between BMI impairments, algal percent cover or algal biomass, or nutrients.
3. The use of the NNE analysis to justify the need for lower targets and allocations was technically flawed.
4. The calculation of allocations based on reference conditions does not present sufficient information to justify lower allocations and does not account for natural conditions in the watershed.
5. The basis for including winter season and particularly wet weather allocations has not been demonstrated, particularly for Ventura County MS4s whose discharges are unlikely to have significant impacts on the main stem of Malibu Creek and Malibu Lagoon.

2.1 The Draft TMDL Incorrectly Evaluated Whether The Summertime Target From The 2003 Nutrient TMDL Is Too Lenient To Control Algal Coverage. Comment 6-8

The Draft TMDL justifies revising the nutrient targets for Malibu Creek Watershed by concluding that the Total Nitrogen (TN) allocations in the previously adopted 2003 Nutrient TMDL were too lenient, and are preventing attainment of algal percent cover targets.

"Strong evidence indicates that the nutrient targets established in the 2003 TMDL have mostly been met; however Busse et al's (2003) study and the overwhelming data on the algae and macroalgae coverage in the streams and mainstem since the 2003 TMDL suggest that the assimilative capacity was substantially overestimated." (Draft TMDL, p. 10-10)

Necessary support for this argument is evidence that the nitrogen allocations from the 2003 TMDL have already been achieved in the watershed; otherwise, there would be no basis for concluding that the 2003 allocations were inadequate. The information presented in the Draft TMDL to justify revised targets is presented in Sections 7.5.1 and 8.3. The Draft TMDL mistakenly refers to the summer N target from the 2003 Nutrient TMDL as a nitrate-plus-nitrite (NO3/2) target (the 2003 target was for TN)[1], and then proceeds to develop an argument as follows:

1. If NO3/2-N is typically below 1 mg/L at a particular site(s), (and thus the 2003 TMDL target is being met), and
2. algal coverage exceeds its target in the same locations, then
3. the TN target from the 2003 TMDL was not strict enough, and lower targets are needed to drive algal mat percent cover lower.

The Draft TMDL's rationale for revising the nutrient targets falls apart at all three levels, as follows:

1. The Draft TMDL uses the wrong kind of nutrient data to evaluate the first part of the argument. The Draft TMDL is incorrect in asserting that the TN targets from the 2003 TMDL are generally met. Inspection of available TN data does not reveal that the 2003 TMDL's summertime target of 1.0 mg/L is generally met in the watershed.
2. Percent cover data is presented in the Draft TMDL for (apparently) only three sites in the watershed, and is inadequate evidence that the 2003 TMDL's algal coverage target is exceeded at non-reference sites. In addition, no algal coverage data from reference sites *within* the Malibu Creek Watershed are presented.
3. Paired TN and algal coverage data are not presented or evaluated, so the Draft TMDL has not determined whether particular TN levels (high or low) are associated with particular degrees of algal coverage (high or low).

More information about the flaws in the Draft TMDL's argument is presented below.

2.1.1 The Draft TMDL makes its argument for revising nutrient targets using the wrong N target.

The summer N target from the 2003 TMDL was for Total Nitrogen, not NO3/2-N. The adequacy of the previous TMDL target for nitrogen has to be evaluated using Total Nitrogen data, not nitrate data. If TN data are consulted, it becomes apparent that the summer N target from the 2003 TMDL is not being "mostly met".

[1] The Draft TMDL mischaracterizes the 2003 TMDL target as being for nitrate+nitrite throughout the document.

Only two monitoring programs described in the Draft TMDL monitored for all three constituents that allow calculation of TN (nitrate, nitrite, and TKN) in receiving water; the Malibu Creek Watershed Monitoring Program (MCWMP) and the LACDWP MS4 Mass Emission site monitoring. In Table 7-8 of the Draft TMDL, median TN concentrations are presented for six "selected stations" from the MCWMP (the program uses 13 sites).[2] The table in the Draft TMDL appears to imply that the majority of sites in the watershed have summer TN values less than 1.0 mg/L, because this appears true for 4 out of 6 of the sites included in the table. In Table 1 below, summer mean and median TN concentrations are provided for all 13 of the MCWMP sites, plus the LACDWP MS4 Mass Emission site. Median TN concentrations for 10 out of 14 sites exceed the 2003 TMDL target for TN during the summer.

In addition, according to Section 7.5, nutrient concentrations at monitoring stations on Malibu Creek are characterized by excursions above the summer and winter nutrient targets from the 2003 Nutrient TMDL.

[2] The summer median value for Site CC (0.06 mg/L) is an order of magnitude lower than the median value obtained by this commenter using MCWMP data. USEPA should check the median for this site.

Table 1. Mean and median concentrations of total nitrogen (TN) for the summer season (Apr. 15-Nov. 15) for all available sites where total nitrogen has been measured. With the exception of SO2, all data are from the Malibu Creek Watershed Monitoring Program (MCWMP).

Site	Description	Sample Size	Mean TN (mg N/L)	Median TN (mg N/L)
	Sites in LA County			
SO2	LA County MS4 Mass Emissions Site(1)	--	1.89	1.65
CC	Cold Creek(2)	14	0.61	0.57
LC	Liberty Canyon Creek(2)	18	2.77	1.75
LIN1	Lindero Creek, upstream from Lake Lindero(2)	15	1.47	1.41
LIN2	Lindero Creek, downstream from Lake Lindero(2)	14	2.11	1.94
LV2	Las Virgenes Creek(2)	18	3.49	3.67
MAL	Malibu Creek(2)	18	0.76	0.64
MED2	Medea Creek(2)	16	0.78	0.72
RUS	Russel Creek(2)	14	2.93	2.69
TRI	downstream from Westlake(2)	15	1.40	1.44
	Sites in Ventura County			
HV	Hidden Valley Creek, drains into Lake Sherwood(2)	2	13.28	13.28
POT	immediately upstream from Westlake(2)	1	1.44	1.44
	Sites on border between Ventura and LA counties			
LV1	Las Virgenes Creek(2)	18	1.58	1.49
MED1	Medea Creek (upstream from Malibou Lake)(2)	16	1.73	0.88

(1) Values for SO2 are from Table 7-9 in draft TMDL, summer values for 2005-2011.
(2) Data were collected April 2005-Nov 2006.

2.1.2 *Nitrate data cannot be used as a proxy for TN data to evaluate whether conditions in the watershed are meeting the previous TMDL target for N*

In absence of TN data, the Draft TMDL makes liberal use of data for NO3/2-N and inorganic-N to make inferences about presumed linkages between algal cover and total nitrogen concentrations, or to infer spatial or temporal patterns in TN concentrations. The use of nitrate as a proxy for TN is unwarranted and misleading. It is possible to compute the ratio between TN and NO3/2-N using data from the MCWMP. Ratios for all available samples for all 13 sites in the program are presented in Figure 1. As is evident from Figure 1, the proportion of TN accounted for by NO3/2-N is highly variable within sites, between sites, and within seasons. TN exceeds NO3/2-N by factors ranging from just over 1.0 to over 100. Based on this data, there is no justification for using NO3/2 data to evaluate whether the 2003 TMDL summertime targets for TN have been attained in the watershed, and no justification for alleging spatial trends or temporal trends in TN using nitrate-N or inorganic-N.

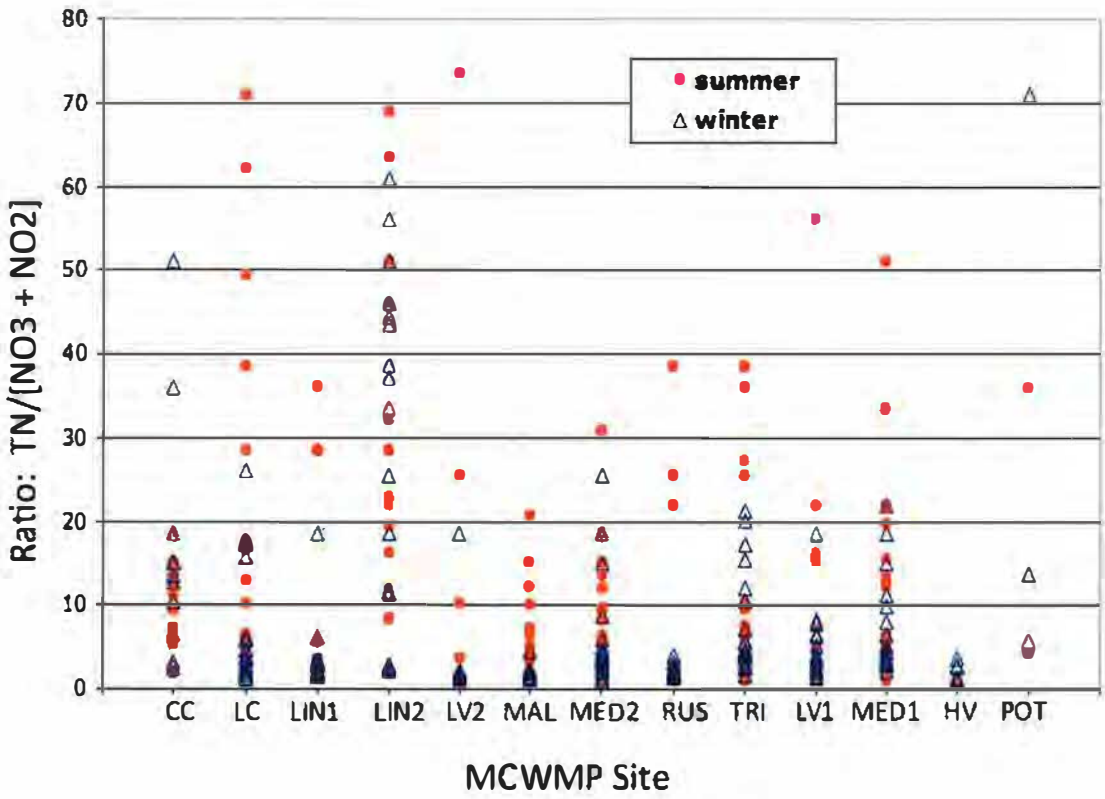

Figure 1. Ratios between Total Nitrogen (TN) and [Nitrate+Nitrite]-N at MCWMP monitoring sites in the Malibu Creek Watershed. Data were collected between February 2005-February 2007. Summer values are for samples collected Apr. 15-Nov.15; winter values are for samples collected Nov. 16-Apr.14. The four sites on the right side of the figure (LV1, MED1, HV, and POT) are in Ventura County or at the border between Ventura and Los Angeles counties. Two ratios were >80 and are not indicated in the graph: 109 for LIN2 on 9/9/05, and 376 for LC on 5/9/06.

2.1.3 *The Draft TMDL does not demonstrate that nitrogen concentrations below the 2003 TMDL target are associated with algal percent cover exceedances.*

As discussed in more detail above, colocated and concurrently collected data for TN and algal percent cover are not provided for any sites in the watershed (for either season), but are necessary to argue that TN concentrations below the 2003 Nutrient TMDL target are resulting in percent cover exceedances. Additionally, the excel file obtained from USEPA does not include TN concentrations (only nitrate) for comparison to the algal percent cover observations. Owing to the inability to treat nitrate-N as a proxy for TN, it is not sufficient to compare nitrate-N to percent cover data.

2.2 The Draft TMDL Does Not Provide Sufficient Linkage Between Nutrient Concentrations and BMI Impairments Comment 6-9

The stressor analysis that was conducted to determine that elevated mat algal coverage resulting from excess nutrients as a major stressor causing impairment to the BMI communities in Malibu Creek fails on several counts as outlined below.

2.2.1 *The Linkage Between BMI Impairments and Mat Algal Coverage and Nutrient Concentrations is Missing*

The Draft TMDL authors cite elevated mat algal coverage resulting from excess nutrients as a major stressor causing impairment to the BMI communities in Malibu Creek. This linkage fails on several counts.

The Draft TMDL authors cite Luce (2003) results that there was no significant correlation of IBI scores with macroalgal cover, but still conclude that macroalgal cover as a contributing factor to low IBI scores. Luce (2003) also found that IBI scores significantly *increased* with microalgal cover (e.g., periphytic diatoms), which further contradicts the Draft TMDL linkage between nutrients, algae and BMI metrics in Malibu Creek. The Draft TMDL authors also acknowledge there is… "*almost no correlation between algae coverage and either inorganic N or inorganic P concentrations (Figure 8-21). Notably, 100 percent cover can occur at the lowest inorganic nutrient concentrations, while low cover is often found at high inorganic nutrient concentrations.*" Given the lack of correspondence between nutrient concentrations and algal mat coverage, or between increased algal coverage and decreased IBI scores, there can be no expectation that lower nutrient targets would result in less algal mat coverage, or a consequent increase in O/E or IBI scores.

The Draft TMDL linkage between algae and BMI metrics is based solely on co-occurrence of lower SC-IBI scores with elevated benthic algae coverage at non-reference sites. This evaluation ignores the fact that differences in O/E scores (which are more appropriate metrics than IBI scores for Malibu Creek) are better explained by their relationship to the Modelo formation than by mat algae coverage, nutrient concentrations, upstream imperviousness, or conductivity (see figures 8-12, 8-13, and 8-17 below). Note that although the Draft TMDL characterizes Las Virgenes Creek site HtB-LV-9 as a Modelo formation site, it is located at the upper edge of the formation and receives most of its flows from drainage above the Modelo formation. As a result, it may or may not be significantly influenced by the Modelo formation. Similarly, the Triunfo Creek location (TR-17) is characterized as a non-Modelo site, but receives much of its flow from the upstream Modelo formation drainage (Figures 4-4 and 7-1 of the Draft TMDL). When the

BMI metrics are evaluated based on the contributing drainages for the sites, the relationships between these metrics and the Modelo formation influence become clear and are more congruent than the relationships with nutrients, conductivity, or percent imperviousness.

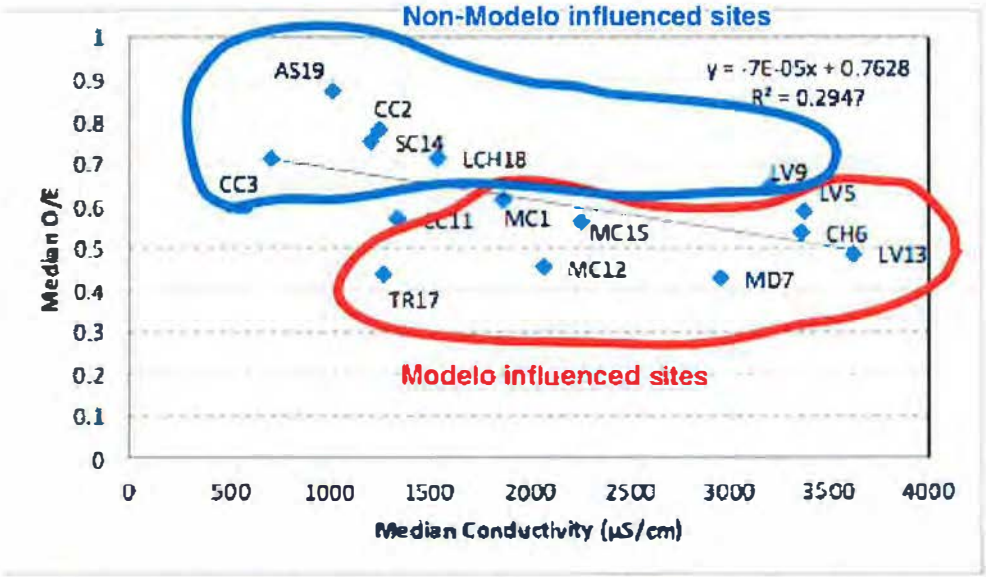

Figure 8-12. Correlation of Median O/E Scores with Median Conductivity.
Note: Sites with at least 5 observations, 2000 – 2010. Median shown for MC-1 combines LVMWD R-4 samples; median shown for MC-15 combines LVMWD R-13 samples.

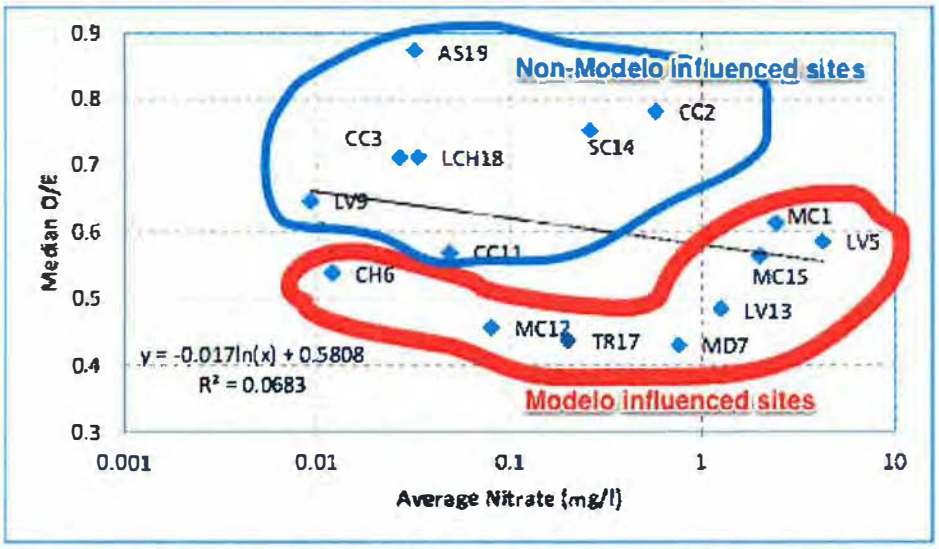

Figure 8-13. Correlation of Median O/E Scores with Average Nitrate-Nitrogen Concentration.
Note: Sites with at least 5 observations, 2000 – 2010. Median shown for MC-1 combines LVMWD R-4 samples; median shown for MC-15 combines LVMWD R-13 samples.

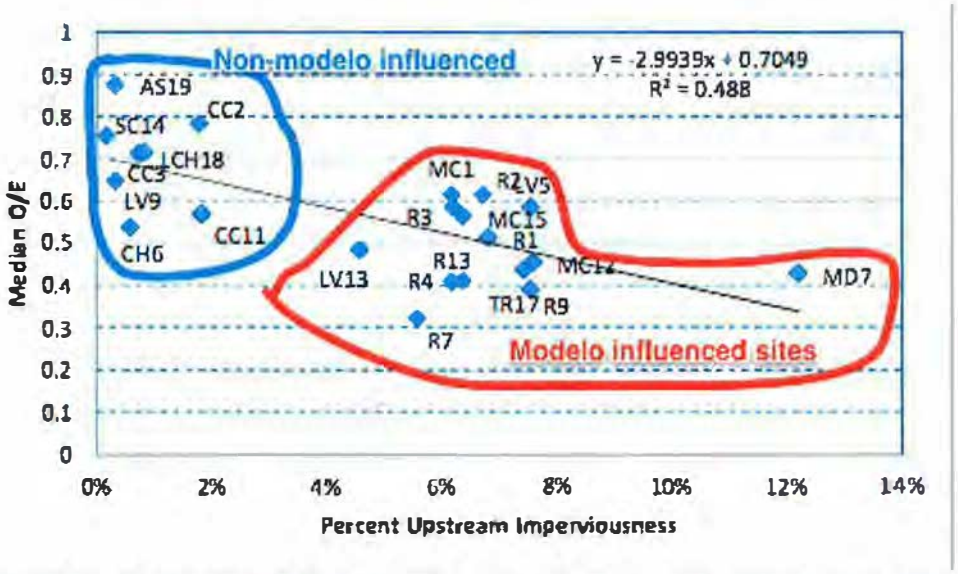

Figure 8-17. Correlation of Median O/E Scores with Percent Upstream Imperviousness.
Note: Sites with at least 5 observations, 2000 – 2010. Medianshown for MC-1 combines LVMWD R-4 samples; median shown for MC-15 combines LVMWD R-13 samples.

2.2.2 The Stressor Analysis contains inconsistencies and fails to consider other influences that could be having more impact than nutrients

In addition to the absent linkage between benthic algal coverage and BMI metrics, we are concerned with the stressor analysis that was conducted to determine nutrients are causing or contributing to benthic impairments.

First, the stressor analysis is primarily based on the SC-IBI scores. As will be discussed later in these comments, the SC-IBI is not considered suitable for the evaluating impairment. The Draft TMDL does provide an assessment of impairments based on both the SC-IBI and the O/E. However, as acknowledged in the Draft TMDL, the findings based on these two methods conflict. The O/E results do not "complement" the IBI as stated in the Draft TMDL – they suggest a *different* interpretation, i.e., that Malibu Creek benthic communities are less impaired than suggested by the SC-IBI. Although the O/E results are still imperfect, they likely represent a better characterization of Malibu Creek watershed conditions than the SC-IBI. Therefore, the O/E scores should take precedence over the SC-IBI scores. No analysis is provided to allow assessment of whether the watershed would continue to be impaired if the O/E analysis was used to assess impairment or whether the stressor analysis would have generated different results if the O/E scores were used.

In addition, the Draft TMDL dismisses or fails to consider other potentially significant limiting factors. Related to the influence of the Modelo formation, the authors found that… "sulfate acute and chronic standards were exceeded in approximately half of both the wet and dry samples." The authors cite analyses of Brown and Bay (2005) suggesting that sulfate and other dissolved salts (naturally elevated in drainage from the Modelo formation) were the likely cause of observed dry and wet weather toxicity, but do not conclude this was a significant stressor on BMIs. Elsewhere, the authors link benthic impairment to upstream development and urban runoff, but do not consider the potential effects of pyrethroid pesticides in runoff from urban and

residential area. These pesticides have been demonstrated to cause significant sediment toxicity in urban creeks (Weston 2010[3], 2005[4]) and although other urban source pesticides are considered and largely dismissed in the Draft TMDL, pyrethroid pesticides are not specifically considered at all.

Additionally, the Draft TMDL dismisses the impact of invasive species on the IBI scores because the impacts do not have a temporal relationship (i.e. the lower IBI scores were present prior to the observation of invasive species). However, invasive species are known to have significant impacts on the biological communities in a waterbody. As discussed in the SWRCB's workshop on biological objectives on January 23, 2013, reference sites known to have invasive species have been excluded from inclusion in the reference network as these species can confound evaluation of the biological results. Although invasive species may not have been present at all times when low IBI scores were observed, the current presence of invasive species could be contributing to the current biological community health and could be masking any improvements that have resulted from implementation of the 2003 Nutrient TMDL.

Finally, on page 2-7, the Draft TMDL states that the source of impairment in the Malibu Lagoon is hydromodification. If hydromodification is the basis for the impairment in the Lagoon, the impairment should be addressed by assigning the listing to Category 4c on the 303(d) list, and a TMDL should not be developed. The stressor analysis identifies hydromodification as a source of impairment, and the linkage between hydromodification and BMI impairment is stronger than the linkage between BMI impairment and algae or nutrients.

The stressor analysis also includes a number of inconsistencies and confusing statements that bring into question the conclusions of the analysis. On page 9.1.2, the analysis states that "for a causal pathway to be considered complete, a source must be present and linked to a stressor, which must then be linked with the resulting impairment." We feel that a number of the analyses presented do not provide this complete pathway or present conflicting statements. As a result, we feel Section 9 should be revisited to clarify and correct the inconsistencies and include further analysis of stressors as identified above. Some examples of these conflicting statements are summarized below.

- Page 9-10-"However the biological gradient evidence is weak, because the physical habitat scores are generally acceptable and do not appear to correlate with the SC-IBI scores. Evidence from the literature supports sedimentation as a plausible, but not specific stressor resulting in benthic macroinvertebrate community impairment. Other stressors elicit similar responses. No evidence is available to support predictive performance. Over the consistency of evidence for sedimentation causing biological impairment to Malibu Creek is most consistent." How do weak evidence relating to IBI scores, general literature information with no watershed specific evidence, and no evidence for predictive performance lead to sedimentation being a likely stressor? It appears the only basis for this conclusion is excess sedimentation being observed by Heal the Bay's Stream Walk

[3] Weston, D.P., and M.J. Lydy, 2010. Urban and Agricultural Sources of Pyrethroid Insecticides to the Sacramento-San Joaquin Delta of California. *Environmental Science and Technology* 44:1833–1840.

[4] Weston, D.P., R.W. Holmes, J. You, and M.J. Lydy, 2005. Aquatic toxicity due to residential use of pyrethroid insecticides. *Environmental Science and Technology* 39:9778-9784

observations that occur spatially with the impairment. However, this data is not provided for review and the methods for making the observations are not discussed.

- On page 9-17, most of the discussion regarding toxicity concludes that there is no linkage or weak linkages to toxicity being a stressor. However, the concluding sentence of the paragraph states that "Most of the evidence is consistent with toxicity as a causal factor of benthic macroinvertebrate impairment, and any inconsistencies can be explained by a credible mechanism." Then, later in the Draft TMDL, toxicity is eliminated from the possible causes. Also, the discussion in this section just focuses on selenium and sulfate when other possible sources of toxicity are discussed in other portions of the document. If other possible sources of toxicity were evaluated here, would the linkages change (i.e. the conclusion that the biological gradient is weak because reference sites also have high conductivity?). In general, the discussion of toxicity seems to be inconsistent throughout the document and therefore the conclusions of the stressor analysis regarding toxicity are unclear.

- On page 9-20, the Draft TMDL states "the strength of evidence supporting the causal pathway between increased sedimentation and reduced habitat quality leading to biological impairment is strong." This seems to contradict the statement on page 9-10 quoted above and the technical analysis in the Draft TMDL that the "biological gradient evidence is weak" for sediment. This statement is repeated again on page 9-21 and 9-22 under B2. Channel Alteration for Malibu Creek and Malibu Lagoon respectively and on page 9-26.

- On page 9-27, the third paragraph discusses the relationship between toxicity and urban runoff. The concluding sentence does not seem consistent with the information provided in the paragraph. The paragraph states that evidence is "incompatible", "inconsistent", and "weak" and the exposure pathway is incomplete. Yet the concluding sentence states that "The evidence supporting the relationship between urban runoff and increased toxicity is consistent". The concluding sentence should be modified to state there is not a relationship based on the evidence if the previous statements in the paragraph are correct.

- The Table on page 9-3 summarizing the results of the analysis does not seem to reflect the text or the results. For example, the same score (+) is given to all of the considerations for A1. Reduced Habitat from Sedimentation. However, the information provided for each consideration is different, with some indicating insufficient or incomplete information while others indicate clear relationships. As a result, they should not be all given the same score. The same situation occurs within the evaluation of A3. Reduced DO from Excess Algal Growth or Oxygen-Demanding Wastes. Additionally, how is a score of +++ given to Consistency of Evidence for B1. Altered Hydrology when none of the scores above are higher than + other than the literature analysis? Finally, the summary in this table does not seem to match the conclusions of the stressor analysis that were used as the basis for the Draft TMDL. For example, the Table lists toxicity as the only stressor with "actual evidence" of impacts to benthic communities.

Finally, we have concerns about the methodology utilized to conduct the stressor analysis. It is our understanding that EPA utilized existing causal assessment tools, specifically the Causal Analysis/Diagnosis Decision Information System (CADDIS). It is important to acknowledge that the same Technical Team assembled by the SWRCB to develop the scoring tools for the Biological Objectives also conducted a pilot study to evaluate the efficacy of using the CADDIS causal assessment tool to identify causes of suspected BMI impairments in California. Their overarching conclusion was that for streams exposed to chronic and systemic stressors, CADDIS was only marginally useful in being able to rule out potential causes, and was wholly inadequate in identifying the causes of BMI impairments.[5] As a result, the Draft TMDL's reliance on this approach to determine that lower concentrations of nutrients are required is premature.

2.2.3 The Draft TMDL relies on potentially unmeaningful percent cover data to support its designation of nutrients as a stressor for benthic invertebrates.

Percent cover data, as currently generated in California, is not a meaningful metric for evaluating the extent or nature of benthic algal colonies, and by extension, effects on benthic invertebrates. By relying on percent cover data from Heal the Bay (and by reference, to information in a report prepared for Heal the Bay by Luce and Abramson (2005),and in Busse et al. 2003), the Draft TMDL fails to provide evidence that benthic algae occurs at levels in the Malibu Creek Watershed that would influence benthic invertebrate community composition.

There is no official or standardized method for generating scores for percent cover of benthic algae for stream sites in California. The California Surface Water Ambient Monitoring Program (SWAMP) SOP for collecting stream algae samples[6], provides a scheme for characterizing the presence and thickness of microalgae (e.g., diatom films) at positions along sampling transects, and presence (but not thickness) of macroalgae (e.g., filamentous forms like *Cladophora*), but provides no recipe for converting the scores obtained during point/intercept transects into aggregate site percent cover values that are quantitatively or ecologically meaningful.

Specifically, the SWAMP SOP (and associated official field form[7]) merely requires the field crew to indicate presence or absence of *macro*algae (e.g., filamentous algae) at several points in the stream, and to assign one of several codes related to *micro*algae (e.g., diatoms) as shown in Figure 2 and Figure 3. Procedures for assigning an overall percent cover score for benthic algae for the sampling reach are left entirely to the discretion of the investigator. There is no SWAMP protocol for converting the information from the field form into a site-based metric for percent cover of any kind, much less one that is ecologically meaningful.

In practice, it is not uncommon for investigators using the SWAMP SOP to generate a percent cover score for a whole sampling reach by counting transect positions that received any one of

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[5] Science Advisory Group Meeting. October 17, 2013. Technical Team Causal Assessment Update Presentation. http://www.waterboards.ca.gov/plans_policies/docs/biological_objective/101712_meeting/four_caddis_overview.pdf

[6] Fetscher, A.E., L. Busse, P.R. Ode. 2010. Standard Operating Procedures for Collecting Stream Algae Samples and Associated Physical Habitat and Chemical Data for Ambient Bioassessments in California. SWAMP Surface Water Ambient Monitoring Program Bioassessment Procedures 2010.

[7] Available at http://swamp.mpsl.mlml.calstate.edu/resources-and-downloads/database-management-systems/swamp-25-database/templates-25/field-data-sheets#BAFieldData, accessed January 17, 2013.

the SWAMP codes 1-5 for microalgae, and/or a code of "P" (for "present") for macroalgae, and then dividing the resulting number of benthic algae "hits" by the total number of positions evaluated in the sampling reach. In other words, substrates colonized by inches-thick layers of diatoms would contribute equally to a percent cover score as substrates that feel "slimy", but have no visible algae. In addition, positions occupied by a foot-thick mattress of filamentous algae would contribute equally to a percent cover score as positions where a single strand of filamentous algae drifts back and forth in the current below the measuring tape.

Using this common approach, a reach could technically receive a 100% cover score for microalgae if the rocks or other substrates encountered at transect positions all "felt slimy", but had no visible algae! Clearly, this is an inadequate measure of the potential for beneficial use impairment, as stream surfaces are naturally colonized with micro- and macroalgae to some extent in even the most pristine conditions.

The same issues apply to the determination of percent floating algae; any thickness of floating algae encountered at a transect point is commonly assigned an equivalent and indiscriminant "present" score. Consequently, a 100% cover score for floating algae for a site could indicate that the sampling reach was uniformly covered by a stationary, thick, suspended mat of filamentous algae, or that thin wisps of algae happened to drift over the measurement point while the investigator was looking down at the substrate.

None of the customary procedures for deriving site values for percent cover (regardless of whether the data were obtained using the SWAMP field data form, or EPA or State draft protocols that preceded the SWAMP SOP) would produce percent cover values that are consistent with the type of coverage targets in the 2003 Nutrient TMDL, which dictated that percent cover of floating algae be determined on the basis of algal filaments > 2 cm *in length*, and that bottom algal coverage be determined on the basis of "diatoms and blue-green algae mats" > 0.3 cm in thickness, expressed as seasonal means. Note that the second criterion most closely resembles the "3" category in the SWAMP scheme, and yet it is common practice to include transect scores as low as "1" when computing percent cover.

Table 4
Microalgal thickness codes and descriptions (adapted from Stevenson and Rollins 2006).

Code	Thickness	Diagnostics
0	No microalgae present	The surface of the substrate feels rough, not slimy.
1	Present, but not visible	The surface of the substrate feels slimy, but the microalgal layer is too thin to be visible.
2	<1mm	Rubbing fingers on the substrate surface produces a brownish tint on them, and scraping the substrate leaves a visible trail, but the microalgal layer is too thin to measure.
3	1-5mm	
4	5-20mm	
5	> 20mm	
UD	Cannot determine if a microalgal layer is present	
D	Dry point	

Figure 2. The Scheme for Scoring Microalgae in the SWAMP Algae Protocol.

Transect Substrates										
Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes	**Microalgae Thickness Codes** 0 = No microalgae present. Feels rough, not slimy; 1 = Present but not visible, Feels slimy; 2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail. 3 = 1-5mm; 4 = 5-20mm; 5 = >20mm; UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code). D = Dry, not assessed
Left Bank					P A		P A D	P A D	P A D	
Left Center					P A		P A D	P A D	P A D	
Center					P A		P A D	P A D	P A D	
Right Center					P A		P A D	P A D	P A D	
Right Bank					P A		P A D	P A D	P A D	
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)									

Figure 3. Portion of SWAMP stream habitat characterization form (dated Jan. 9, 2012) for recording point-intercept scores for presence/thickness of microalgae and presence (but not thickness) of macroalgae. Form contains no standardized procedure for converting data to an overall percent cover score

The only percent cover data the Draft TMDL presents is from Heal the Bay, from a total of three sites from the Malibu Creek watershed, as follows:

Table 8-13: 5-year averages for percent cover for floating and mat algae for 2 sites (Sites 1, 12)

Figure 8-18: Time series of floating algae percents for Sites 1 and 12

Figure 8-19: Time series of algal mat coverage for Sites 1 and 12

Figure 8-20: Box plots for 5 sites (time frame not revealed); 3 sites in the Malibu Creek watershed (Sites 1, 12, and 15) and 2 sites outside of the Malibu Creek watershed (Sites 14 and 18)

Figure 8-21: Scatter plots with inorganic N or inorganic P on the x-axis and mat algal coverage on y-axis (with no indication of the sites or years included)

No source is cited for the data (report, website, methodology) that would allow a critique of the methodology used to generate the data (was it visual estimation or point-intercept? were all thicknesses or lengths treated equally? did the procedures produce percent cover data that match the definition in the 2003 Nutrient TMDL? are the data meaningfully interpreted as a proxy for benthic invertebrate impairment?). We have reason to believe that the Heal the Bay data were obtained using visual estimates. If true, the data are subjective, not truly quantitative, not suitable for comparing to TMDL targets, and should not be used as evidence for impairment of benthic invertebrate habitat.

In the section of the Draft TMDL where percent cover data from Heal the Bay is presented, the Draft TMDL also discusses a report prepared by Luce & Abramson (2005), who apparently performed statistical analysis of percent cover data from Heal the Bay sites, and related it to nutrient concentrations. However, the methods description in this report indicates that the field work was not conducted using SWAMP-comparable procedures, that the percent cover values

were assigned irrespective of the magnitude (i.e., thickness or length) or taxonomic nature (macro- or micro-algae) of benthic algae, and that the data are not compatible with the targets as specified in the 2003 Nutrient TMDL:

> *"Algal Cover Survey*
> *We conducted monthly line-intercept surveys for periphyton cover at each site at the time of water chemistry sampling. In these surveys, we did not distinguish between macroalgal periphyton and the diatom layer (diatoms). We stretched a tape measure across the wetted width of the stream along two separate transects that represented periphyton conditions at the site. For each transect we recorded the length that had macroalgal or diatom cover and calculated a percent cover, then averaged the two measurements."* (Luce & Abramson 2005, p. 6)

and later, for semi-annual surveys:

> *"We recorded presence of macroalgal and diatom cover separately at each point across the transect, and calculated the proportion of points that had cover, to obtain the percent cover of each type of algae...We measured areal cover of macroalgae and diatoms rather than biomass, so we did not distinguish between thin and thick covers of periphyton."* (p. 7-8)

Finally, we understand from conversations with USEPA staff that percent cover data in Busse et al. (2003) was influential in the conclusion that percent cover targets are not being attained in the watershed since the 2003 TMDL was adopted. This would not be a logical approach, because the data were collected prior to the adoption of the 2003 TMDL, and do not bear upon arguments related to the suitability of the nutrient targets in the 2003 TMDL. In addition, the percent cover data tabulated in Busse et al. (2003) (which is not presented in the Draft TMDL or discussed in detail) is also not consistent with the targets defined in the 2003 Nutrient TMDL, is categorized using single genera of algae, and is not stratified into thickness or length categories.

2.2.4 The Draft TMDL fails to determine that nutrients are related to percent cover of algae

The Draft TMDL fails to make the case that TN and TP are related to percent cover of algae in the Malibu Creek Watershed. The Draft TMDL appears to "pick and choose" pieces of information about percent cover and nutrients to make the case that there is a direct relationship, in almost an anecdotal fashion. For example, in one place the Draft TMDL will describe spatial patterns in nutrients, generally speaking (e.g., in the "trends" narratives in Section 7), and in other places describe spatial patterns in percent cover, generally speaking (e.g., in Section 8), and then conclude elsewhere in the document (e.g., in the Linkage Analysis) that the disparate data sets provide evidence for a predictive relationship between nutrients and algal coverage. The only statement describing paired nutrient data (of any kind) and algal coverage data *for any particular site* is qualitative, and concerns the wrong nitrogen parameter (nitrate-N):

"Indeed, MC-12 concentrations [of nitrate-N] have not been noted in excess of the 1 mg/L target, yet mat algal coverage remains high." (Draft TMDL, p. 7-17).

The circuitous arguments in the Draft TMDL are directly contradicted by the only analysis of paired nutrient and percent cover data in the Draft TMDL. In Figure 8-21, scatterplots are presented relating inorganic N or P, and percent cover of mat algae. The scatterplots (and correlation coefficients) show no significant relationships. The ability to generate a line with any

slope at all in the N vs. algae plot is likely driven by a single point anchoring the regression line in the upper right quadrant of the plot. The Draft TMDL does not provide the statistical parameters needed to indicate whether the slopes of the regressions were significantly different than zero, but inspection of the figures indicates that if even an extremely weak relationship exists, is not ecologically meaningful. The Draft TMDL acknowledges the lack of the relationship as follows, but chooses to speculate that maybe things would be different if data for TN or TP were available:

> *"An examination of all the Heal the Bay mat algae coverage data shows that there is almost no correlation between algae coverage and either inorganic N or inorganic P concentrations (Figure 8-21). Notably, 100 percent cover can occur at the lowest inorganic nutrient concentrations, while low cover is often found at high inorganic nutrient concentrations. In part, this may reflect control by light limitations and other factors; however, it also suggests that inorganic nutrient measurements may not provide a good indication of algal growth potential; instead total nutrient concentrations may be better at providing an indication of primary production"* (Draft TMDL, p. 8-36)

Speculation regarding the ability of TN or TP to predict algal biomass cover is a poor basis for establishing specific numeric targets for TN and TP to address benthic invertebrate index scores. The Draft TMDL makes other acknowledgements of a weak link between nutrients and algal percent cover in the Malibu Creek Watershed:

> *"SCCWRP (Busse et al., 2003) performed a detailed examination of algal conditions in 2001 and 2002, including measurements of benthic chlorophyll a densities, and concluded that most developed sites in the Malibu Creek watershed had chlorophyll a concentrations that "exceed suggested thresholds for acceptable levels.' At most sites, algal biomass was not limited by nutrients, but rather by light availability and water current."* (Draft TMDL, p. 8-33)

2.2.5 Benthic Algal Biomass in the Malibu Creek Watershed does not Appear to be Related to Nutrient Concentrations

Using data from Appendix F, observed concentrations of benthic algae are plotted by the corresponding water column Total Nitrogen (TN) concentrations in Figure 4. The 150 mg/m^2 benthic algae target is called out on the figure. Five of the observations are below the algae target, and these five sites correspond to water column TN concentrations spanning the entire range in the dataset (from 0.7 to 3.8 mg/L). The corresponding plot for Total Phosphorous (TP) is presented as Figure 5; sites with benthic algae less than 150 mg/m2 have water column TP ranging from less than 0.1 mg/L to greater than 0.3 mg/L. Based on the paired data for TN and benthic algal biomass collected in the Malibu Creek Watershed, there does not appear to be a relationship between benthic algal chlorophyll-*a* concentrations and water column total nutrient concentrations.

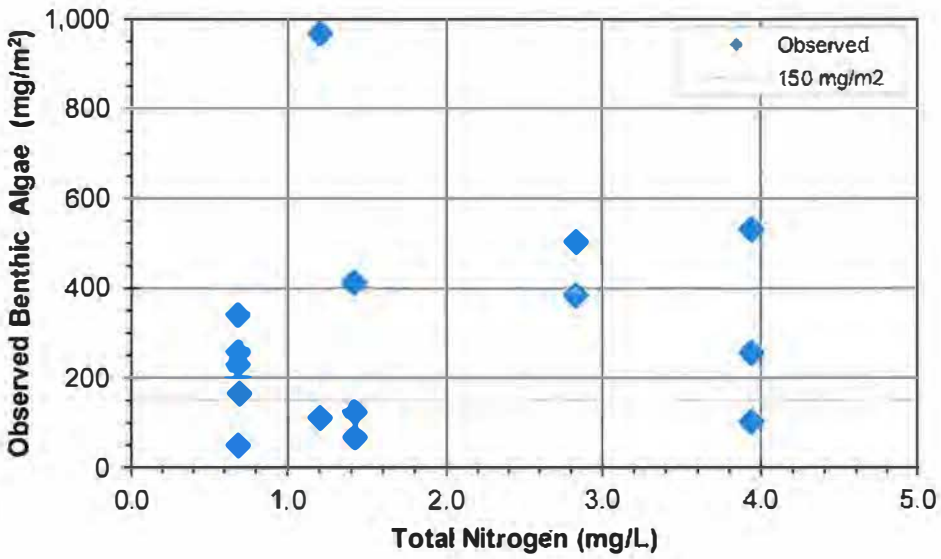


Figure 4. Measured Benthic Algae Concentration plotted at Corresponding Total Nitrogen Concentration.

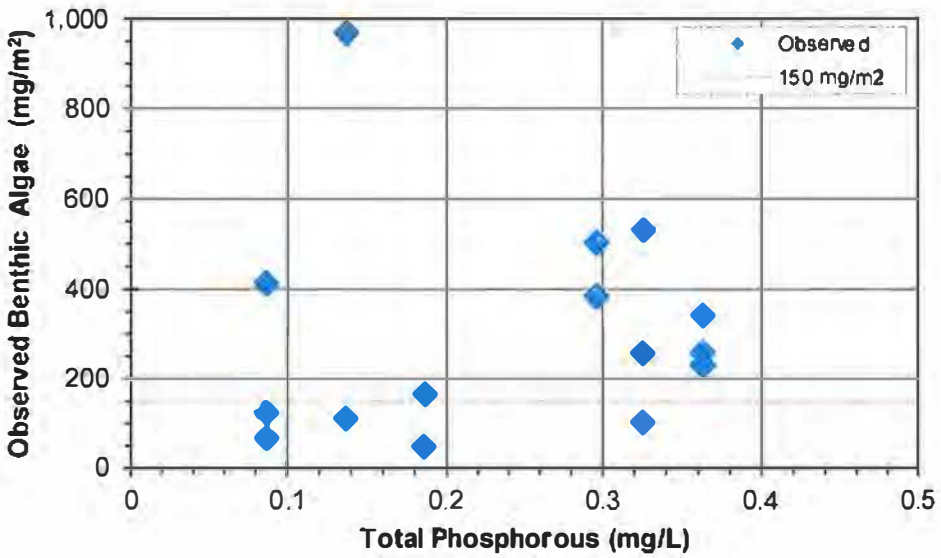


Figure 5. Measured Benthic Algae Concentration plotted at Corresponding Total Phosphorous Concentration.

Nutrients also fail to correlate to algal biomass in the watershed when algal biomass is evaluated using AFDW. Using information in Appendix F, one observes that where there is a high degree of canopy cover, the ratio of chlorophyll-a to ash free dry weight (AFDW) is higher. The pertinent data from Appendix F are plotted in Figure 6. The relationship makes sense because when there is less available light, algae produce more chlorophyll per unit mass of algae. AFDW

is a more appropriate metric for algal biomass targets, because it is a measurement of the mass of algae, whereas the chlorophyll-a is a measure of the chemical used by the algae to convert light into energy. Where there is a high degree of canopy cover, the chlorophyll-a measurement may be high, but the physical amount of algae (measured as AFDW) may be acceptable.

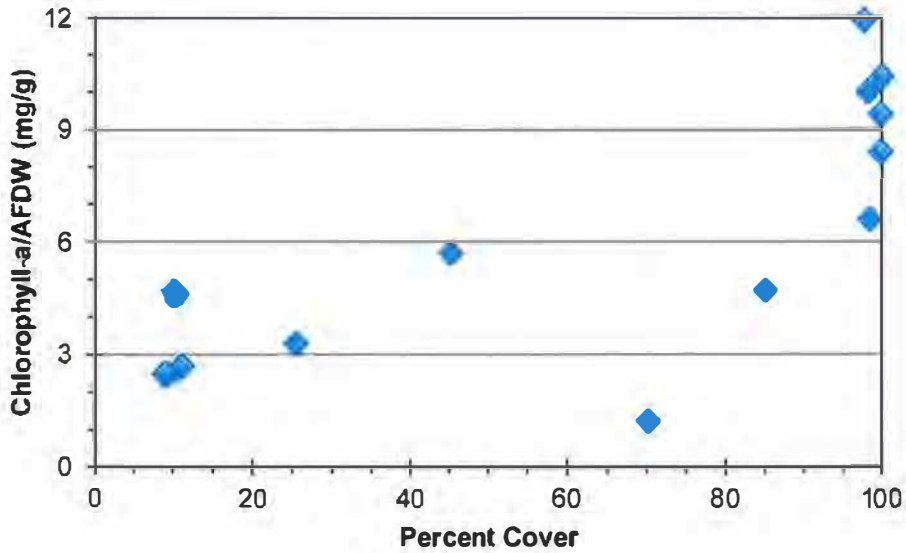


Figure 6. Ratio of Measured Chlorophyll-a to Ash Free Dry Weigh at the corresponding Percent Canopy Cover.

In Figure 7, algal biomass, as AFDW, is plotted by the corresponding water column TN concentrations for Malibu Creek Watershed using data from Appendix F. Over the entire range of measured TN, there are values for AFDW below the 60 g/m^2 target. In other words, there is no obvious relationship between water column TN and the amount of algae present.

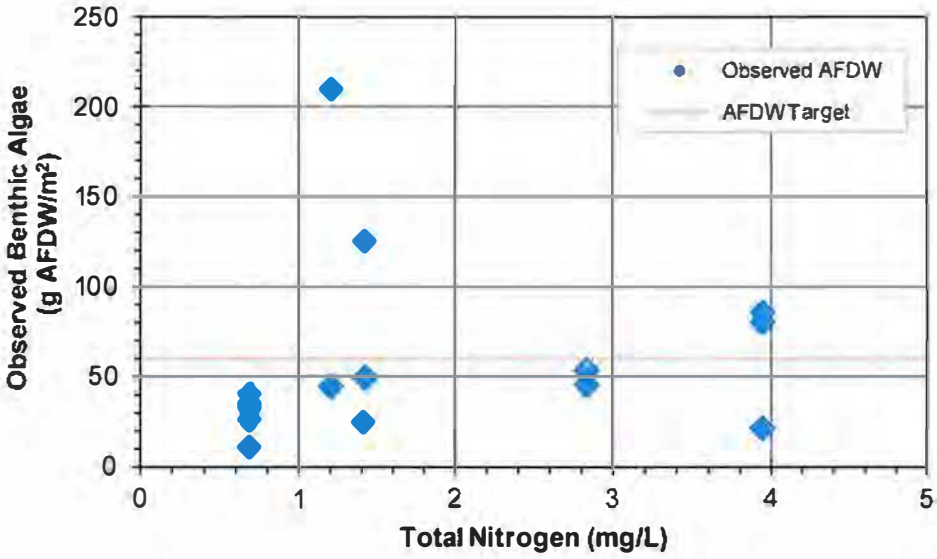


Figure 7. Benthic Algae Concentration as AFDW plotted at the Corresponding Water Column Total Nitrogen Concentration. The red line indicates the value for AFDW that corresponds to the proposed algal biomass target of 150 mg chl.-a/m2, assuming a ratio of AFDW/chl.a = 2.5.

2.3 The Analysis to Justify the Use of the NNE Tools as a Basis for Lowering the Nutrient Targets is Flawed Comment 6-10

For the Draft TMDL, it is stated that a nutrient numeric endpoint (NNE) technical document is being prepared for the Malibu Creek Watershed. The draft NNE document is listed as a reason it is necessary to set nutrient allocations lower than the 2003 Nutrient TMDL currently in effect. On page 2-3, the Draft TMDL states that a Draft NNE document specific for Malibu Creek Watershed is being developed that provides strong evidence that the nutrient limits from the 2003 TMDL should be revisited. This draft work product is also referred to on page 1-3 as follows: *"Based on this draft NNE document specific for Malibu Creek Watershed an other additional monitoring in Malibu Creek and Lagoon, there is strong evidence that the nutrient limits should be revisited."* However, the Draft NNE document is not available for review, not included in the information provided for evaluation of the Draft TMDL, and should not be used as justification for revising the 2003 numbers.

Regardless of whether a Draft NNE document is under development, the use of the NNE modeling tools as justification for requiring lower nutrient allocations is premature given that the State's Nutrient Policy is not yet developed. Additionally, we have concerns about inherent biases and other technical issues with the NNE spreadsheet tool that were used to conduct the analysis, as outlined below.

The NNE Benthic Biomass Predictor spreadsheet tool (BBT) was developed largely from the data compiled by Dodds (1997, 2002, corrected in 2006). The regressions developed by Dodds are used to calibrate the "Standard", "Revised", and "Revised with Accrual "models within the BBT. Thus the variability present in the Dodds datasets is built into all of the BBT submodels. Based on the 95% confidence interval surrounding the regression lines predicting chlorophyll-a

from nutrient concentrations derived by Dodds, the 95% confidence interval associated with a chlorophyll-a "target" of 150 mg/m^2 is approximately 40 to 2,100 mg chl.-a/m^2. The observed algal biomass in the Malibu Creek Watershed ranges between 50 and 1,000 mg chl.-a/m^2. The inherent accuracy of the underlying nutrient/algal relationships incorporated into the BBT is not sufficient to determine if there are algal or nutrient impairments in the watershed (or really any watersheds). In fact, based on the poor precision of the BBT, and because the measured algal biomass in the Malibu Creek Watershed is within the BBT's 95% confidence interval for the 150 mg/m^2 prediction, the conclusion could be that the watershed is not impaired for algae.

The BBT also produces biased nutrient predictions owing to its treatment of incident solar radiation. When considering the available solar insolation, the original QUAL2K model (not the borrowed equation sets incorporated into the BBT) recognizes that not all light from the sun is available for photosynthesis. In the original QUAL2K documentation it is stated that 47% of the solar insolation is photosynthetically available radiation (PAR). The original QUAL2K model converts solar insolation to PAR when calculating algal growth. The BBT does not convert solar insolation to PAR, and are therefore flawed because they use too much light and therefore predict too much algae. The steady state equations in the BBT use the average light intensity to calculate growth, which corresponds to a condition of continuous (24-br) light available for growth. In reality, during the night there is no light available for growth, which if accounted for in the model, would result in lower algal biomass predictions. The net result is that the BBT over estimates algal biomass, due to the flawed implementation of available light.

Another source of bias in the BBT is its treatment of temperature. The original QUAL2K model documentation notes that all temperature dependent reaction rates are modified by the Arrhenius relationship. However, even though the BBT documentation notes that respiration and death rates are temperature dependent, respiration and death rates are not adjusted for temperature in the BBT spreadsheet. The net effect is that when the water temperature is greater than 20°C, the BBT over estimates algal biomass. At 30°C, the algal biomass predicted by the BBT is double what it would be if the temperature was correctly implemented. Because of the error in BBT implementation, the predicted levels of algae are incorrect, when the temperature is not 20°C, and is the reason, for example, why the BBT models calculate a relatively low algae concentration for the Las Virgenes, Multiple 2, sun run site when the water column nutrient concentrations are high.

In addition, the models within the BBT were developed using seasonal average nutrient water column concentrations to calculate the seasonal average or seasonal maximum benthic algal concentration. Instantaneous water column nutrient concentrations, instead of seasonal average concentrations, are used in the Malibu NNE analysis to predict season maximum algal biomass, instead of seasonal average concentrations. The BBT is not being used correctly for the Malibu Creek Watershed in the NNE tool analysis.

Finally, the results of the NNE analysis in Appendix F do not accurately reflect the observed conditions in the watershed. Modeled algal biomass from Appendix F is compared to the observed algal biomass in Figure 8. In the modeling presented in Appendix F, is it stated that the ratio of chlorophyll-a to AFDW was taken into account for each individual site. In the figure, a perfect match between model and observation would result in all points plotting on the horizontal line at 1.0. At high benthic algae concentrations, the model appears to be within 50% of the measured concentrations, at lower benthic algae concentrations, the model appears to be heavily

biased high. For the observations under the 150 mg/m^2 chlorophyll-a target, the BBT over-predicts the algal biomass by up to 320%. Using the BBT may indicate more impairment than is actually present in the watershed.

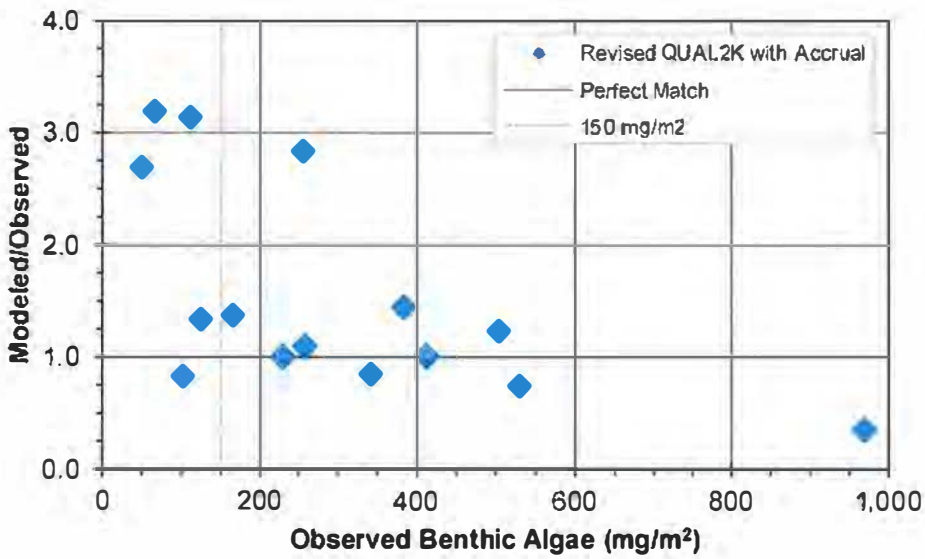


Figure 8. Ratio of Modeled Predicted to Observed Benthic Algae Concentrations Plotted to the Corresponding Observed Concentrations.

2.4 Reference Condition Calculations are Unclear and Do Not Account for Natural Watershed Conditions Comment 6-11

The Draft TMDL lacks transparency regarding how the specific TN allocations were derived. On page 7-24, the Draft TMDL states:

"In sum, evidence to date indicate that natural reference conditions for the Malibu Creek watershed have a central tendency for the summer period of between 0.52 - 0.67 mg/L total N" (Draft TMDL, p. 7-24)

No actual explanation for how this range was derived is provided in the Draft TMDL. Inspection of Table 7-11 that accompanies this text in the Draft TMDL suggest that this range was created by pairing the Level 3 Ecoregion recommendation of 0.518 (which would round up to 0.52) and the value listed for Cold Creek (0.67). Later, on page 10-8, the Draft TMDL claims that data from nine reference sites were used to derive the TN target for the Draft TMDL, but the sites and associated data are not revealed, nor is the calculation explained. Finally, no explanation is provided for how any of this information was used to compute summer and winter TN allocations of 0.6 and 1.0, respectively. Consequently, stakeholders are unable to evaluate the appropriateness of the reference site data that was relied upon, or the calculations that were used.

Additionally, information provided in Table 7-11 shows much higher concentrations, above those currently in the 2003 Nutrient TMDL, for sites draining the Modelo Formation. Although

the identified site may have some issues that make it inappropriate for consideration as a reference site, the fact that reference conditions within the Modelo formation were not considered as part of the analysis for the watershed is inappropriate. It is our understanding that other data are available that could have been evaluated to determine reference conditions. In particular, other National Park Service (NPS) water quality data were available to the EPA, but were not included in Draft TMDL analyses (see LVMWD 2011)[8]. The NPS data would have been particularly informative because of the many sites are in undeveloped headwaters.

2.5 Basis for adding wet season requirements is not justified and the allocations should remain seasonal with significantly higher numbers in the winter season Comment 6-12

In general, the Draft TMDL does not provide sufficient justification for including winter season or wet weather allocations within the Draft TMDL. The only statements we could find to justify winter allocations were in the Critical Conditions section on page 10-13 and a few references to the need for year round dry weather and wet weather targets in Section 9. Section 10 states that Malibu Lagoon is most sensitive to nutrient loads delivered during winter storms and stored within the estuary and that year round nutrient concentrations during dry weather are needed to protect the Creek. We have concerns with these statements as the Draft TMDL does not provide any evidence to justify them.

- The Draft TMDL does not lay out its evidence for wintertime exceedances of algal percent cover, or for a circumstantial relationship between algal percent cover and wintertime TN or TP concentrations. Algal percent cover data is not evaluated on a seasonal basis in the Draft TMDL, nor is there any direct comparison of TN or TP concentrations and wintertime percent cover for specific locations. As discussed previously, we were able to obtain a copy of an excel file from USEPA containing the algal percent cover data that was considered in the Draft TMDL. Precipitation data from the watershed was obtained to determine if data were collected during wet weather exceeded the 2003 Nutrient TMDL algal percent cover targets. Only two out of nine observations since 2006 have exceeded 60% during a wet event or within three days of a rain event. During the wet season, some observations were seen above the 2003 Nutrient TMDL algal percent cover targets throughout the watershed, but not in the tributaries downstream of the Ventura County MS4s.
- The Draft TMDL does not explain how in-stream concentrations of nutrients during storm runoff events impairs habitat for benthic invertebrates in the streams. In fact, on p. 8-33, winter scour is cited as reducing periphytic algae based on 20 years of data in Byron & DuPuis (2002).
- The Draft TMDL does not explain how nutrients in storm runoff that are captured by upstream lakes and reservoirs contribute to a benthic invertebrate impairment in the lagoon. As discussed previously, the dams are likely to limit the discharges from Ventura County MS4s that will reach the lagoon.

[8] Las Virgenes Metropolitan Water District (LVMWD). 2011. Water Quality in the Malibu Creek Watershed, 1971-2010. LVMWD Report #2475.00.

- By requiring that all stream reaches attain reference concentrations during wet and dry weather between Nov-Apr, the Draft TMDL does not recognize that part of the wintertime load of nutrients reaching the main stem Malibu Creek (even nutrients derived from open space) is exported to the ocean. The Draft TMDL states that:

  "Natural breaching of the Lagoon barrier would occur primarily in response to winter storms. Alterations to the hydrology of the system have affected this natural cycle. Extensive use of imported water in the basin has extended flows into the dry season, which, in conjunction with reduced storage in the Lagoon, tends to result in overtopping of the beach during the summer. To prevent flooding, mechanical breaching of the beach during summer has been used." (Draft TMDL, p. 6-10)

  "However, increased flows during the natural dry season have overtopped the beach barrier and opened the Lagoon to ocean waters. While these increased flows may help scour out accumulated sediments, the timing of the events may conflict with lagoon benthic macroinvertebrate phenology." (Draft TMDL 9-21)

  If beach overtopping is occurring during the summer, it seems reasonable to expect that water is exported from the lagoon to the ocean during wet weather. Requiring reference condition concentrations to protect the lagoon from winter loadings that do not all remain in the lagoon is inappropriate.

- The Draft TMDL does not make the case that replicating nutrient concentrations (or other conditions) from reference reaches will attain desired levels of algal percent cover. The Draft TMDL concludes that percent cover is much lower at reference sites than in the Malibu Creek main stem. However, the only data to support this conclusion in the Draft TMDL (in Figure 8-20) is for two sites that are outside of the watershed, and the data are not stratified by season. Monitoring at sites within the watershed has not occurred since 2003 according to the excel file provided by USEPA.

- The Draft TMDL does not explain what has changed since USEPA previously disputed the need for low wintertime targets in the watershed. In response to comments on the 2003 Nutrient TMDL, EPA stated:

  > *"We do not think it is appropriate at this time to impose summer time targets to the winter time because there are uncertainties associated with the 1) extent of impairment in the winter 2) the relationship between nutrient concentrations and algae in the winter and 3) the relationship between winter nutrient loads and sediment. EPA has opted to apply the existing concentration-based standard to the wintertime conditions along with a margin of safety which will result in a substantial reduction in the annual nitrogen loadings to the system. We believe that this approach is appropriate given the uncertainties noted above."*

  None of these uncertainties have been addressed by this Draft TMDL sufficiently to justify adding winter targets at this time. As shown above, several of the uncertainties, such as the relationship between algae and nutrient concentrations, remain.

In essence, the selection of new wintertime targets in the Draft TMDL appears to be driven by a desire to impose newly available reference reach concentrations (not necessarily even from the Malibu watershed) as watershed-wide WQOs (albeit with a little "wiggle room") merely because new data are available, but not because there is compelling evidence that new, lower wintertime targets for dissolved or particulate nutrients are necessary to protect beneficial uses for benthic invertebrates in the main stem of Malibu Creek.

- The NNE Benthic Biomass Predictor Tool (BBT) is not suitable to evaluate the role of wet-weather nutrient loads on algal biomass. The BBT uses seasonal average input to calculate seasonal average benthic algal density and season maximum benthic algal density, and was built and calibrated using seasonal data from other systems. The BBT has no mechanism to model wet-weather events. As a result, the NNE analysis performed for Malibu Creek Watershed cannot be used as justification for the need for wet weather allocations.

- Other California Nutrient TMDLs for streams (with estuaries) that were recently developed following the NNE approach recognize the weak link between wet weather nutrient loads and algal-related impairment. These TMDLs assign sensible wet weather allocations to MS4 Permittees and non-point sources that are substantially higher than summer – or dry weather - allocations, and establish the wet weather allocations as limits for nitrate-N, not TN. The Salinas River nutrient TMDL[9] assigns a numeric target of 8.0 mg/L nitrate-N (expressed as a maximum of wet season samples) to all reaches during Nov.1-Apr. 30. The recently adopted Ventura River Algae TMDL[10] assigns year-round wet weather allocations for MS4 permittees, agriculture, and livestock sources of 5-10 mg/L nitrate-N, depending on the reach.

2.6 The proposed nutrient targets and allocations are unachievable with available technology Comment 6-13

The Draft TMDL proposes numeric targets for total nitrogen of 0.6 mg/L during the summer and 1.0 mg/L during the winter and total phosphorous of 0.1 mg/L year round. As discussed in Attachment C, although structural and non-structural best management practices for treatment of MS4 discharges are capable of reducing TN and TP discharges, they cannot reliably result in consistent reductions that will achieve the proposed targets and allocations under all conditions

[9] California Regional Water Quality Control Board, Central Coast Region, Resolution NO. R3-2013-0008 Amending the Water Quality Control Plan for the Central Coast Basin to Adopt Total Maximum Daily Loads for Nitrogen Compounds and Orthophosphate in the Lower Salinas River and Reclamation Canal Basin and the Moro Cojo Slough Subwatershed.

[10] California Regional Water Quality Control Board, Los Angeles Region, Amendment to the Water Quality Control Plan – Los Angeles Region to Incorporate the Total Maximum Daily Load for Algae, Eutrophic Conditions, and Nutrients In the Ventura River and its Tributaries, Adopted by on December 6, 2012.

year round. In particular, achieving treatment of wet weather flows under all conditions as required by the Draft TMDL would likely be infeasible.

A TMDL should not be adopted that from its outset is not attainable within the limits of technology. One of the main goals of the Clean Water Act, namely the goal of fishable/swimmable waters, clearly recognizes that this goal may not always be attainable. (33 U.S.C. §1251(a)(2)(limited to "where attainable").) Thus, EPA should not adopt TMDLs that have demonstrably unattainable goals and targets as outlined in Attachment C.

3 BENTHIC MACROINVERTEBRATE TARGETS AND IN-STREAM ALLOCATIONS SHOULD BE REMOVED

We feel that EPA is going beyond its authority by setting targets and allocations for BMI in the Draft TMDL. Additionally, the State Water Resources Control Board (SWRCB) is actively engaged in the development of the Biological Objectives for the State of California. The Draft Benthic TMDL sets targets and allocations for BMI that are inconsistent with and arguably contradictory to the direction in which the biological objectives process is going. While we recognize that the policy is still under development, the State has made some determinations and developed scientific information that are relevant and were not considered as part of the Draft TMDL development. These elements include:

1. The SC-IBI is not appropriate for setting biologically based objectives due to the lack of appropriate reference sites and conditions for many locations in California, including the Malibu Creek watershed.
2. The scientific advisory group for the biological objectives is currently recommending that a multi scoring tool approach be used that does not rely solely on one index (such as the O/E).
3. The science advisory group is recommending consideration of a "grey area" for setting thresholds for biological objectives within which additional data would be collected before determining whether an impairment exists.

Finally, the analysis in the Draft TMDL is based on reference conditions that do not adequately represent the conditions in the Malibu Creek watershed, particularly the presence of the Modelo formation.

Consequently, the Draft TMDL should simply remove the numeric IBI and O/E targets in the Draft TMDL and defer setting biologically based targets until the policy and an appropriate approach have been established.

3.1 Establishing BMI Targets and Allocations are Outside of EPA's Authority

Comment 6-14

We feel it is inappropriate to include targets for benthic macroinvertebrates in the Draft TMDL, since they are not pollutants as defined under the Clean Water Act. The US District Court for the Eastern District of Virginia recently ruled that EPA exceeded its authority in establishing a

flow-based TMDL[11]. This case ruled that EPA cannot use surrogates in place of regulating pollutants. According to the case, EPA is charged with "establishing TMDLs for appropriate pollutants; that does not give them the authority to regulate nonpollutants." The term "pollutant" is defined in the CWA as "dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water." 33 U.S.C., § 1362(6). Benthic macroinvertebrates are not defined as pollutants by the Clean Water Act. However, there are benthic macroinvertebrate targets in the Draft TMDL and those targets are additionally assigned as in-stream allocations that are required to be included in the NPDES permits for dischargers. On page 10-13, the Draft TMDL states *"The biological response numeric targets for Malibu Creek and Lagoon are directly linked to the allocations and should be placed into the applicable regulatory mechanism (i.e., NPDES permit) in order to ensure that the benthic community condition achieves the water quality objectives."* As result, this Draft TMDL is inappropriately regulating nonpollutants through the inclusion of benthic macroinvertebrate targets and corresponding in-stream allocations. By extension, it is also arguable that listings for such non-pollutant based impairments are also inappropriate under the Clean Water Act. Thus, the original listing is inappropriate, and therefore improperly the subject of this TMDL.

3.2 Proposed Benthic Macroinvertebrate Targets Are Inconsistent with Science Developed for the State Bioobjectives Policy Comment 6-15

The experts on the Technical Team charged by the SWRCB to evaluate and develop appropriate BMI tools for eventual inclusion in the SWRCB's Biological Objective Policy have independently already concluded that the SC-IBI is not appropriate for setting biologically based objectives. The SC-IBI has been determined to be not appropriate primarily due to the lack of appropriate reference sites and conditions for many locations in California. The most widespread and universal problem with the SC-IBI identified by the Technical Team and Science Advisory Group experts is that reference expectations are based on a region-wide sampling of minimally impacted locations without regard to site-specific differences in natural gradients such as slope, precipitation, watershed size, etc. In the case of the Malibu Creek watershed, the local geologic differences are expected to result in significant differences from the reference conditions utilized for the SC-IBI. In addition to the general defect regarding watershed features that are not accounted for by SC-IBI reference expectations, the SC-IBI was developed for perennial wadeable streams, while Malibu Creek is non-perennial or non-wadeable along most reaches.

Rather than using the SC-IBI or other metric, such as the O/E, independently, these technical experts have developed a multi-metric tool that utilizes a modeled estimate of reference condition based on site-specific similarities in natural gradients from a statewide database of minimally impacted locations. This metric was then combined with an observed over expected ratio (O/E). However, unlike the O/E score calculated in the Draft TMDL that estimates reference expectation based on regional minimally disturbed locations without regard to matching natural gradients, the new O/E model has been updated to be based on temperature,

[11] Virginia DOT v. EPA, E.D. Va., No. 1:12-cv-775, 1/3/13

precipitation, elevation, and watershed area. These new scoring tools are ultimately combined into a single score for estimation of biological condition.

Additionally, the percentile threshold to be used for the new California biological objectives policy has not been decided, and the 10th percentile target included in the Draft TMDL was not specifically recommended as one of the options. Instead, the developers of the new multi-metric California Stream Condition Index approach [12] recommend a combination of some statistically defined threshold with a "gray area", which is intended to express the statistical uncertainty around the selected threshold. That "gray area" could be defined in a number of ways (see the CSCI presentation), and could be used conservatively (upper boundary) or "leniently" (lower boundary) depending on the states bias toward avoiding false negative or false positive findings of impairment. The SWRCB has not decided on whether or how to define or use this gray area concept, but the concept was not considered in the Draft TMDL. The 10th percentile is a conservative target that has not been vetted and may not be consistent with the SWRCB's approach to biological objectives.

3.3 Reference Conditions Used to Develop SC-IBI and O/E Targets are Not Appropriate for the Malibu Creek Watershed Comment 6-16

The Draft TMDL conclusions of impairment based on the SC-IBI are based on comparisons to inappropriate and unrepresentative reference sites (Section 8.1.2). All but one of the proposed reference sites are outside of and uninfluenced by the Monterey/Modelo formation geology and simply do not adequately represent the unique conditions of the Malibu Creek watershed (see also previous comments discussing the Modelo formation influence). Ultimately, the coastal "reference" streams used by USEPA are only relevant for considering expected nutrient concentrations and BMI scores from Malibu Creek tributaries lacking both urban development and Monterey/Modelo Formation rock, such as upper Cold Creek. Perhaps not surprisingly, SC-IBI scores from Cold Creek are similar to those from the Draft TMDL's coastal "reference" stream sites. However, the sites outside the watershed cannot serve as reference sites for assessing nutrients or BMI scores in areas tributary to Malibu Creek located in urban development built on, or downstream of, the Monterey Formation, as is done in the Draft TMDL, because those sites do not represent water quality impacts solely from urban development, but rather impacts from both urban development and the Monterey/Modelo Formation. The Draft TMDL authors acknowledge that... "*SC-IBI category rankings are not necessarily representative of the unique physical and geological situation of Malibu Creek*" (page 8-11 of the Draft TMDL report). Indeed, USEPA excluded at least two reference sites within the Modelo/ Monterey Formation. USEPA also excludes reference sites within Malibu Creek watershed with sulfate concentrations similar to those in Malibu Creek (median 591 mg/L, but with a maximum of 2,050 mg/L), and excludes reference sites with comparable phosphate concentrations to Malibu Creek's.

USEPA omitted from consideration BMI data that was available for potentially suitable reference sites from several monitoring programs. USEPA ignored three of Heal the Bay's

[12] [12] Science Advisory Group Meeting. October 17, 2013. Technical Team Causal Assessment Update Presentation. http://www.waterboards.ca.gov/plans_policies/docs/biological_objective/101712_meeting/three_scoring_tool.pdf

bioassessment reference sites *within* the watershed. These are sites 3 (Upper Cold Creek), 6 (Cheseboro Creek) and 9 (Las Virgenes Creek). BMI data were excluded from reference Site 16 of the Los Angeles County MS4 tributary monitoring program and from minimally developed Site LV-1 of the MCWMP. According to LVMWD, data for these sites were submitted to the EPA in September 2011 and should have been used to provide an accurate and complete picture of reference conditions in the Malibu Creek watershed.

Finally, on page 8-8 of the Draft TMDL, USEPA acknowledges monitoring they conducted themselves on the main stem at sites selected as potential reference sites. These sites are then explained away as not being appropriate reference sites because of upstream development. However, because the purpose of the monitoring was to look at less impacted sites *on the main stem*, the Draft TMDL should still valuate whether the sites represent natural conditions in the watershed that can naturally lower watershed IBI scores.

Similarly, the SC-O/E targets are also not based on an adequately representative condition. Although the Draft TMDL Appendix D indicates that all the Malibu Creek sites are "within the experience of " the SC-O/E model, the model does not adequately characterize the unique geology and resulting water quality of the Malibu Creek watershed. The predictors used in the California O/E model were mean annual precipitation, watershed percent sedimentary geology, and longitude. These predictors do not represent the elevated concentrations of sulfate, selenium, conductivity, magnesium, chloride, and phosphorus that are characteristic of the Malibu drainage that is influenced by the Modelo formation. The California SC-O/E model used in the Draft TMDL does not consider these factors or a number of other environmental gradients that have been found to be influential on BMI community structure and metrics, including elevation range, stream gradient, temperature, soil permeability, hydraulic conductivity, and watershed area.

4 DISCUSSIONS ON MS4 JURISDICTIONS SHOULD BE CLARIFIED IN DRAFT TMDL Comment 6-17

The City of Thousand Oaks, Ventura County, and Ventura County Watershed Protection District (VCWPD are all listed in the Draft Benthic TMDL as being located with the Malibu Creek Watershed. The wasteload allocations in the Draft Benthic TMDL are assigned to Ventura County MS4s without identifying specific Ventura County permittees as responsible parties. As there are numerous other municipalities that are covered by the Ventura County MS4 permit, the Draft TMDL should clarify that the Ventura County MS4 allocations only apply to the agencies identified in the Draft TMDL.

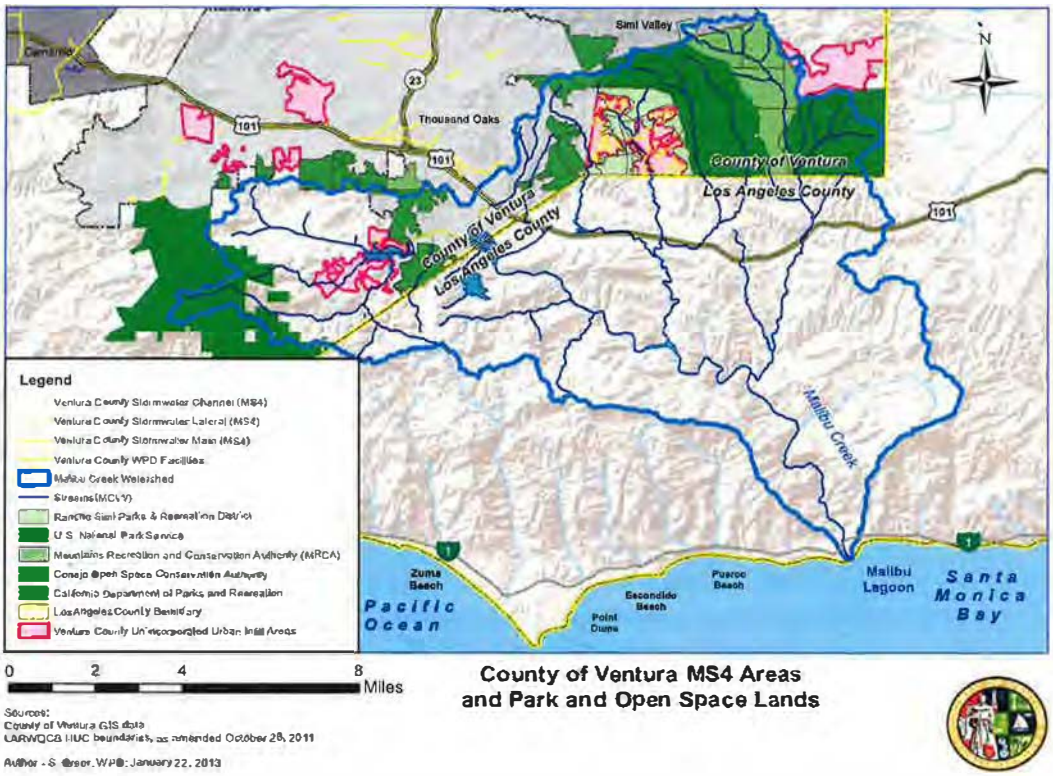
This is an important distinction because on page 4-1, the Draft TMDL states that "all areas within the watershed are covered by municipal stormwater permits for LA and Ventura counties." This is an incorrect statement that should be corrected. Municipal Storm Sewer System drainages within the jurisdictions of the City of Thousand Oaks and unincorporated Ventura County are covered by the municipal stormwater permits for Ventura County. However, open space under the jurisdiction of state and federal agencies and portions of the City and County that do not have MS4 systems are not covered by the permit. The language included in the Draft TMDL in essence makes MS4s responsible for all discharges in Ventura County, including agricultural and open space discharges over which they have no authority. As a result,

this language should be clarified to reflect the true coverage of the MS4 permit. Examples of the language that should be modified include:

- Page 5-3 includes Table 5-1 that summarizes land use by MS4 jurisdiction. However, this table includes agriculture and undeveloped land. It appears that this table represents all land area in Ventura County, not just the land area under the jurisdiction of the MS4 permittees. This table and associated discussion should be clarified as being the land areas within LA and Ventura Counties and not reference the MS4 permittees. Or, the table should be modified to reflect only the areas within the MS4 jurisdictions.

- On page 5-4 under Non-Point Sources of Pollution, the Draft TMDL states "However, the entire watershed is covered by MS4 permits and flows from properties that drain directly to the creeks without passing through an organized stormwater conveyance represent minimal amounts of impervious area." The majority of the upper watershed is not covered by an MS4 permit and many open space areas drain to the creek without passing through an MS4. As a result, this statement is incorrect and makes MS4s responsible for all drainage in Ventura County. The MS4s do not have authority over or responsibility for these discharges.

The following two figures show the MS4 system for the County of Ventura and City of Thousand Oaks respectively.



County of Ventura MS4 Areas and Park and Open Space Lands

Figure 9. Ventura County Unincorporated Area MS4 and Watershed Protection District Facilities

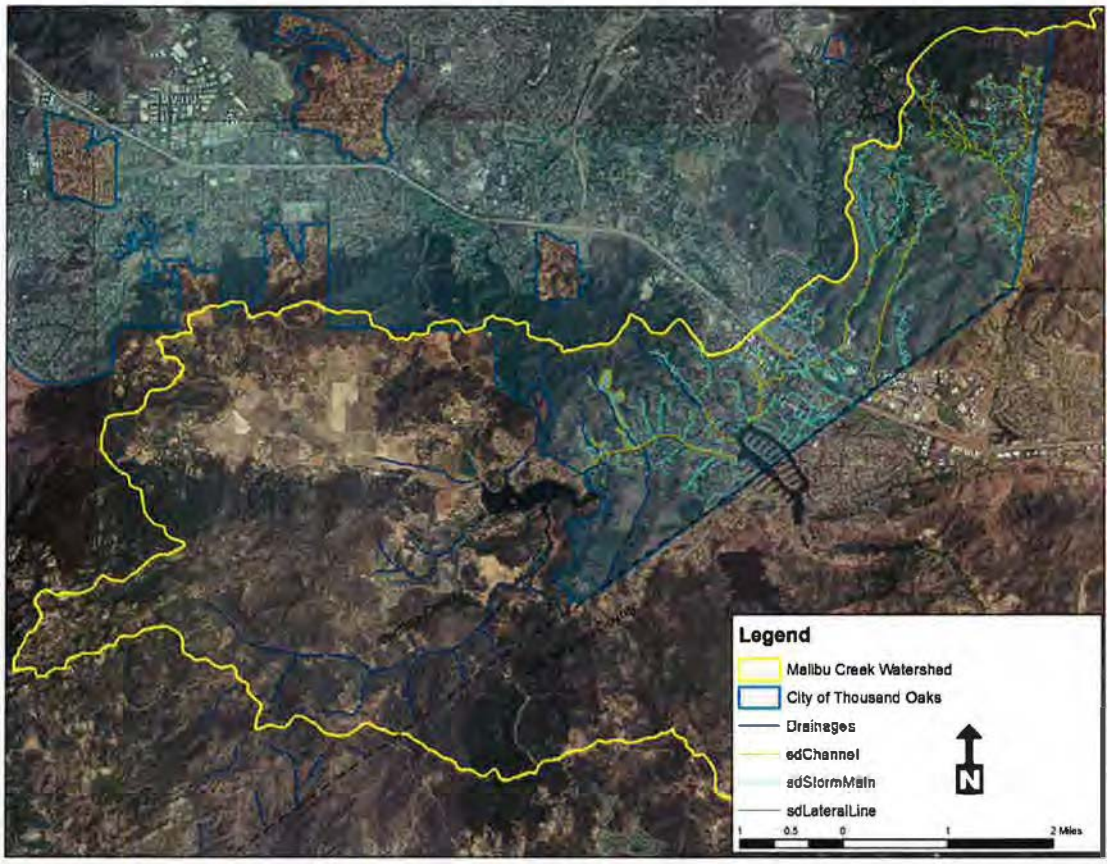


Figure 10. City of Thousand Oaks MS4 System

5 THE DRAFT TMDL TARGETS AND ALLOCATIONS SHOULD ONLY APPLY TO THE MAIN STEM OF MALIBU CREEK Comment 6-18

As required by the consent decree, the Draft TMDL addresses the impairments for benthic-macroinvertebrate bioassessments in Malibu Creek and benthic community effects in Malibu Lagoon. No other reaches or tributaries in the Malibu Creek watershed are included on the consent decree or specifically identified in the Draft TMDL as being addressed. There is no obligation to include additional tributaries in the Draft TMDL and the Draft TMDL analysis does not sufficiently develop the technical and stressor analysis to justify the application of the proposed targets and allocations to other reaches. Specifically, the modification to the Consent Decree in 2010 that added the Malibu Creek bioassessment community listings also removed the requirement to develop a TMDL for sediment in the tributaries. As discussed in previous comments, there are a number of concerns with the science and technical analysis included in the Draft TMDL and the ability of the current bioassessment information to be used to determine impairments in the Malibu Creek watershed given its unique geologic characteristics. As a result, the Draft TMDL should not address any reaches that were not explicitly required by the Consent Decree.

Additionally, we feel that the technical analysis does not support inclusion of the tributaries at this time. Although data from other reaches are discussed throughout the document, the document does not clearly identify which tributaries are covered by the Draft TMDL and what impairments are being addressed by the Draft TMDL for those reaches. The Draft TMDL in some cases discusses only the main stem, in other cases it refers to main tributaries, and in others refers to tributaries draining to the main stem. As a result it is not possible to determine if the analysis presented applies to the tributaries. For example, the stressor analysis identifies diazinon as a possible cause of toxicity in some tributaries that is not present in the main stem. If a stressor analysis was done for each tributary, it is possible that different stressors would be identified. Additionally, data are not presented in the Draft TMDL that evaluate the current status of mat algae coverage in the tributaries to determine if the information presented in the Draft TMDL applies to the tributaries as well as the main stem.

As discussed in section 1, we were able to review a data file of algal coverage data for the watershed tributaries. Although we have concerns about the use of percent cover data provided as justification for consideration of impairments, these data were considered in the Draft TMDL and are the only available data for analysis. A review of the file confirmed that tributary analyses need to be considered separately from the main stem. Five tributary sites in the provided file have recorded algal percent cover observations since 2006 (though data do not appear to have been collected in 2007 and 2008). Of these five sites, only site LV-5, has consistent observations over the 60% coverage target in the Draft TMDL. A few sites have some observations over 30%, but generally the values fall below the Draft TMDL thresholds. Additionally, the site downstream of LV-5, LV-13 has lower percent cover observations. This review indicates that making a blanket statement that tributaries continue to be impaired for algal coverage is not correct and that algal biomass may not be contributing to any observed benthic impairments in the tributaries.

Based on this analysis, we request that the Draft TMDL clarify that the proposed targets and allocations apply solely to the main stem of Malibu Creek and Malibu Lagoon. In particular, Section 10 should be modified throughout to remove references to the tributaries. Additionally, Table 10-5 should only include responsible parties that discharge directly to the main stem or lagoon.

6 THE DRAFT TMDL ALLOCATION DISCUSSION SHOULD REMOVE REQUIREMENTS TO INCLUDE BIOLOGICAL AND ALGAL RESPONSE TARGETS IN NPDES PERMITS Comment 6-19

On page 10-11, the Draft TMDL includes allocations that state "both the nutrient allocations and the algal coverage target must be met." Allocations cannot regulate non-pollutants, nor do the dischargers have any control over the biological response of the waterbody to nutrient discharges. As a result, it is not appropriate to assign allocations that include the algal coverage target to the MS4s.

In addition, please remove the following statement on page 10-13:

> "The biological response numeric targets for Malibu Creek and Lagoon are directly linked to the allocations and should be placed into the applicable regulatory mechanism

(i.e., NPDES permit) in order to ensure that the benthic community condition achieves the water quality objectives."

As discussed for the algal targets and in the main body of the comment letter. We do not believe that EPA has the authority to regulate benthic macroinvertebrates in a Draft TMDL and cannot assign them as allocations. MS4 dischargers do not have the ability to control benthic macroinvertebrates, just the pollutants that may impact them. As a result, it is inappropriate to include the statement above in the Draft TMDL.

Finally, it is not appropriate to hold individual NPDES permit holders responsible in their NPDES permits for attainment of algal coverage and biological response numeric targets. Insufficient evidence has been provided in the Draft TMDL to indicate that any individual NPDES permit holder is causing or contributing to any biological condition impairment. Individual NPDES permit holders should not be held responsible for attaining targets that may not be related to their discharges, and that may require actions beyond the NPDES permit holder's control to resolve.

7 THE DRAFT TMDL ALLOCATION DISCUSSION SHOULD CLARIFY THE MEANING OF IN-STREAM ALLOCATIONS Comment 6-20

Section 10.3.3 needs to be revised for clarity. The section includes both in-stream allocations and Table 10-5 that lists the responsible parties as having in-stream allocations. However, the Draft TMDL is not clear on where the in-stream allocations apply and how in-stream allocations will be included in NPDES permits. Are the allocations to be applied as receiving water limitations? If so, the Draft TMDL should be clear that these are receiving water limitations and that any end-of-pipe allocations that are determined for individual dischargers should be developed using a technical analysis (i.e. model) that provides a linkage between the discharges and the in-stream allocation. Responsible parties that do not directly discharge to the reaches for which the in-stream allocations apply should not be included Table 10-5.

8 ADDITIONAL CLARIFICATION REQUESTS

This section of the technical comments provides additional requests for clarification in the Draft TMDL in addition to the main comments outlined above. This portion of the comments has been organized by section of the Draft TMDL.

8.1 Section 1 Specific Comments Comment 6-21

On page 1-4, the Draft TMDL states for Malibu Lagoon "The impact from the previous construction activities led to loss of native species, increasing urban runoff, and excessive nutrient inputs." No justification is provided for this statement other than development occurred. Although these impacts may have occurred, without data to support this statement, it should be removed.

8.2 Section 2 Specific Comments

In section 2.1.3, the Draft TMDL incorrectly identifies that "Any actions that can adversely affect water quality in all surface and ground waters must be consistent with the maximum benefit to the people of the state, must not unreasonably affect present and anticipated beneficial use of such water, and must not result in water quality les than that prescribed in water quality plans and policies." The Antidegradation Policy does not require all actions to be consistent with the maximum benefit to the people of the state. Only actions that will degrade high quality waters require consideration of the maximum benefit to the people of the state. Comment 6-22

On page 2-6, the Draft TMDL refers to a 2008 303(d) list. Although the Los Angeles Regional Water Quality Control Board developed a staff report and recommendations in 2008, there was no 303(d) list approved in 2008 by the SWRCB or USEPA. The section should clarify the references in this section and where appropriate refer to the 2010 list. Comment 6-23

Page 2-9. There is no basis for the citation that 40 taxa is a threshold for a healthy community of benthic macroinvertebrates in Malibu Lagoon. This threshold should be removed. Additionally, it conflicts with the statements in Section 10 that say 35 is the appropriate target. Comment 6-24

8.3 Section 3 Specific Comments

Page 3-2. The target for Benthic Community Diversity should be removed. There is no basis for this target or any way for it to be measured. It is not numeric and is duplicative of the IBI and O/E targets which are already duplicative of each other. Additionally, it is inconsistent with Section 10 where no target is included for the creek. Therefore, it should be removed from Section 3. Comment 6-25

Page 3-2. The last portion of the last sentence in the Benthic Algal Coverage target should be removed as follows "and ideally less than 100 mg/m^2 (referred to as the BURC II/III and BURC I/II boundaries." As is discussed later in the Draft TMDL, there are questions about the ability of the watershed to achieve 150 mg/m^2 due to natural conditions and there has been no technical data presented anywhere in the document that justifies consideration of 100 mg/m^2 as a target. The NNE Policy has not yet been promulgated and it is premature to include a lower algal biomass target without technical justification in the report. In fact, the Draft TMDL states on page 10-9 that "nutrient levels are naturally elevated to some extent due to the presence of marine sedimentary rocks, further suggesting use of the BURC II/II threshold as a target." The inclusion of the BURC I/II threshold of 100 mg/m^2 in the target discussion creates confusion about the targets in the Draft TMDL and it should be removed. The same statement should also be removed from page 10-2. Comment 6-26

Page 3-3. How do reference conditions based on data in the upper reaches reflect the concentration needed to protect the Lagoon? What analysis was provided in the Draft TMDL that nutrient concentrations in the Lagoon need to be lower? Comment 6-27

Page 3-3. There is no basis for the determination that less than 20 taxa is an impaired system. As stated on page 3-3, there where no reference site data available for the Lagoon to determine whether or not it is impaired and what the appropriate number of taxa should be in an unimpaired lagoon. Also, on page 3-4, the target goal is set at 35 and in Section 2, a number below 40 is considered impaired. This shows there is no consistent basis for the target and that it should be removed. Comment 6-28

8.4 Section 4 Specific Comments

On Page 4-12, the Draft TMDL states that no GIS coverages were available for Thousand Oaks and Ventura County stormwater systems. GIS coverages for both these areas are available and can be provided to USEPA, if needed. Comment 6-29

8.5 Section 6 Specific Comments

On page 6-8, Table 6-4 summarizes the Draft TMDL model analysis that was done to predict pre and post impacts of development. The text below the table states *"There is a dramatic change in extreme low flow frequency: In the pre-impact period the median number of days with zero flow was four per year, whereas none occur in the post-impact period."* However, Table 6-2 shows the average flow for many months in 2007-2010 as being zero. This appears to indicate that the analysis shown in Table 6-4 is not accurately reflecting the actual conditions in the watershed. Comment 6-30

8.6 Section 7 Specific Comments

On page 7-7, Table 7-3 lists a criteria value for conductivity that is an extrapolation of a TDS water quality objective. It is inappropriate to call this a criterion in the table as no water quality criterion for conductivity applies in the watershed. The header in the table should be changed. Comment 6-31

On page 7-9, Table 7-4 discusses the results of the turbidity analysis for Malibu Creek. The average turbidity for the main stem sites ranges from 1.31 to 2.62 NTU. This is compared to reference reaches that are located outside the watershed with no analysis or comparison as to the soil conditions. As discussed earlier in the Draft TMDL, the Malibu Creek watershed has highly erodible soils and it is inappropriate to determine the watershed is exceeding turbidity standards when compared to reference conditions that are not within the watershed. Additionally, determination of turbidities in the 1 to 2 range as being impaired does not seem accurate. Tertiary treated wastewater has turbidity in that range and is considered high quality recycled water. Comment 6-32

On page 7-16, LVMWD data is not summarized because it does not include Total N or Total P data. However, all of the Heal the Bay data is summarized and used as the basis for multiple analyses and it does not include Total N or Total P data either. Why was this data not included in the analysis when the Heal the Bay data was included? Comment 6-33

Section 7.5 is very confusing and does not provide a clear understanding of reference conditions or data analysis. The section mixes discussion of inorganic and total forms of nitrogen and phosphorus. The discussion and information shown in Figure 7-11 demonstrates the importance of only discussing total nitrogen and the significant impacts of other forms of nitrogen on the analysis. This section should be clarified and only discuss total forms of the constituents. Comment 6-34

8.7 Section 10 Specific Comments

On page 10-8, the Draft TMDL states "TMDL nitrate targets have generally been met in the Malibu creek main stem". However, the 2003 TMDL summer target was for total nitrogen, not nitrate. The Draft TMDL should be revised here and throughout the document to reflect the total nitrogen target for summer time. and all references to comparisons to nitrate concentrations should be removed or revised. Comment 6-35

The statement on page 10-10 that "Strong evidence indicates that the nutrient targets established in the 2003 TMDL have been mostly met" is in contradiction with other statements throughout the Draft TMDL and the data analysis presented in previous sections and should be removed. Comment 6-36

8.8 Section 11 Specific Comments

In Section 11, the Draft TMDL should include a recommendation to revisit the Draft TMDL once the State's bioobjectives are developed. The Draft TMDL should be clear that the implementation schedule for any required actions should reflect the schedule for the biological objective development to ensure that significant costs are not incurred before an appropriate analysis of the biological condition of the Malibu Creek watershed can be developed in accordance with the State's Policy. Comment 6-37

ATTACHMENT C

Comment 6-38

Technical Achievability Assessment of the Malibu Creek and Ventura River Nutrient TMDLs

January 2013

Prepared by **Geosyntec Consultants, Inc.**

Prepared for **County of Ventura**

Geosyntec consultants

Technical Achievability Assessment of the Malibu Creek and Ventura River Nutrient TMDLs

Ventura County
January 2013

Executive Summary

The Draft Malibu Creek & Lagoon Total Maximum Daily Load (TMDL) for Sedimentation and Nutrients to address Benthic Community Impairments (Malibu Creek Benthic TMDL) (U.S. Environmental Protection Agency [USEPA] Region 9, 2012) and the Draft Ventura River Reaches 3 and 4 TMDL for Pumping & Water Diversion-Related Water Quality Impairments (Ventura River Pumping TMDL) (USEPA Region 9, 2012) have both established numeric targets for nutrient reduction that, based on available solutions, are infeasible to consistently meet. Although non-structural and structural Best Management Practices (BMPs) are capable of reducing total nitrogen (TN) and total phosphorous (TP), this analysis finds no solution capable of meeting the proposed numeric targets with the consistency that is required. The TMDL-established numeric targets do not allow for any exceedances within each specific water body, which, due to the variable nature of influent quality and BMP performance, makes meeting these targets infeasible.

The Malibu Creek Benthic TMDL establishes summer and winter TN numeric targets of 0.6 mg/L and 1.0 mg/L, respectively, and a year-round TP numeric target of 0.1 mg/L. The International BMP Database shows that no traditional structural treatment BMP is capable of producing a median (i.e., 50% of samples exceed this) TN effluent concentration of 0.6 mg/L, a 75th percentile (i.e., 25% of samples exceed this) TN effluent concentration of 1.0 mg/L, or a 75th percentile TP effluent concentration of 0.1 mg/L (shown in Figures 1 and 2) (Geosyntec Consultants, *et al*, 2012). Therefore, no traditional structural treatment BMP types are available to consistently meet these low TMDL numeric targets.

The Ventura River Pumping TMDL establishes a dry weather TN numeric target of 1.5 mg/L and a dry weather TP numeric target of 0.028 mg/L. The International BMP Database shows that no traditional structural BMP is capable of producing a 75th percentile (i.e., 25% of samples exceed this) TN effluent concentration of 1.5 mg/L or a 25th percentile (i.e., 75% of samples exceed this) TP effluent concentration of 0.028 mg/L (shown in Figures 1 and 2) (Geosyntec Consultants, *et al*, 2012). Therefore, no traditional structural treatment BMP types are available to consistently meet these low TMDL numeric targets.

Additionally, the inability to achieve 100 percent coverage of non-structural BMPs, combined with the economic and siting constraints associated with structural BMPs, add further compliance feasibility complications. The conflicting treatment conditions required for TN and TP removal (i.e., denitrification

of nitrate requires anaerobic conditions, however this typically results in the export of previously-bound phosphorus from soil or filter media) also make developing a single cost-effective solution technically infeasible. Due to these various constraints, achieving the proposed numeric targets will require costly chemical/mechanical systems (which are typically impractical for treating wet weather flows) or an impractical suite of advanced natural treatment systems.

Introduction

The purpose of this memorandum is to evaluate the feasibility of attaining the nutrient numeric targets outlined in the Draft Malibu Creek Benthic TMDL and the Draft Ventura River Pumping TMDL. While a variety of nutrient numeric targets exist, total nitrogen (TN) and total phosphorous (TP) were selected for this analysis based on their data availability and consistency between TMDLs.

The following sections outline the existing numeric targets for each of the TMDLs, the available solutions for meeting these targets, and a discussion of the feasibility of applying such solutions.

TMDL Numeric Targets

TMDL numeric targets are established to measure attainment of the water quality standards for the most significant pollutants within each specific TMDL. These targets were set based on reference stream data, with the goal of matching reference stream conditions for control of algal stimulation and eutrophication, and ultimately biota protection. Table 1 displays the range of TN and TP numeric targets defined for MS4s in the Draft TMDLs.

Table 1: TMDL Numeric Targets Summary

Constituent	Draft Malibu Creek Benthic TMDL		Draft Ventura River Pumping TMDL[1]	
	Summer	*Winter*	*Dry*	*Wet*
TN (mg/L)	0.6	1.0	1.5	5[2] - 7.4[3]
TP (mg/L)	0.1	0.1	0.028	-

[1] Draft Ventura River Pumping TMDL numeric targets are presented as waste load allocations.
[2] NO3-N + NO2-N only
[3] TMDL WLAs of 10 mg/L NO3-N +NO2-N apply to reaches downstream of Reach 3, however the TMDL only applies to Reaches 3 and 4, therefore 10 mg/L is not shown here.

Non-Structural Source Controls

Due to their low cost relative to structural treatment controls, the first emphasis of most nutrient TMDL implementation strategies is to exhaustively explore and implement non-structural BMPs to control nutrients at their source. Non-structural BMPs include outreach, inspection, and enforcement-based programs, such as those targeting homeowners to address over-irrigation and car-washing as sources of nutrient rich dry weather runoff, pet owners to address pet waste, homeowners and landscapers on proper fertilizer application, and food outlets to address sidewalk hose-down and proper trash and grease trap management. Non-structural BMPs also include illicit discharge detection and elimination (IDDE) programs, including efforts to identify chronic sources of nutrients into the MS4. Street sweeping and catch basin cleaning are also emphasized and intended to remove sources of sediment, trash and organic litter, all of which may contribute nutrients to the MS4.

The City of Tulsa, Oklahoma (City) carried out a multi-dimensional stormwater quality management program in the 1990s that used non-structural BMPs including an IDDE program, litter collection campaigns, illegal dumping minimization programs, hazardous waste collection programs, advertising campaigns, and a stormwater drain stenciling program. The City conducted wet weather sampling before and after program implementation to determine four year event mean concentrations (EMC) used to quantify the program's success. The pre-program TP EMC was 0.33 mg/L, which was reduced to 0.27 mg/L as a result of the program. The pre-program Total Kjeldahl Nitrogen (TKN)[4] EMC was 1.66 mg/L, which was reduced to 1.35 mg/L as a result of the program (Lehner, *et al*, 1999). Although the success of non-structural BMPs is difficult to quantify, and this case study represents a relatively successful program, the efforts exerted still resulted in post-program average EMCs that are significantly higher than the do-not-exceed TMDL numeric targets cited above.

Even with the most optimistic assumptions, a thoroughly exhaustive and comprehensive implementation of non-structural BMPs can simply not achieve compliance with any of the TMDL numeric targets unless discharges are completely eliminated, which is not an option during wet weather and may not be feasible during dry weather given the existence of permitted flows (e.g., fire hydrant testing, groundwater inflow, etc.). This is partly because outreach, inspection, and enforcement can never achieve perfect control outcomes (i.e., some target groups will miss outreach, some behaviors won't change, and some waste generation activities will miss inspection). This is also partly because some urban nutrient loads are unable to be addressed by such programs (e.g., nutrients in stormdrain sediments consistently mobilize whenever flows are present, such as during one of the many allowed dry weather flow sources) and

[4] TN will be higher than TKN (ammonia plus organic nitrogen) since TN also includes NO3-N and NO2-N.

because there are also natural sources of nutrients (e.g., plant debris). Additionally, many street sweeping programs fail to remove fine particles, which often contain the highest concentrations of pollutants, and overall one study found that street sweepers were only capable, on average, of removing 50% of the debris on the street (Taylor, *et al*, 2002). Evaluations of the effectiveness of sweeping and cleaning programs have consistently indicated that they are not able to capture 100% of sediments and organic debris.

Structural BMPs

Due to limitations in the effectiveness and consistent performance of non-structural BMPs, more costly and time-intensive (i.e., more advance planning time is required) structural BMPs may be employed due to their more reliable, effective, and controllable nutrient reduction capabilities. In general, more natural, passive, sustainable, and multi-benefit structural BMPs are preferred and recommended (as opposed to energy-intensive, mechanical systems). Dry weather structural BMPs may potentially include localized infiltration and diversions to the sewer system. During wet weather, however, many structural BMPs are often not capable of achieving compliance due to substantially greater and more variable inflow rates. Treating wet weather flows would require considerable transient storage, more than is often feasible based on site constraints.

Geosyntec is co-principal investigator on the EPA/ASCE International Stormwater BMP Database, which is used to help evaluate and predict performance of traditional structural treatment BMPs in removing constituents. When comparing nutrient removal statistics, the database includes wet weather structural BMPs such as grass strips, bioretention, bioswales, composite/treatment trains, detention basins (surface/grass-lined), green roofs, manufactured devices, media filters, porous pavement, retention ponds (surface pond with a permanent pool), wetland basins[5], and wetland channels (swales and channels with wetland vegetation) (Geosyntec Consultants, *etal*, 2012). Figures 1 and 2 display statistically evaluated monitoring data from the database describing structural BMP performance by comparing influent and effluent TP and TN concentrations. The range of TMDL numeric targets has been identified on Figures 1 and 2 for reference, with the TP targets ranging from 0.028 to 0.1 mg/L (varies based on specific TMDL), and the TN targets ranging from 0.6 to 7.4 mg/L (varies based on specific TMDL). Effluent concentrations have been shown to be a more robust predictor of BMP performance than percent concentration reduction, therefore they are used here for comparison with TMDL numeric targets.

[5] The wetland basins compared in this analysis are free surface wetlands.

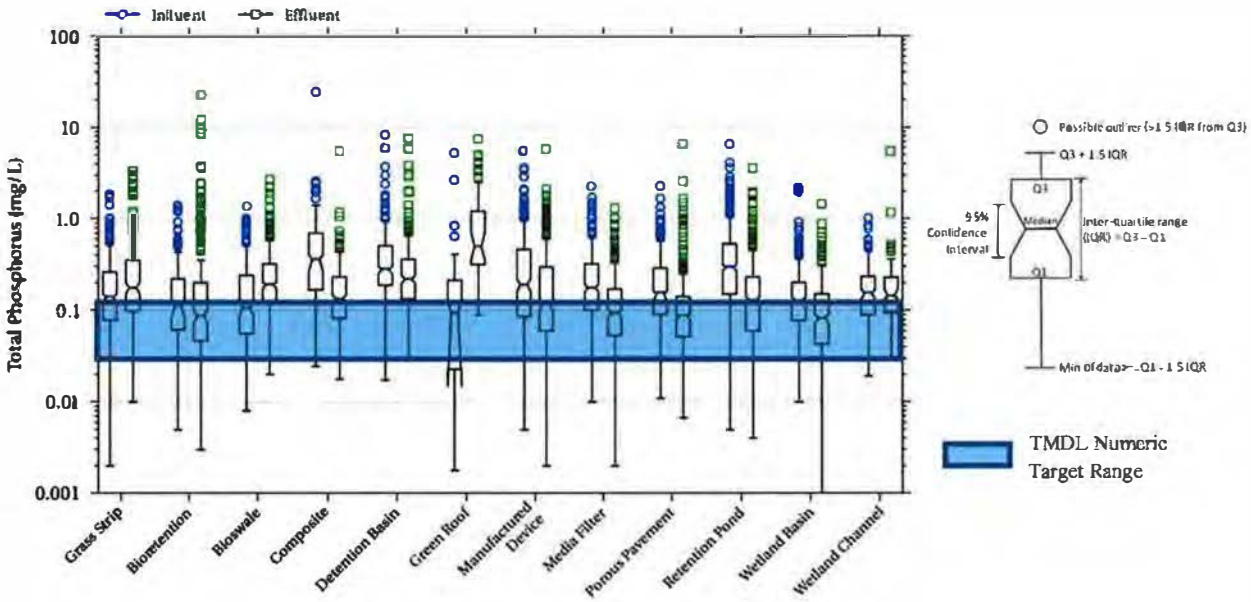


Figure 1. Structural BMP performance (TP)

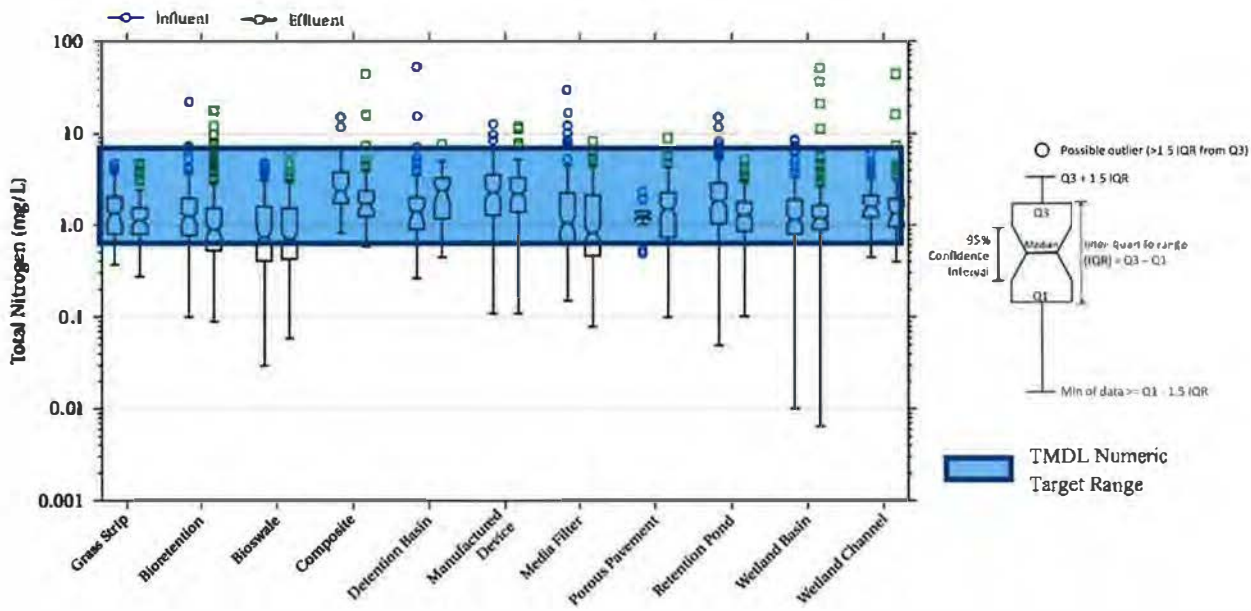


Figure 2. Structural BMP performance (TN)

Overall, the most effective BMP types for TP (i.e., those with the lowest effluent concentrations and with non-overlapping influent-effluent confidence intervals), which all have a median effluent concentration less than 0.1 mg/L TP, are bioretention, media filters, porous pavement, and wetland basins. The most

effective BMP types for TN, which all have a median effluent concentration less than 1 mg/L, are bioretention and media filters[6]. **Therefore, based on a comparison of reported BMP effluent concentrations and the TMDL numeric target ranges, even these best performing structural BMPs are not capable of consistently (i.e., meeting ≥75% of the time) achieving any of these TMDL numeric targets except where TN is around 2 mg/L or greater.**

Beyond those BMPs studied in the database, additional structural BMPs appropriate for nutrient reduction exist such as subsurface flow wetlands (which have less performance data available but initial datasets suggest a relatively high level of effectiveness) and "zero discharge" types that rely on infiltration (e.g., infiltration trenches and basins) or capture and use (e.g., rainwater harvesting cisterns). While data for subsurface wetland pollutant removal vary widely, one study conducted by the University of New Hampshire from 2004 through 2010, reports an expected average subsurface wetland effluent TP concentration of 0.02 mg/L (UNHSC, 2012) and a separate study reports an expected average subsurface wetland effluent TN concentration of 0.47 mg/L (Lyon, 2006). However, these are average effluent concentrations and therefore results above the 0.6 mg/L TN and 0.028 mg/L TP targets would be very likely. Infiltration basins and capture and use systems will result in 100% removal of pollutants captured, however the quantity captured is dependent on the storage available. Most importantly though, it is not feasible to completely retain or capture/use all wet weather MS4 discharges, and so some treatment and discharge would be necessary. Additionally, the Environmental Protection Agency (EPA) reports that infiltration basins are only capable of removing 55-60% of TN and 60-70% of TP (EPA, 2012). Therefore, even if the nutrient load is removed from the discharge, a percentage will infiltrate into the groundwater and ultimately influence nearby surface water.

These "additional" structural BMPs are effective for nutrient removal but are subject to local and site-specific constraints, which must be evaluated before implementation. For instance, infiltration BMPs are not appropriate for areas with relatively impervious soils, shallow groundwater, steep hillsides, landslide or liquefaction risk zones, subsurface contamination, or close proximity to certain structures. Similarly, capture and use BMPs are not cost effective for areas with little available water demand (such as minimal landscaping irrigation needs) or where water demand is temporally inconsistent with available supply (frequently the case in the arid southwest where rainfall occurs during one season while peak irrigation demands occur during a different period). Finally, "zero discharge" type BMPs are not appropriate if the

[6] Bioswales also have a low effluent concentration however they are not further considered here because their influent and effluent concentrations are not statistically different and therefore this BMP type is likely not effective for TN removal.

discharge area warrants a footprint area that is not available at the site. Therefore, these low numeric nutrient targets leave many urban areas without feasible or cost-effective wet weather structural BMP options available for TMDL compliance.

Basin-Wide Implementation

Even combining non-structural and structural BMPs, the ability to develop a basin-wide implementation plan and meet specific numeric targets is difficult. Such plans often require high investments and may result in minimal benefit. For instance, the Chesapeake Bay nutrient management strategy has been an extremely challenging task that has resulted in very high expenditures with mediocre results. Out of concern for the nutrient enriched Chesapeake Bay, the EPA along with local states agreed to implement a basin-wide nutrient reduction strategy in 1987. With the ultimate goal of improving dissolved oxygen (DO) conditions within the bottom waters of the bay, a 40% nitrogen and phosphorous load reduction goal was set for achievement by 2000. Between 1985 and 1996 an estimated $3.5 billion were spend toward nutrient controls; 20% of these funds allocated to point source nutrient reductions. As of 1996, nitrogen had been reduced by 16% and phosphorous by 53%, however there was no observable benefits to the DO conditions (Butt, *et al*, 2000). Furthermore, a more recent study suggests that nitrogen loads from urban/suburban sectors have actually increased in the Chesapeake Bay by 3%, and phosphorous by 7% between 1985 and 2009 (Committee on the Evaluation of Chesapeake Bay Program Implementation for Nutrient Reduction to Improve Water Quality, 2011). In 2010, the EPA established the Chesapeake Bay TMDL to restore the Bay by 2025, with an interim goal of 60% restoration by 2017 (EPA, 2010). To accelerate progress, a two-year milestone strategy was developed that included the application of land-based BMPs to ensure each jurisdiction was on track for reaching the TMDL goal in 2025. A review of the 2-year milestone status found the costs of urban stormwater BMPs to be between a few thousand dollars per impervious acre up to $200,000 per impervious acre. The high expenditures were attributed to space constraints and prohibitive costs of purchasing land (CECBP, 2011).

The Chesapeake Bay case study is an example of a costly stormwater nutrient management program that used available non-structural and structural BMPs and ultimately failed to achieve the established program goals. As targets were continually not met, the funds continued to grow, which is a potential result if the available solutions and technology are incapable of achieving the established numeric targets.

Discussion

Although some BMPs have been shown to meet the TMDL targets, even if 100% of the stormwater volume was treated and the BMPs were capable of achieving the TMDL numeric targets, they would likely not meet them on a consistent basis due to the variability in runoff volume and performance of BMPs. Furthermore, site constraints will limit the quantity of treatable volume and reduce the overall runoff capture percentage.

For dry weather compliance; solutions such as public outreach and education, IDDE, and localized infiltration or diversion to the sewer can potentially be effective but are largely limited by implementation

coverage. Non-structural BMPs are less expensive but due to uncontrollable behavior, are incapable of locating and reducing/eliminating 100% of all dry-weather sources within the watershed. Therefore, dry-weather BMPs are expected to reduce TN and TP loading to some degree as demonstrated in Tulsa, Oklahoma, but are most likely not capable of consistently meeting the numeric targets outlined in the TMDLs unless 100% of MS4 discharges can be prevented or captured.

Based on the available wet weather technologies presented in the previous section and in Figures 1 and 2, the best performing structural BMPs for treating both TN and TP are bioretention, media filters, and subsurface flow wetlands. However, as previously discussed, site constraints regarding soil suitability may limit the application of bioretention systems and media filters. Additionally, the large quantity and variability in runoff volume is generally not suitable for subsurface wetlands unless a sufficient footprint is available to allow adequate pretreatment, flow equalization, and residence time in the wetland system. Finally, even if construction is feasible, the median effluent concentrations for TN and TP were determined based on a range of data that includes much higher concentrations that would have exceeded the TMDL numeric targets. As a result, 100 percent achievement of the numeric targets is not feasible. **Due to these limitations, there is no apparent single solution available to consistently meet the numeric targets established within each TMDL for both TP and TN. The alternative solution will instead likely necessitate a costly and impractical suite of advanced natural systems or mechanical treatment systems.**

Furthermore, achieving nutrients numeric targets through treatment using traditional BMPs is made more difficult by the fact that different reduction-oxidation conditions are required to treat stormwater for the predominant forms of TN and TP in stormwater. A 2010 evaluation of advanced biofiltration media composition showed an increase in nitrate removal with media containing increasing percentages of granular activated carbon (GAC); however, this same increase in GAC resulted in a higher export of phosphate. Conversely, the addition of peat moss in the mixture resulted in no substantial nitrate removal, but resulted in less phosphate exported. The results of this study suggest that there are tradeoffs that the designer must consider when treating both nitrate and phosphate, which will ultimately decrease the overall efficiency of the design (Pitt, *et al*, 2010). In addition, the removal of nitrates within a bioretention system requires denitrification under anaerobic conditions. However, such anaerobic conditions can potentially export phosphate from the system, thus increasing TP in the effluent (Pitt, *et al*, 2010). One study that analyzed the capabilities of an optimized bioretention soil mixture found similarly that a saturation zone (anaerobic condition) would increase nitrate removal and decrease ortho-phosphate removal (Palmer, 2012). However, a separate study of laboratory and field data for various bioretention designs found that the inclusion of an anaerobic zone had a limited impact on the system and actually showed an increase in TP reduction when analyzing a system with an anaerobic zone (Hunt, 2003). These academic studies evaluated optimized designs under controlled conditions, and do not represent BMP implementation on a basin-wide scale. However, even such controlled conditions provide varying results, which further complicates the design for TN and TP removal. Based on a review of available data and literature, no suitable treatment BMP was discovered that can efficiently treat both TP and TN to very

low levels concurrently. Therefore, multiple structural controls (such as aerobic and anaerobic units in series) will be necessary within a treatment train to treat for TN and TP sequentially.

The difficulty in achieving high coverage with non-structural BMPs (i.e., for source control and dry weather MS4 discharge prevention), the site constraints associated with structural BMPs, and the very limited set of structural BMPs capable of consistently meeting the very low TN and TP numeric targets, make developing a basin-wide nutrient reduction strategy very difficult. As shown in the Chesapeake Bay case study, high investments will be required without the promise of beneficial results. As a result, consistent MS4 compliance with the low TMDL numeric targets at all outfalls during both dry and wet weather is considered technically infeasible.

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