ADDITIONAL EXHIBITS SUBMITTED TO STATE BOARD IN SUPPORT OF RUTAN & TUCKER COMMENTS ON PROPOSED METALS TMDL FOR SAN GABRIEL RIVER

OCTOBER 25, 2006

LIST OF ADDITIONAL EXHIBITS SUBMITTED TO STATE BOARD ON OCTOBER 25, 2006, IN SUPPORT OF RUTAN & TUCKER COMMENTS ON PROPOSED METALS TMDL FOR SAN GABRIEL RIVER

DESCRIPTION	EXHIBIT NO.
July 12, 2006 letter to Ms. Jenny Newman from Rutan & Tucker, LLP, re Additional Comments re CEQA Metals and Selenium TMDL for the San Gabriel River and Impaired Tributaries	A
July 12, 2006 letter to Ms. Jenny Newman from Rutan & Tucker, LLP, re Failure to Provide At Least Ten Days Notice on Responses to Comments Required by the CEQA – Metals and Selenium TMDL for the San Gabriel River and Impaired Tributaries	B
Amended portions of California Regional Water Quality Control Board, Los Angeles Region – Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges Within the County of Los Angeles, and the Incorporated Cities Therein, dated December 13, 2001 as Amended on September 14, 2006 by Order R4-2006-0074)	C
Storm Water Panel Recommendations to the California State Water Resources Control Board – The Feasibility of Numeric Effluent Limits Applicable to Discharges of Storm Water Associated with Municipal, Industrial and Construction Activities, dated June 19, 2006	D
July 31, 2002 letter from EPA Administrator Christine Todd Whitman, to Congressman Stephen Horn, with attached "Detailed Response to Concerns Raised by Congressman Horn, the Coalition for Practical Regulation, and the City of Signal Hill, California"	E
Transcript of State Water Board Meeting, Item No. 8, October 5, 2005	F
Transcript of State Water Board Meeting, Item No. 8, October 20, 2005	G

LIST OF ADDITIONAL EXHIBITS SUBMITTED TO STATE BOARD ON OCTOBER 25, 2006, IN SUPPORT OF RUTAN & TUCKER COMMENTS ON PROPOSED METALS TMDL FOR SAN GABRIEL RIVER

DESCRIPTION	EXHIBIT NO.
State Water Resources Control Board **Total Maximum Daily Loads (TMDL)** QUESTIONS & ANSWERS	H
EPA Region 7 Total Maximum Daily Load – Definitions	I
Copper Sources in Urban Runoff and Shoreline Activities, Information Update, dated November 2004	J
Copper Management Strategy Development Resources, Final, dated September 2006	K

EXHIBIT "A"

RUTAN
ATTORNEYS AT LAW

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July 12, 2006

VIA FACSIMILE

Ms. Jenny Newman
California Regional Water Quality Control Board
Los Angeles Region
320 West Fourth Street, Suite 200
Los Angeles, CA 90013

Re: Additional Comments Re California Environmental Quality Act ("CEQA") -- Metals and Selenium TMDL for the San Gabriel River and Impaired Tributaries

Dear Ms. Newman:

Enclosed herewith please find additional comments to the proposed Metals TMDL for the San Gabriel River arising out of the staff's Responses to Comments circulated on July 10, 2006. The attached comments primarily concern defects in the Environmental Analysis of the Metals TMDL under the California Environmental Quality Act.

Please include this letter and the attached comments as a part of the Administrative Record for the Regional Board's review and consideration at the hearing tomorrow, July 13, 2006.

Thank you for your assistance in this matter.

Sincerely,

RUTAN & TUCKER, LLP

Richard Montevideo

RM:clc
cc: Mr. Jonathan Bishop (via facsimile)
Michael Levy, Esq. (via facsimile)
Mr. Kenneth Farfsing (via facsimile)

EXHIBIT "A"

Additional Comments Arising From the Responses to Comments on the Metals TMDL for the San Gabriel River July 12, 2006

1. **IMPROPER DEFERRAL.** The Responses to Comments continue the fatal flaw of the Environmental Analysis (EA) of deferring evaluation of impacts and consideration of mitigation measures based on the excuse that the Board cannot dictate compliance methods for the TMDLs, so it would only be speculation to analyze impacts:

   - that **exact approach was rejected** by the court in *City of Arcadia v. State Water Resources Control Board* (the LA River trash TMDL decision) published earlier this year (135 CA4th 1392);

   - further, as the court in *City of Antioch v. City Council* (187 CA3d 1325) points out, the Board **must assume** the general form, **location**, and amount of development under a general level plan that is reasonable to anticipate **and evaluate that development** by means of the EIR process. Here, the EA made certain assumptions (compliance in 40% of the watershed by non-structural BMPs and in 60% by structural BMPs, with compliance focused in high-density residential, industrial, and highway areas), but it failed thereafter to evaluate the impacts that could be expected based on those assumptions;

   - finally, Public Resources Code section 21159(c) requires the Board to **evaluate a reasonable range of specific sites** that will be subject to the TMDL. This requirement is acknowledged in the Responses, which concede that the EA must examine "a reasonably representative sample of [sites]." (Page 12.) But the Responses then attempt to shed this responsibility by stating that estimating the locations of individual projects would be speculative because the Board is prohibited from specifying the manner of compliance with the TMDL. It is not speculative. As pointed out in the TMDL:

     "The focus of compliance should be on developed areas where the contribution of metals is highest and areas where activities occur that contribute significant loading of metals (e.g., high density residential, industrial areas and highways)." (TMDL, p. 53.)

     Thus, reasonable assumptions regarding a range of locations of structural BMPs could have been made and the EA could have effectively disclosed and evaluated project impacts. It failed to do so.

2. **DESIGN STORM.** The Responses also illustrate that the environmental evaluation done to date is deficient because the Board has not yet come up with a "design storm." A

design storm should be used as the basis for evaluating environmental impacts because the impacts of compliance will depend on the size of the storm that must be accommodated. Thus, the Board has put the cart before the horse—the Board uses an arbitrary cost analysis based on costs per acre for one-half inch of runoff, but facilities may need to be sized to meet larger runoff, so that impacts, both environmental and economic, could be much greater than those disclosed in the EA. The Board should establish the design storm first, and then evaluate the impacts of compliance.

3. **RESPONSES DO NOT ADDRESS ALL ISSUES.** The Responses do not address certain important issues raised in the comments. For example, *compare* the responses labeled 16.29 (utilities), 16.33 (mandatory findings of significance), 16.34 (alternatives), 16.35 (mitigation measures), and 16.36 (segmentation) *with* the comments that CPR submitted. The responses are clearly non-responsive and omit several of the important points raised.

4. **RESPONSES ARE CONCLUSORY.** The Responses that actually do address the issues raised are conclusory and fail to state the reasons for rejecting the comments and suggestions made. Responses must be reasoned, factual responses, a need which is particularly acute when critical comments are made by other agencies and experts. Because the Responses fail to identify data or **quantify** impacts, they are deficient.

For example, the Responses add an entirely new compliance option to the mix: the conversion to cooling towers. The Responses concede that this option could result in (i) increased **air emissions** (Staff Report 13); (ii) increased demand for public **water supply** (p 17); (iii) increased **noise** (p. 21); and (4) an increased rate of **fuel consumption** (natural gas) (p. 22.) There is no quantification of any of these increases, just conclusory statements:

- With regard to **emission increases**, the Responses state that they "would **likely be insignificant** when compared to emissions produced by the power plants' gas fired generators," and that "any potential air quality impacts would be intermediate." (Staff Report, p. 13.) This Response is deficient in that there is no quantification of what is "intermediate." And the courts have specifically struck down such general responses. In *Kings County Farm Bureau v. City of Hanford* (221 CA3d 692), the court invalidated an EIR that simply identified a natural gas alternative as having emissions levels "**somewhat lower**" than the project because no data was provided.

- Similarly, with regard to the **increased demand for public water supply**, the Responses merely state that agencies "could look to alternative sources" for water. (Staff Report, p. 17.) However, when it is uncertain whether water supplies will have to be obtained from another source, the EIR cannot simply characterize the uncertainly as speculative and refuse to address it. The EIR should examine whether other sources exist and describe the environmental consequences of tapping such resources. (*Napa Citizens for Honest Government v. Napa County Board of Supervisors* (2001) 91 Cal.App.4th 342, 371.)

- With regard to **noise** impacts, the Responses just say that it will be masked by noise already emanating from the power plant sites. However, the EA cannot discount impacts

by simply saying the existing level of impacts in that area is already high. In the *Kings County* case, the court struck down an EIR that adopted this "ratio approach."

- Finally, with regard to the **increased consumption of natural resources** (natural gas), the Responses merely state that "consumption will **likely be insignificant** in comparison to the existing gas consumption to operate power plants." (Staff Report, p. 22.) Again, this is the same vague, conclusory, non-quantitative response that has been rejected by the courts.

4. **RECIRCULATION IS REQUIRED.** The environmental documents should be recirculated because they now have added an entirely **new compliance option** and have revised the checklist to **acknowledge impacts that were not listed before**. The public needs the opportunity to evaluate the new data and information and the validity of the conclusions drawn from it.

5. **DEFECTIVE ALTERNATIVES ANALYSIS.** The Responses regarding the alternatives analysis are deficient for three reasons: First, the Responses fail to adequately discuss why the specific alternatives suggested by CPR were rejected. Second, the Responses fail to address CPR's point that the Board has failed to do the second analysis required by CEQA—that is, just because more than one method of compliance was proposed for the TMDL (*i.e.*, was reasonably foreseeable), this did not convert the discussion of those compliance methods into an analysis of alternatives—the EA also had to evaluate alternatives to those compliance methods that would avoid the identifiable impacts of the compliance methods. Third, there was no evaluation of alternatives to the proposed activity itself (*i.e.*, to the TMDL).

6. **DEFECTIVE STATEMENT OF OVERRIDING CONSIDERATIONS.** Finally, the Responses do not adequately explain why the EA has pre-determined that the project's benefits outweigh the project's impacts. The EA has no idea of what the project's impacts actually are because the analyses of impacts and mitigation measures are all deferred to the **implementation stage**. Although the Board may be the appropriate body to determine the appropriateness of region-wide regulations, the statement of overriding considerations goes to the implementation of the TMDL, not to the TMDL itself, and since those implementation methods are left up to the local agencies, the local agencies are the appropriate agencies for making the findings regarding overriding considerations.

   Furthermore, the environmental documents are inconsistent in that they find that all potential impacts are mitigated to insignificance, while at the same time finding that unmitigated impacts are overridden by the project benefits. The Responses try to explain-away this inconsistency by stating that "even if feasible mitigation measures are readily available to avoid or minimize impacts, it is still appropriate for the Regional Board to recognize that local agencies may not employ them." That is incorrect—local agencies are bound by the substantive provisions of CEQA **that forbid an agency from approving any project unless it adopts all feasible mitigation measures which are available to avoid minimum impacts**. (Pub. Res. Code §§ 21002.) The Board cannot assume that local agencies will not follow the law.

EXHIBIT "B"

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July 12, 2006

VIA FACSIMILE

Ms. Jenny Newman
California Regional Water Quality Control Board
Los Angeles Region
320 West Fourth Street, Suite 200
Los Angeles, CA 90013

Re: Failure to Provide At Least Ten (10) Days Notice on Responses to Comments Required by the California Environmental Quality Act ("CEQA") -- Metals and Selenium TMDL for the San Gabriel River and Impaired Tributaries

Dear Ms. Newman:

This office represents the Cities of Bellflower, Downey and Signal Hill, along with a number of cities in Los Angeles County who are members of an ad hoc coalition known as the Coalition for Practical Regulation ("CPR").[1] The purpose of this letter is to request that the Regional Board continue the hearing on the above-referenced matter presently scheduled for July 13, 2006 at 9:00 a.m., in light of the Regional Board's failure to comply with the notice requirements under Public Resources Code section 21092.5(a). Under section 21092.5, the Regional Board was required to provide "**at least ten days notice**" prior to the upcoming hearing on the certification of the proposed Environmental Impact Report for the subject Metals and Selenium TMDL, of its Responses to public agency comments.

Unfortunately, the Responses to Comments to my clients, who are all public agencies, was not provided until July 7, 2006, via posting on the Regional Board's website. These Responses were thus only posted six (6) days prior to the July 13, 2006 hearing. As such, the Regional Board has failed to comply with the requirements of Public Resources Code section 21092.5, as it has failed to provide the necessary ten (10) days notice of its Responses to Comments. Further, the Responses to Comments are voluminous, totaling 111 pages of

[1] The Coalition for Practical Regulation also known as "CPR" is an ad hoc group of municipalities in Los Angeles County committed to obtaining clean water through cost-effective and reasonable storm water regulations, and consists of the following Cities: Arcadia, Artesia, Baldwin Park, Bell, Bellflower, Bell Gardens, Bradbury, Carson, Cerritos, Commerce, Covina, Diamond Bar, Downey, Gardena, Hawaiian Gardens, Industry, Irwindale, La Canada Flintridge, La Mirada, Lakewood, Lawndale, Monrovia, Montebello, Monterey Park, Norwalk, Palos Verdes Estates, Paramount, Pico Rivera, Pomona, Rancho Palos Verdes, Rosemead, Santa Fe Springs, San Gabriel, Sierra Madre, Signal Hill, South El Monte, South Gate, South Pasadena, Temple City, Vernon, Walnut, West Covina, and Whittier.

EXHIBIT "B"

Responses, and my clients have not had sufficient opportunity to fully evaluate and understand the Responses, let alone consider the potential adverse impacts created by the proposed changes, mitigation measures or alternatives suggested in the Responses.

Accordingly, as the Regional Board has failed to comply with Public Resources Code section 21092.5, we respectfully request that the subject hearing scheduled for July 13, 2006, be continued until such time as the notice requirements under CEQA have been complied with, and adequate time has been provided to all public agencies to fully evaluate the Responses to Comments.

Please contact me if you have any questions with respect to the above and we look forward to a continued hearing at which time we will be in a better position to fully evaluate and comment on the Responses to Comments.

Sincerely,

RUTAN & TUCKER, LLP

Richard Montevideo

RM:clc
cc: Mr. Jonathan Bishop (via facsimile)
Michael Levy, Esq. (via facsimile)
Mr. Kenneth Farfsing (via facsimile)

EXHIBIT "C"

STATE OF CALIFORNIA

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LOS ANGELES REGION

ORDER NO. 01-182
NPDES PERMIT NO. CAS004001
WASTE DISCHARGE REQUIREMENTS
FOR
MUNICIPAL STORM WATER AND URBAN RUNOFF DISCHARGES WITHIN THE COUNTY OF LOS ANGELES, AND THE INCORPORATED CITIES THEREIN, EXCEPT THE CITY OF LONG BEACH

December 13, 2001
(Amended on September 14, 2006 by Order R4-2006-0074)

EXHIBIT "C"

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STATE OF CALIFORNIA

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LOS ANGELES REGION

ORDER NO. 01-182
NPDES PERMIT NO. CAS004001
WASTE DISCHARGE REQUIREMENTS
FOR
MUNICIPAL STORM WATER AND URBAN RUNOFF DISCHARGES WITHIN THE COUNTY OF LOS ANGELES, AND THE INCORPORATED CITIES THEREIN, EXCEPT THE CITY OF LONG BEACH

The California Regional Water Quality Control Board, Los Angeles Region (hereinafter referred to as the Regional Board) finds:

A. Existing Permit

The Los Angeles County Flood Control District, the County of Los Angeles, and 84 incorporated cities within the Los Angeles County Flood Control District (see Attachment A, List of Permittees), hereinafter referred to separately as Permittees and jointly as the Discharger, discharge or contribute to discharges of storm water and urban runoff from municipal separate storm sewer systems (MS4s), also called storm drain systems. The discharges flow to water courses within the Los Angeles County Flood Control District and into receiving waters of the Los Angeles Region. These discharges are covered under countywide waste discharge requirements contained in Order No. 96-054 adopted by this Regional Board on July 15, 1996, which replaced Order No. 90-079 adopted by this Regional Board on June 18, 1990. Order No. 96-054 also serves as a National Pollutant Discharge Elimination System (NPDES) permit for the discharge of municipal storm water.

B. Nature of Discharges and Sources of Pollutant

1. Storm water discharges consist of surface runoff generated from various land uses in all the hydrologic drainage basins that discharge into water bodies of the State. The quality of these discharges varies considerably and is affected by the hydrology, geology, land use, season, and sequence and duration of hydrologic events. The primary constituents of concern currently identified by the Los Angeles County Flood Control District Integrated Receiving Water Impacts Report (1994-2000) are cyanide, indicator bacteria, total dissolved solids, turbidity, total suspended solids, nutrients, total aluminum, dissolved cadmium, copper, lead, total mercury, nickel, zinc, bis(2-ethylhexyl)phthalate, polycyclic aromatic hydrocarbons (PAHs), diazinon, and chlorpyrifos.

2. Certain pollutants present in storm water and/or urban runoff may be derived from extraneous sources that Permittees have no or limited jurisdiction over. Examples of such pollutants and their respective sources are: PAHs which are products of internal combustion engine

Findings Related To the Incorporation Of The Santa Monica Bay Beaches Dry Weather Bacteria TMDL

28. The Regional Board adopted the Santa Monica Bay Beaches Dry Weather TMDL for Bacteria (hereinafter "Dry Weather Bacteria TMDL") on January 24, 2002. The TMDL was subsequently approved by the State Board, the Office of Administrative Law (OAL), and the USEPA and became effective on July 15, 2003.

29. The Waste Load Allocations (WLAs) in the Dry Weather Bacteria TMDL are expressed as the number of allowable days that the Santa Monica Bay beaches may exceed the Basin Plan water quality objectives for protection of Water Contact Recreation (REC-1) in marine waters, specifically the water quality objectives for bacteria. Appropriate modifications to this order are therefore included in Parts 1 (Discharge Prohibitions) and 2 (Receiving Water Limitations), pursuant to 40 CFR 122.41(f) and 122.62, and Part 6.I.1 of this Order. Additionally, 40 CFR 122.44(d)(1)(vii)(B) requires that NPDES permits be consistent with the assumptions and requirements of any available waste load allocation. Tables 7-4.1, 7-4.2a, and 7-4.3 of the Basin Plan set forth the pertinent provisions of the Dry Weather Bacteria TMDL. They require that during Summer Dry Weather there shall be no exceedances in the Wave Wash of the single sample or the geometric mean bacteria objectives set to protect the Water Contact Recreation (REC-1) beneficial use in marine waters. Accordingly, a prohibition is included in this Order barring discharges from a MS4 to Santa Monica Bay that result in exceedance of these objectives. Since the TMDL and the WLAs contained therein are expressed as receiving water conditions, Receiving Water Limitations have been included in this Order that are consistent with and implement the zero exceedance day WLAs.

30. Pursuant to federal regulations at 40 CFR 124.8, and 125.56, a Fact Sheet was prepared to provide the basis for incorporating the Dry Weather Bacteria TMDL into this Order. The Fact Sheet is hereby incorporated by reference into these findings.

31. The iterative approach to regulating municipal storm water is not an appropriate means of implementing the Santa Monica Bay beaches Summer Dry Weather WLAs for any and all of the following reasons: (a) The WLAs do not regulate the discharge of storm water; (b) The harm to the public from violating the WLAs is dramatic both in terms of health impacts to exposed beachgoers, and the economic cost to the region associated with related illnesses; (c) Despite the fact that more than a decade and a half has passed since MS4 permittees were required to eliminate illicit connections/discharges (IC/ID) into their MS4s, their programs have not eliminated standards violations at the beaches; and (d) Few permittees have ever documented revisions to their SQMP to address chronic exceedances of water quality standards.

32. The Receiving Water Limitations have been revised to implement the Summer Dry Weather WLAs set forth in Basin Plan Table 7-4.1 (attached as Appendix A to this order). These Receiving Water Limitations apply at the compliance monitoring sites identified in the *Santa Monica Bay Beaches Bacterial TMDLs Coordinated Shoreline Monitoring Plan* dated April 7, 2004.[1] Compliance with the Receiving Water Limitations shall be determined using shoreline monitoring data obtained in conformance with the *Santa Monica Bay Beaches Bacterial TMDLs Coordinated Shoreline Monitoring Plan* dated April 7, 2004.

33. If the Receiving Water Limitations are exceeded at a compliance monitoring site, the Regional Board will generally issue an appropriate investigative order pursuant to Cal. Water Code § 13267 or § 13225 to the Permittees and other responsible agencies or jurisdictions within the relevant subwatershed to determine the source of the exceedance. Following these actions, Regional Board staff will generally evaluate the need for further enforcement as follows:

a) If the Regional Board determines that the exceedance did not result from discharges from the MS4, then the MS4 Permittees would not be responsible for violations of these provisions.

b) If the Regional Board determines that Permittees in the relevant subwatershed have demonstrated that their MS4 does not discharge dry weather flow into Santa Monica Bay, those Permittees would not be responsible for violations of these provisions even if the Receiving Water Limitations are exceeded at an associated compliance monitoring site.

c) If the Regional Board determines that Permittees in the relevant subwatershed have demonstrated that their MS4 summer dry weather discharge into Santa Monica Bay is treated to a level that does not exceed either the single sample or the geometric mean bacteria objectives, those Permittees shall not be responsible for violations of these provisions even if the Receiving Water Limitations are exceeded at an associated compliance monitoring site.

d) If the Regional Board determines that one or more Permittees have caused or contributed to violations of these Receiving Water Limitations, the Regional Board will consider appropriate enforcement action, including a cease and desist order with or without a time schedule for compliance, or other appropriate enforcement action depending upon the circumstances and the extent to which the Permittee(s) has endeavored to comply with these provisions.

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1. If the Regional Board determines that publicly owned storm drains that flow during dry weather are situated at additional shoreline locations, the *Santa Monica Bay Beaches Bacterial TMDLs Coordinated Shoreline Monitoring Plan* may be revised by the Regional Board Executive Officer approval, after providing the opportunity for public comment, to include these locations as compliance monitoring sites.

34. A Permittee would not be responsible for violations of these provisions if the Regional Board Executive Officer determines that the Permittee has adequately documented through a source investigation of the subwatershed, pursuant to protocols established under Cal. Water Code 13178, that bacterial sources originating within the jurisdiction of the Permittee have not caused or contributed to the exceedance of the Receiving Water Limitations.

35. Water Code section 13389 exempts the Regional Board from compliance with Chapter 3 (commencing with Section 21100) of Division 13 of the Public Resources Code prior to the adoption of waste discharge requirements. Therefore the Regional Board is not required to prepare environmental documents to evaluate this permit modification. Nevertheless, the Regional Board has considered the policies and requirements set forth in Chapters 1 through 2.6 of CEQA, and further, has considered the final substitute environmental documents for the Santa Monica Bay Beaches Bacteria TMDL.

F. Implementation

1. The California Environmental Quality Act (CEQA) (Cal. Pub. Resources Code § 21000 *et seq.*) requires that public agencies consider the environmental impacts of the projects they approve for development. CEQA applies to projects that are considered discretionary and does not apply to ministerial projects, which involve the use of established standards or objective measurements. A ministerial project may be made discretionary by adopting local ordinance provisions or imposing conditions to create decision-making discretion in approving the project. In the alternative, Permittees may establish standards and objective criteria administratively for storm water mitigation for ministerial projects. For water quality purposes, the Regional Board considers that all new development and significant redevelopment activity in specified categories, that receive approval or permits from a municipality, are subject to storm water mitigation requirements.

2. The objective of this Order is to protect the beneficial uses of receiving waters in Los Angeles County. To meet this objective, this Order requires that the SQMP specify BMPs that will be implemented to reduce the discharge of pollutants in storm water to the maximum extent practicable. Further, Permittees are to assure that storm water discharges from the MS4 shall neither cause nor contribute to the exceedance of water quality standards and objectives nor create conditions of nuisance in the receiving waters, and that the discharge of non-storm water to the MS4 has been effectively prohibited.

3. The SQMP required in this Order builds upon the programs established in Order Nos. 90-079, and 96-054, consists of the components recommended in the USEPA guidance manual, and was developed with the cooperation of representatives from the regulated community and environmental groups. The SQMP includes provisions that promote

customized initiatives, both on a countywide and watershed basis, in developing and implementing cost-effective measures to minimize discharge of pollutants to the receiving water. The various components of the SQMP, taken as a whole rather than individually, are expected to reduce pollutants in storm water and urban runoff to the maximum extent practicable. Provisions of the SQMP are fully enforceable under provisions of this Order.

4. The emphasis of the SQMP is pollution prevention through education, public outreach, planning, and implementation as source control BMPs first and then Structural and Treatment Control BMPs next. Successful implementation of the provisions of the SQMP will require cooperation and coordination of all public agencies in each Permittee's organization, among Permittees, and with the regulated community.

5. The implementation of a Public Information and Participation Program is a critical component of a storm water management program. An informed and knowledgeable community is critical to the success of a storm water management program since it helps insure the following: (i) greater support for the program as the public gains a greater understanding of the reasons why it is necessary and important, and (ii) greater compliance with the program as the public becomes aware of the personal responsibilities expected of them and others in the community, including the individual actions they can take to protect or improve the quality of area waters.

6. This Order includes a Monitoring Program that incorporates Minimum Levels (MLs) established under the SIP. The SIP's MLs represent the lowest quantifiable concentration for priority toxic pollutants that is measurable with the use of proper method-based analytical procedures and factoring out matrix interference. The SIP's MLs therefore represent the best available science for determining MLs and are appropriate for a storm water monitoring program. The use of MLs allows the detection of toxic priority pollutants at concentrations of concern using recent advances in chemical analytical methods.

7. This Order provides flexibility for Permittees to petition the Regional Board Executive Officer to substitute a BMP under the SQMP with an alternative BMP, if they can provide information and documentation on the effectiveness of the alternative, equal to or greater than the prescribed BMP in meeting the objectives of this Order.

8. This Order contemplates that the Permittees are responsible for considering potential storm water impacts when making planning decisions in order to fulfill the Permittees' CWA requirement to reduce the discharge of pollutants in municipal storm water to the MEP from new development and redevelopment activities. However, the Permittees retain authority to make the final land-use decisions and retain full statutory authority for deciding what land uses are appropriate at specific locations within each Permittee's jurisdiction. This Order and its requirements are not intended to restrict or control local land use decision-making authority.

9. This Order is not intended to prohibit the inspection for or abatement of vectors by the State Department of Health Services or local vector agencies in accordance with Cal. Health and Safety Code § 2270 *et seq.* and §116110 *et seq.* Certain Treatment Control BMPs if not properly designed, operated or maintained may create habitats for vectors (e.g. mosquito and rodents). This Order contemplates that the Permittees will closely cooperate and collaborate with local vector control agencies and the State Department of Health Services for the implementation, operation, and maintenance of Treatment Control BMPs in order to minimize the risk to public health from vector borne diseases.

G. Public Process

1. The Regional Board has notified the Permittees and interested agencies and persons of its intent to issue waste discharge requirements for this discharge, and has provided them with an opportunity to submit their written view and recommendations.

2. The Regional Board, in a public hearing, heard and considered all comments pertaining to the discharge and to the tentative requirements.

3. The Regional Board has conducted public workshops to discuss drafts of the permit. On April 24, 2001, Regional Board staff conducted a workshop outlining the reasoning behind the changes proposed for the new permit and received input from the Permittees and the public regarding those proposed changes. On July 26, 2001, a second public workshop was held at a special Regional Board meeting. The Permittees and the public had another opportunity to express their opinions regarding the proposed changes to the permit in front of the Regional Board members. A significant number of working meetings with the Permittees and other interested parties have occurred throughout the period from the submittal of the ROWD and completion of the tentative draft, in an attempt to incorporate and address all the comments presented.

4. The Los Angeles County Flood Control District, the County of Los Angeles and the other municipalities are co-permittees as defined in 40 CFR 122.26 (b)(1). Los Angeles County Flood Control District will coordinate with the other municipalities and facilitate program implementation. Each Permittee is responsible only for a discharge for which it is the operator.

5. This Order shall serve as a NPDES Permit, pursuant to CWA § 402, or amendments thereto, and shall take effect 50 days from Order adoption provided the Regional Administrator of the USEPA has no objections.

6. The action to adopt an NPDES permit is exempt from the provisions of Chapter 3 of CEQA (Cal. Pub. Resources Code § 21100 *et seq.*), in accordance with CWC § 13389.

7. Pursuant to CWC §13320, any aggrieved party may seek review of this Order by filing a petition with the State Board. A petition must be sent to:

State Water Resources Control Board, P.O. Box 100, Sacramento, California, 95812, within 30 days of adoption of the Order by the Regional Board.

8. This Order may be modified or alternatively revoked or reissued prior to its expiration date, in accordance with the procedural requirements of the NPDES program, and the CWC for the issuance of waste discharge requirements.

IT IS HEREBY ORDERED that the Los Angeles County Flood Control District, Los Angeles County, and the Cities of Agoura Hills, Alhambra, Arcadia, Artesia, Azusa, Baldwin Park, Bell, Bellflower, Bell Gardens, Beverly Hills, Bradbury, Burbank, Calabasas, Carson, Cerritos, Claremont, Commerce, Compton, Covina, Cudahy, Culver City, Diamond Bar, Downey, Duarte, El Monte, El Segundo, Gardena, Glendale, Glendora, Hawaiian Gardens, Hawthorne, Hermosa Beach, Hidden Hills, Huntington Park, Industry, Inglewood, Irwindale, La Cañada Flintridge, La Habra Heights, Lakewood, La Mirada, La Puente, La Verne, Lawndale, Lomita, Los Angeles, Lynwood, Malibu, Manhattan Beach, Maywood, Monrovia, Montebello, Monterey Park, Norwalk, Palos Verdes Estates, Paramount, Pasadena, Pico Rivera, Pomona, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, Rosemead, San Dimas, San Fernando, San Gabriel, San Marino, Santa Clarita, Santa Fe Springs, Santa Monica, Sierra Madre, Signal Hill, South El Monte, South Gate, South Pasadena, Temple City, Torrance, Vernon, Walnut, West Covina, West Hollywood, Westlake Village, and Whittier, in order to meet the provisions contained in Division 7 of the CWC and regulations adopted thereunder, and the provisions of the CWA, as amended, and regulations and guidelines adopted thereunder, shall comply with the following:

Part 1. DISCHARGE PROHIBITIONS

Part 1. A. The Permittees shall effectively prohibit non-storm water discharges into the MS4 and watercourses, except where such discharges:

1. Are covered by a separate individual or general NPDES permit for non-storm water discharges; or

2. Fall within one of the categories below, and meet all conditions when specified by the Regional Board Executive Officer:

   a) Category A - Natural flow:

      (1) Natural springs and rising ground water;

      (2) Flows from riparian habitats or wetlands;

      (3) Stream diversions, permitted by the State Board; and

      (4) Uncontaminated ground water infiltration [as defined by 40 CFR 35.2005(20)].

   b) Category B - Flows from emergency fire fighting activity.

   c) Category C - Flows incidental to urban activities:

(1) Reclaimed and potable landscape irrigation runoff;

(2) Potable drinking water supply and distribution system releases (consistent with American Water Works Association guidelines for dechlorination and suspended solids reduction practices);

(3) Drains for foundations, footings, and crawl spaces;

(4) Air conditioning condensate;

(5) Dechlorinated/debrominated swimming pool discharges;

(6) Dewatering of lakes and decorative fountains;

(7) Non-commercial car washing by residents or by non-profit organizations; and

(8) Sidewalk rinsing.

The Regional Board Executive Officer may add or remove categories of non-storm water discharges above. Furthermore, in the event that any of the above categories of non-storm water discharges are determined to be a source of pollutants by the Regional Board Executive Officer, the discharge will no longer be exempt from this prohibition unless the Permittee implements conditions approved by the Regional Board Executive Officer to ensure that the discharge is not a source of pollutants. Notwithstanding the above, the Regional Board Executive Officer may impose additional prohibitions of non-storm water discharges in consideration of antidegradation policies and TMDLs.

Part 1. B. Discharges of Summer Dry Weather[2] flows from MS4s into Santa Monica Bay[3] that cause or contribute to exceedances of the bacteria Receiving Water Limitations in Part 2.5 below are prohibited.[4]

Part 2. RECEIVING WATER LIMITATIONS

[2] Dry Weather shall be determined as set forth in the *Santa Monica Bay Beaches Bacterial TMDLs Coordinated Shoreline Monitoring Plan* dated April 7, 2004, or any amendments thereto.

[3] Santa Monica Bay encompasses the coastal waters from Point Dume to Point Fermin and seaward to the 500-meter depth contour. It includes all beaches from the Los Angeles/Ventura County line south to the Outer Cabrillo Beach located just south of the Palos Verdes Peninsula.

[4] Responsibility for such prohibited discharges is determined as indicated in Footnote 3 part (3) of Table 7-4.1 of the Basin Plan. All Permittees within a subwatershed of the Santa Monica Bay Watershed Management Area are jointly responsible for compliance with the limitations imposed in Table 7-4.1.

1. Except as provided in Part 2.5 below, discharges from the MS4 that cause or contribute to the violation of Water Quality Standards or water quality objectives are prohibited.

2. Discharges from the MS4 of storm water, or non-storm water, for which a Permittee is responsible for, shall not cause or contribute to a condition of nuisance.

3. The Permittees shall comply with Part 2.1. and 2.2. through timely implementation of control measures and other actions to reduce pollutants in the discharges in accordance with the SQMP and its components and other requirements of this Order including any modifications. The SQMP and its components shall be designed to achieve compliance with receiving water limitations. If exceedances of Water Quality Objectives or Water Quality Standards (collectively, Water Quality Standards) persist, notwithstanding implementation of the SQMP and its components and other requirements of this permit, the Permittee shall assure compliance with discharge prohibitions and receiving water limitations by complying with the following procedure:

   a) Upon a determination by either the Permittee or the Regional Board that discharges are causing or contributing to an exceedance of an applicable Water Quality Standard, the Permittee shall promptly notify and thereafter submit a Receiving Water Limitations (RWL) Compliance Report (as described in the Program Reporting Requirements, Section I of the Monitoring and Reporting Program) to the Regional Board that describes BMPs that are currently being implemented and additional BMPs that will be implemented to prevent or reduce any pollutants that are causing or contributing to the exceedances of Water Quality Standards. This RWL Compliance Report may be incorporated in the annual Storm Water Report and Assessment unless the Regional Board directs an earlier submittal. The RWL Compliance Report shall include an implementation schedule. The Regional Board may require modifications to the RWL Compliance Report.

   b) Submit any modifications to the RWL Compliance Report required by the Regional Board within 30 days of notification.

   c) Within 30 days following the approval of the RWL Compliance Report, the Permittee shall revise the SQMP and its components and monitoring program to incorporate the approved modified BMPs that have been and will be implemented, an implementation schedule, and any additional monitoring required.

   d) Implement the revised SQMP and its components and monitoring program according to the approved schedule.

4. So long as the Permittee has complied with the procedures set forth above and is implementing the revised SQMP and its components, the Permittee does not have to repeat the same procedure for continuing or recurring exceedances of

the same receiving water limitations unless directed by the Regional Board to develop additional BMPs.

5. During Summer Dry Weather there shall be no discharges of bacteria from MS4s into the Santa Monica Bay that cause or contribute to exceedances in the Wave Wash, of the applicable bacteria objectives. The applicable bacteria objectives include both the single sample and geometric mean bacteria objectives set to protect the Water Contact Recreation (REC-1) beneficial use, as set forth in the Basin Plan.[5]

Part 3. STORM WATER QUALITY MANAGEMENT PROGRAM (SQMP) IMPLEMENTATION

A. General Requirements

1. Each Permittee shall, at a minimum, implement the SQMP. The SQMP is an enforceable element of this Order. The SQMP shall be implemented no later than February 1, 2002, unless a later date has been specified for a particular provision in this Order.

2. The SQMP shall, at a minimum, comply with the applicable storm water program requirements of 40 CFR 122.26(d)(2). The SQMP and its components shall be implemented so as to reduce the discharges of pollutants in storm water to the MEP.

3. Each Permittee shall implement additional controls, where necessary, to reduce the discharges of pollutants in storm water to the MEP.

4. Permittees that modify the countywide SQMP (i.e., implement additional controls, implement different controls than described in the countywide SQMP, or determine that certain BMPs in the countywide SQMP are not applicable in the area under its jurisdiction), shall develop a local SQMP, no later than August 1, 2002. The local SQMP shall be customized to reflect the conditions in the area under the Permittee's jurisdiction and shall specify activities being implemented under the appropriate elements described in the countywide SQMP.

B. Best Management Practice Implementation

The Permittees shall implement or require the implementation of the most effective combination of BMPs for storm water/urban runoff pollution control. When implemented, BMPs are intended to result in the reduction of pollutants in storm water to the MEP.

C. Revision of the Storm Water Quality Management Program

[5] Samples collected for determining compliance with the receiving water limitations of Part 2.5 shall be processed in accordance with the sampling procedures and analytical methodology set forth in the *Santa Monica Bay Beaches Bacterial TMDLs Coordinated Shoreline Monitoring Plan* dated April 7, 2004.

EXHIBIT "D"

Storm Water Panel Recommendations to the California State Water Resources Control Board

The Feasibility of Numeric Effluent Limits Applicable to Discharges of Storm Water Associated with Municipal, Industrial and Construction Activities

June 19, 2006

EXHIBIT "D"

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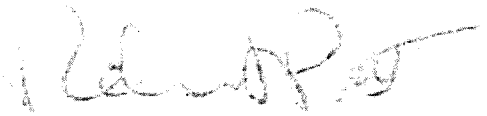

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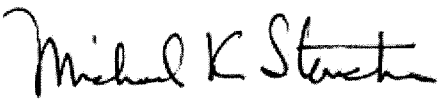

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"The opinions I express are my own and do not represent official US EPA policy."

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Background

The NPDES storm water permit program came into being as a result of the 1987 amendments to the federal Clean Water Act and its implementing regulations. In California, the State Water Resources Control Board (State Water Board) and the nine Regional Water Quality Control Boards (Regional Water Boards) implement the NPDES storm water program.

The Clean Water Act amendments, Section 402(p) require that discharges of storm water from large and medium municipal separate storm sewer systems (MS4s) and discharges of storm water associated with industrial activities be in compliance with NPDES permits. MS4 permits require that the discharge of pollutants be reduced to the maximum extent practicable (MEP). Discharges associated with industrial activities, were required to meet the technology based standards of best available technology economically achievable (BAT) or best conventional pollutant control technology (BCT), and to meet water quality standards.

In 1990, USEPA promulgated regulations (40 CFR Part 122.26) for the NPDES storm water program. These regulations clarified what industrial activities were subject to storm water permit. Construction that resulted in a land disturbance of five or more acres was included as an industrial activity subject to NPDES storm water permit. The regulations also delineated what was to be included in permit applications and the programmatic elements that were to be in a permit and storm water management program for MS4s or storm water pollution prevention plan for industrial activities.

California's Permits

In 1990, MS4 permits were issued to Santa Clara County by the San Francisco Bay Regional Water Board and to Los Angeles County by the Los Angeles Regional Water Board. These permits were appealed to the State Water Board. The primary basis of the appeals was the lack of numeric limits in the permits. The entities that brought the appeals argued that the permits needed to include numeric limits, as the discharges of pollutants must not only be reduced to the MEP, but they must also meet water quality standards. The State Water Board, in hearing these appeals, determined that it was not feasible at the time to develop numeric limits for MS4 permits, and that water quality standards could and should be achieved through the implementation of best management practices (BMPs). Since this ruling, the Regional Water Boards have typically not included numeric limits in storm water permits.

The State Water Board has adopted NPDES General Permits for the Discharge of Storm Water Associated with Industrial Activities and for the Discharge of Storm Water Associated with Construction Activities. Both of these permits contain language stating that developing numeric limitations is infeasible.

Court Decisions

In addition to these actions on MS4 permits at the State level, there have been a number of rulings from the federal courts regarding the NPDES Storm Water program.

One of the most significant is from the federal court, 9th District Court of Appeals from 1999. In its published opinion on Defenders of Wildlife vs. Browner, the Court held that MS4 permits need not require strict compliance with water quality standards. Rather, compliance was to be based upon the MEP standard. However, the permitting authority (the State Water Board/Regional Water Boards for California) could at their option require compliance with standards. The State Water Board through the permit and appeals process has in fact required that the discharges from MS4s meet water quality standards, but has stated that compliance with numeric standards can be achieved through the implementation of BMPs in an iterative fashion.

The Browner decision also found that discharges of storm water associated with industrial activities must be in strict compliance with water quality standards.

In 2004 the State Water Board conducted a public hearing on a draft General Industrial Storm Water permit. This draft permit met with significant opposition from non-government or non-industrial organizations (NGOs) due to the absence of numeric limits. Staff revised the draft permit to include the benchmarks contained in the USEPA multi-sector general permit. This change resulted in strong opposition from the regulated community.

The concerns that have been raised by the NGOs and the regulated community are similar, though they do not necessarily agree on the best way to address them. Both believe that permitting has become overly complex, and that it is extremely difficult, if not impossible to objectively determine if a facility, operation or municipality is in compliance with its permit requirements. The NGOs argue that requiring storm water permittees to comply with numeric effluent limits will result in an easier way to measure compliance. The regulated community agrees, to a degree, but they argue that it is not simply a matter of selecting a number that is suitable for a POTW or industrial waste discharge. Due to the unique nature of storm events and storm water discharges, any numeric limit that is placed in a storm water permit must take into consideration the episodic nature of storm events and be truly representative of storm water discharges. In addition, the regulated community has argued that there are going to be pollutants in storm water discharges that did not originate in the MS4 (run on) or that they do not have the means to control, and therefore should be given special consideration.

In response to these arguments, State Water Board directed staff to convene a panel of storm water experts to examine the feasibility of developing numeric

limits for storm water permits. Specifically, this panel of experts was asked to consider the following:

> "Is it technically feasible to establish numeric effluent limitations, or some other quantifiable limit, for inclusion in storm water permits? How would such limitations or criteria be established, and what information and data would be required?"
>
> "The answers should address industrial general permits, construction general permits, and area-wide municipal permits. The answers should also address both technology-based limitations or criteria and water quality-based limitations or criteria. In evaluating establishment of any objective criteria, the panel should address all of the following:
>
> (1) The ability of the State Water Board to establish appropriate objective limitations or criteria; (2) how compliance determinations would be made; (3) the ability of dischargers and inspectors to monitor for compliance; and (4) the technical and financial ability of dischargers to comply with the limitations or criteria."

Staff invited 10 individuals from the academic and scientific community to participate on the panel. Of the 10, eight agreed to participate. These eight met in a public session on September 14, 2005 and heard presentations from the regulated and NGO communities. They also heard comments from the public at large. They met again on September 15, 2005 to discuss the public comments and to begin to formulate a response. It was also decided at this meeting that they would form sub-committees to address municipal (MS4), industrial and construction discharges separately. These sub-committees worked on drafts statements for each of these, circulating them over the course of a number of months.

The panel met again in private session on April 3 and 4, 2006. The purpose of these meetings was to address unresolved issues and to develop the final response to the State Water Board. It was also decided to combine the three working statements into one Statement of Findings. The following discussion is the panel's findings and is broken into three program element areas: municipal, construction, and industrial.

Panel's Findings on Feasibility of Numeric Effluent Limits Applicable to Municipal Activities

Municipal Observations

1. The current practice for permitting, designing, and maintaining municipal stormwater treatment facilities (called BMPs herein) on the urban landscape does not lend itself to reliable and efficient performance of the BMPs because:

    - Permitting agencies, including EPA, States, and local governments, have rarely developed BMP design requirements that consider the pollutants and/or parameters of concern, the form(s) that the pollutants or parameters are in, the hydrologic and hydraulic nature of how they pollutants and flow arrive, and then the resulting unit processes (treatment and/or flow management processes) that would be required to address these pollutants or parameters.
    - The permitting agencies generally are not accountable for the performance of the BMP, and thus give much leeway to the developer with respect to the type of BMPs to be constructed, and to the details of the design, although some states do have detailed design standards and have conducted performance tests to identify acceptable devices for their area.
    - The developer is not responsible in most all cases for the performance of the BMP, so the treatment facilities are designed to minimize the cost and/or area of the facility and/or ease of permitting, not maximize the pollutant removal efficiency and/or flow management of the BMP
    - Because BMPs are not held to any, or very few, long-term performance criteria, they are typically not maintained except for aesthetic purposes. Very few stormwater agencies are responsible for BMP maintenance on private property, and public facilities are maintained mostly in response to clogging and/or resultant drainage or aesthetic problems. Even for stormwater agency facilities, maintenance is often limited.

2. The principal reasons for the failure of BMP performance is improper BMP selection, design and/or lack of maintenance.

    - The California BMP Handbooks and other local requirements leave too much of the BMP selection and design to the discretion of the designer, and thus do not address many if not all of the receiving water quality issues

- BMPs need to be *designed to facilitate maintenance*; this is rarely done because it costs the developer money and the BMP designer is rarely responsible for the maintenance.

- Given the amount of debris in urban runoff, and the fact that the hydraulic capacity of many BMPs may be exceeded several to many times per year, BMPs require more maintenance than other types of stormwater control facilities. Since urban BMP maintenance is generally left to untrained homeowner associations and maintenance personnel for commercial properties, inadequate maintenance is a near certainty. Even stormwater agencies often do not have and/or apply the resources necessary to maintain agency owned BMPs.

3. Improvements in the design of municipal BMPs, including residential and commercial as well as municipally owned facilities are necessary to ensure better performance (i.e. sizing, geometry, inlet and outlet design, etc.) and to specifically target receiving water quality issues.

The Problem with Existing Effluent Limit Approaches

Effluent limit approaches usually focus only on conventional water quality constituents that may not be solely or at all responsible for the receiving water beneficial use impairments in urban receiving waters. The important stressors that affect many use impairments can include one or more of the following and may vary in importance from system to system:

- The effect of increased flows and/or volumes (i.e. hydromodification) that can lead to stream channel erosion/sedimentation with resulting habitat destruction

- Sediment contamination (such as enrichment of urban stream sediments with fine-grained heavily polluted particulates; large organic debris masses causing low sediment DO; settled bacteria causing large bacteria gradients with sediment depth etc.)

- Impaired aesthetic value (caused by gross floatables, noxious sediments, etc.)

- Unsafe conditions (caused by dangerous debris, highly fluctuating stream flows and stages, etc.)

- Dissolved and suspended pollutants that are bioavailable in the water column and/or result in downstream sediment contamination

- Elevated temperatures from urban heating effects on runoff and on open conveyances and permanent pool BMPs

It is very difficult to determine specific causative agents or the level of control needed, for a specific beneficial use impairment in a receiving water body. The *Stormwater Effects Handbook: A Tool Box for Watershed Managers, Scientists, and Engineers* (Burton, G.A. Jr., and R. Pitt, ISBN 0-87371-924-7. CRC Press, Inc., Boca Raton, FL. 2002. 911 pages) was written to be used as a guide for stormwater managers to identify their local receiving water problems and to assist in identifying the causative factors. The methods described would need to be applied to a specific area or region to obtain an understanding of local conditions and problems. Although expensive, comprehensive investigations such as these should be considered an investment to help minimize wasteful expenditures due to the application of inappropriate control practices in a watershed.

Monitoring for enforcement of numeric effluent limits would also be challenging. While spot checks could be made at some of the many outfalls in an area, there is wide variation in stormwater quality from place to place, facility to facility, and storm to storm. Coefficients of variation approaching 1 or higher are not uncommon and there are few factors that can be used to significantly reduce this variation. Analysis of the National Stormwater Quality Database indicates that geographical location and land use are the most important factors affecting stormwater quality for most constituents. Some are also affected by the antecedent dry period before the rain and more highly developed watersheds (containing large fractions of impervious areas) often show elevated "first-flush" concentrations in the first portion of the storms for some, but not all pollutants. Since the storm-to-storm variation at any outfall can be high, it may be unreasonable to expect all events to be below a numeric value. In a similar circumstance, there are a number of storms each year that are sufficiently large in volume and/or intensity, to exceed the design capacity volume or flow rates of most BMPs. Assessing compliance during these larger events represents yet another challenge to regulators and the regulated community.

Technical Issues

Even for conventional pollutants, there presently is no protocol that enables an engineer to design with certainty a BMP that will produce a desired outflow concentration for a constituent of concern. A possible exception is removal of Total Suspended Solids in extended detention basins, and some types of media filters. The typical approach for evaluating BMP pollutant removal efficiency has been *percent removal*; but observed removal efficiencies vary greatly from facility to facility and it has been demonstrated that percent removal varies directly with the inflow concentration.

Few, if any, BMPs are designed using the first principles laws of physics, chemistry and/or biology for pollutant removal and/or flow-duration control. It will

take a substantial research effort, including data gathering on well-designed BMPs, to develop design criteria for the removal of pollutants with confidence intervals that enable us to make reliable estimates of the median and variance of the effluent concentrations to be expected from the various types of BMPs. Until this is done, it will be very difficult to assign legally enforceable numerical effluent limitations to any particular BMP.

Drawing upon the body of knowledge that currently exists regarding pollutant removal efficiency, it is possible to estimate mean effluent concentrations and variances for a number of constituents for different types of BMPs, albeit not in a legally enforceable sense. Effluent concentration distributions for a number of BMPs are available in the International BMP Database (www.bmpdatabase.org) from more then 250 studies throughout the US. The following outlines key issues that have been identified regarding the technical feasibility of setting objective criteria for both existing areas and new or redeveloping areas:

- Effluent concentration estimates could be made for a given constituent and a particular BMP from a larger number of BMPs than available in the BMP Database using literature values of percent removal and local or national data on stormwater runoff EMC data. However, the results from this work would be significantly less reliable then the BMP Database data as it could be biased if the influent concentrations for the studied BMP types did not match general urban runoff.
- Designing the facility more rigorously with respect to the physical, chemical and biological processes (e.g. unit processes) that are active in the BMP would give confidence that the BMP would perform at least as well, if not better than the average performance determined from the literature. A WEF/ASCE task force is currently updating their Urban Runoff Quality Management Manual of Practice; design guidance of BMPS will make better use of the physical, chemical, and biologic processes taking place in the BMP before, during and after a storm event. This manual will build upon recent research efforts employing a unit process based approach for BMP design and selection. These research efforts were supported by the Water Environment Research Foundation (WERF) and the National Cooperative Highway Research Program (NCHRP).
- A BMP *designed* and *constructed* according to a set of criteria described above, could be ***presumed*** to deliver an effluent with a mean constituent concentration and variance similar to the performance numbers developed from the literature ***if it is properly maintained***. Enforcement would comprise periodic inspection of the facility using a checklist of items to be inspected. While not an effluent limit, this seems practical and quantifiable.

- Most all existing development rely on non-structural control measures, making it difficult, if not impossible to set numeric effluent limits for these areas because little is known about the quantity and quality performance of non-structural controls. However, certain development characteristics in some existing development areas that minimize the amounts of impervious areas in a drainage area have been shown to be quite effective in reducing adverse hydromodifications in the receiving waters, and should be encouraged.

Municipal Recommendations

It is not feasible at this time to set enforceable numeric effluent criteria for municipal BMPs and in particular urban discharges. However, it is possible to select and design them much more rigorously with respect to the physical, chemical and/or biological processes that take place within them, providing more confidence that the estimated mean concentrations of constituents in the effluents will be close to the design target. Moreover, with this more rigorous design and an enforceable maintenance program, it can be presumed that these facilities will continue to deliver effluent qualities that are reasonably close to the design effluent concentrations over the life of the facility. And if proper maintenance is performed (enforced), the facilities can be expected to perform throughout their design life at the same or better efficiency as when newly constructed. Depending on the pollutants and parameters of concern and BMP choices, it is very likely that treatment trains of structural BMPs will be required in many cases.

For catchments not treated by a structural or treatment BMP, setting a numeric effluent limit is basically not possible. However, the approach of setting an "upset" value, which is clearly above the normal observed variability, may be an interim approach that would allow "bad actor" catchments to receive additional attention. For the purposes of this document, we are calling this "upset" value an ***Action Level*** because the water quality discharged from such locations are enough of a concern that most all could agree that some action should be taken. Action Levels could be developed using at least three different approaches. These approaches include: 1) consensus based approach; 2) ranked percentile distributions; 3) statistically-based population parameters.

The consensus-based approach would be to agree upon effluent concentrations that all parties feel are not acceptable. For example, most parties would likely agree that an average concentration of dissolved copper above 100 ug/l from an urban catchment would not be acceptable. This would be an Action Level value that would trigger an appropriate management response. This approach may not directly address the issue of establishing numeric effluent criteria and achieving desired effluent quality, but the consensus-based approach would ensure that the "bad actor" watersheds received needed attention.

The ranked percentile approach (also a statistical approach) relies on the average cumulative distribution of water quality data for each constituent developed from many water quality samples taken for many events at many locations. The Action Level would then be defined as those concentrations that consistently exceed some percentage of all water quality events (i.e. the 90th percentile). In this case, action would be required at those locations that were consistently in the outer limit (i.e. uppermost 10th percentile) of the distribution of observed effluent qualities from urban runoff.

The statistically based population approach would once again rely on the average distribution of measured water quality values developed from many water quality samples taken for many events at many locations. In this case, however, the Action Level would be defined by the central tendency and variance estimates from the population of data. For example, the Action Level could be set as two standard deviations above the mean, i.e. if measured concentrations are consistently higher than two standard deviations above the mean, an Action situation would be triggered. Other population based estimators of central tendency could be used (i.e. geomean, median, etc.) or estimates of variance (i.e. prediction intervals, etc.). Regardless of which population-based estimators are used (or percentile from above), the idea would be to identify the [statistically-derived] point at which managers feel concentrations are significantly beyond the norm.

The ranked percentile and population-based estimators are highly dependent upon the data sets used to calculate them. There are a number of options that were considered by the Panel, but ultimately they were broken into two distinct categories. The first category was for new development/redevelopment and the second was for built out urban environments. For new development/redevelopment, the panel recommends using the data set associated with the international BMP database (www.bmpdatabase.org). This data set represents the variety of water quality from the most up to date, best conducted and reported BMP studies. The database effort does not limit itself to BMPs types or designs; it focuses on technically sound monitoring studies and reporting information. Therefore there could be some screening of studies to those thought to be well designed BMPs to then develop effluent quality distributions and statistics on performance. Certainly, there is no expectation that urban stormwater managers could improve water quality beyond what would be reported in this dataset.

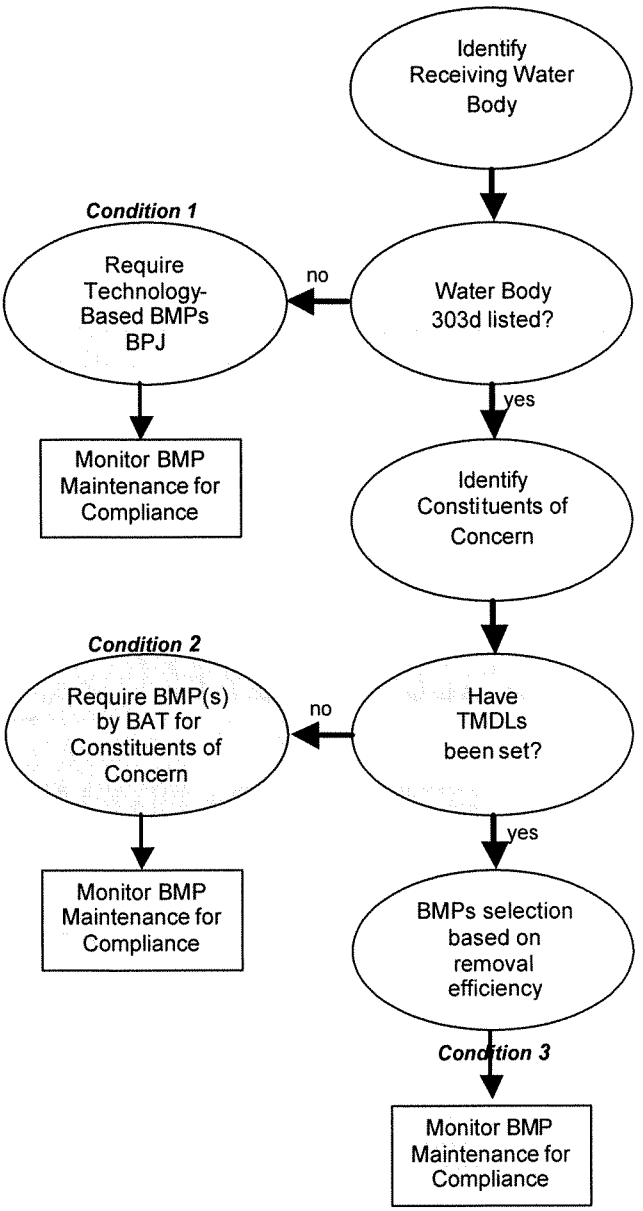
In built-out urbanized environments, there are greater opportunities to examine various data sets for setting Action Levels. For the Panel, these opportunities were a function of spatial scale. The first opportunity would be at the local scale. Some urban stormwater monitoring programs have been in existence for 10 years or longer. Examples include the Los Angeles County Department of Public Works, City of Sacramento, Orange County, San Diego County, amongst others. Using permit specific data sets may make sense if issues of climatic variability or

localized geomorphology are important. The next scale would be to combine these California municipal permit monitoring data sets, especially if lack of data for specific constituents of concern in any one location or region is an important issue. The largest scale would be the National Stormwater Quality Database (NSQD) from municipal monitoring programs across the nation (http://unix.eng.ua.edu/~rpitt/Research/ms4/Paper/Mainms4paper.html). This data set includes monitoring data from urban areas such as residential, commercial, industrial, freeway, institutional, and mixed use which is especially useful if small sample size limits the use of local data. One advantage of using smaller (and local), rather than larger, spatial scales is the ability to update data sets for revising Action Levels. The NSQD may not be updated for quite some time, but local data sets can be updated periodically (annual amendments, 10-year rolling averages, every permit cycle, etc). Ultimately, Action Levels would be expected to become lower as outliers are removed from data sets and as improved water quality data are collected through targeted management actions. It may be appropriate to eliminate older data sets as well over time.

One element to consider when comparing monitoring data to Action Levels is the concept of a design volume for water quality (also known as the Water Quality Capture Volume – WQCV, WEF #23 and ASCE publication #87, 1998) or a design flow rate. The WERF and NCHRP efforts mentioned above include recommendations regarding design sizing using continuous simulation techniques for both volume-based and rate-based BMPs. The Panel acknowledged that several to more times each year, the runoff volume or flow rate from a storm will exceed the design volume or rate capacity of the BMP. Stormwater agencies should not be held accountable for pollutant removal from storms beyond the size for which a BMP is designed.

A Technically Sound and Pragmatically Enforceable BMP Design and the Permit Process

The diagram below provides guidance for determining what BMPs are required in a newly developing watershed. Under ***Condition 1*** where the receiving water quality is not impaired, determination of the appropriate BMP would be by Best Professional Judgment (BPJ). Any of the "state approved" BMPs could be used. The permittee would be required to design the treatment facilities in accordance with the California BMP Handbook, ***which should be revised as a criteria manual***, rather than a guidance manual *and include more physiobiochemically based design criteria designed to address an agreed upon set of "Pollutants and Parameters of Concern" based upon knowledge of the pollutants and parameters that generally are of concern in urban runoff, with perhaps some differences on receiving water type.*



A detailed maintenance plan and schedule would be required that includes:

1. Actions to be taken and when,
2. Designation of the party legally accountable for the facility maintenance, and
3. A whole-life cost estimate for the facility that include maintenance.

Compliance with the design criteria and the maintenance plan and schedule would constitute achievement of the design effluent criteria. In the event of failure by the responsible party to perform the required maintenance and/or to perform it to the required level of quality, the whole-life cost schedule could be used to determine the consideration that the defaulting responsible party would pay to the new responsible party that takes over the maintenance.

Under ***Condition 2*** where water quality impairment exists but a TMDL has not yet been performed, BAT would be required, which means applying the BMPs that can practicably (to be defined) be employed to produce the lowest effluent concentrations (e.g. the lower grouping of BMP effluent quality) of the constituent(s) of concern. Several types of BMPs may fulfill the BAT standard if these BMPs have performance that is not statistically or practically differentiable. This case will allow flexibility in choosing among that sets of BMPs that demonstrate superior performance. As in the case of C*ondition 1,* compliance with the maintenance plan and schedule would constitute compliance with the design effluent criteria.

Condition 3, which occurs when a TMDL has been specified for the BMP or for the tributary watershed, may (or may not be) actually be less stringent that *Condition 2* if the TMDL allows for a higher effluent concentration of the constituents of concern than that discharged by a BAT facility. The same requirements would apply for the design criteria, and the maintenance plan and schedule would constitute the guarantee of design effluent concentrations from the BMP.

Strategies for Stormwater Management to Protect Urban Water Environments

Stormwater effluent limits can become very complex if all the issues are to be directly addressed. If complex, they are not likely to be workable. However, too much simplification can also lead to ineffective programs. Therefore, a reasonable first step is needed, based on local data. Compliance monitoring (e.g. BMP inspections) is also needed to ensure that the goals are likely to be met. Most likely goals will have to be revised over time. The overall strategy should contain these objectives:

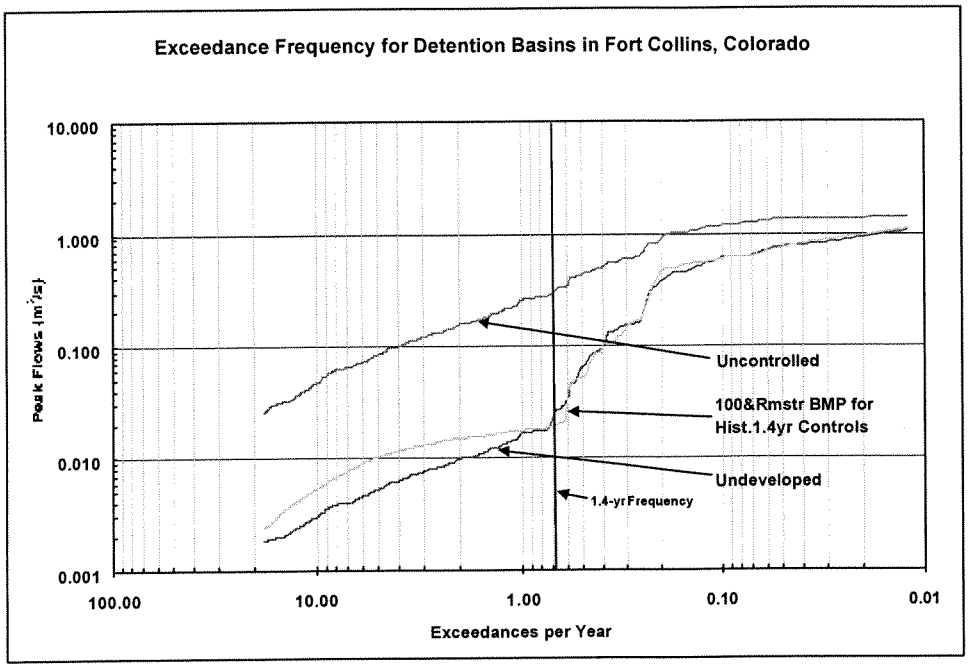
- Effectiveness
- Affordability
- Enforceability, and
- Flexibility

Table 1 - Effects of Urbanization on Hydrologic Regime in Colorado and Georgia

Location	Annual Precipitation	Mean Storm Depth*	Runoff Events per Year		Annual Runoff (mm)	
	Millimeters per Year	Millimeters	Undeveloped	Developed	Undeveloped	Developed
Fort Collins, CO	335	11	27	47	12	124
Atlanta, GA	1262	18	48	78	36	500
* Values obtained from Fig. 5.3 ASCE MOP (1998)						

Runoff volume and peak flows have been recognized as two of the most important stormwater factors needing control. **Table 1** (Roesner and Nehrke) shows that urbanization dramatically changes the hydrologic regime of urban waterways. In both Atlanta (a higher rainfall area) and Fort Collins (a semiarid area), the number of runoff events per year on developed land increases by a factor of 2 times the number of runoff events that occur in the undeveloped state; and the runoff volume increases by a factor of ten! The peak flows also increase dramatically as shown in **Figure 1** below, but as also seen on the figure, the peak flow frequency curve can be adjusted back to its predevelopment character by the proper application of runoff controls. But while these controls restore the peak flow frequency to its natural regime, the duration of flows at the low end (but still channel "working") of the flow frequency curve is greatly increased, which raises potential for channel scour in stream channels with erosive soils.

Figure 1 - Exceedance Frequencies for Detention Basins in Fort Collins, Colorado



Since many of the stormwater pollutants are strongly associated with particulates, stormwater particulate control is also often a component of stormwater control programs. Therefore, an effective stormwater control strategy that could be encouraged is a combination of several practices, listed below in the order of increasing events:

- On-site stormwater reuse, evapotranspiration and infiltration for the smallest storms and up to specific targeted events, depending on site limitations (soil characteristics and groundwater contamination potential) (usually by conservation design emphasizing infiltration, disconnecting paved areas, etc.)
- Treatment of excess runoff that cannot be infiltrated, again, up to a specific targeted runoff volume (usually by sedimentation or filtration) For pollutants of concern, it should be demonstrated that the BMP(s) need to include the physical, biological, and/or chemical treatment processes that address the typical pollutants of concern and/or specific pollutants in the case of 303D listed water bodies or those with established TMDLs.
- Control of energy discharges for the channel forming events (such as through storage-release, focusing on flow-duration analyses and peak flow frequency analyses). To be most effective, this should to be completed under a watershed management plan and not site-by-site.
- Provide safe drainage for damaging events (conventional drainage, plus secondary drainage systems)
- In watersheds that are already experiencing damaging flow impacts to streams, it could be in many circumstances much more cost-effective (and effective period) to develop through a watershed plan a natural stream stabilization approach that could address both the existing development and the remaining smaller infill or otherwise smaller new development. In these cases, requiring the remaining new development to implement flow-duration control would not solve the issue in a measurable way and resources would be better spent restoring the functions of the creek with instream enhancements.

Panel's Findings on Feasibility of Numeric Effluent Limits Applicable to Construction Activities

Construction Observations

Regarding the question of the technical feasibility of Numeric Limits for stormwater discharges from construction activities, the Panel bases its recommendations on the following observations.

1. Limited field studies indicate that traditional erosion and sediment controls are highly variable in performance, resulting in highly variable turbidity levels in the site discharge.
2. Site-to-site variability in runoff turbidity from undeveloped sites can also be quite large in many areas of California, particularly in more arid regions with less natural vegetative cover and steep slopes.
3. Active treatment technologies involving the use of polymers with relatively large storage systems now exist that can provide much more consistent and very low discharge turbidity. However, these technologies have as yet only been applied to larger construction sites, generally five acres or greater. Furthermore, toxicity has been observed at some locations, although at the vast majority of sites, toxicity has not occurred. There is also the potential for an accidental large release of such chemicals with their use
4. To date most of the construction permits have focused on TSS and turbidity, but have not addressed other, potentially significant pollutants such as phosphorus and an assortment of chemicals used at construction sites.
5. Currently, there is no required training or certification program for contractors, preparers of soil erosion and sediment control Stormwater Pollution Prevention Plans, or field inspectors.
6. The quality of stormwater discharges from construction sites that effectively employ BMPs likely varies due to site conditions such as climate, soil, and topography.
7. The States of Oregon and Washington have recently adopted similar concepts to the Action Levels described earlier.

Construction Recommendations

It is the consensus of the Panel that active treatment technologies make Numeric Limits technically feasible for pollutants commonly associated with stormwater discharges from construction sites (e.g. TSS and turbidity) for larger construction sites. Technical practicalities and cost-effectiveness may make these technologies less feasible for smaller sites, including small drainages within a larger site, as these technologies have seen limited use at small construction sites. If chemical addition is not permitted, then Numeric Limits are not likely feasible. Whether the use of Numeric Limits is prudent, practical or necessary to more effectively achieve nonpoint pollution control is a separate question that

needs to be answered, but is outside the scope of this Panel. However, Action Levels are likely to be more commonly feasible. For small sites or smaller drainages within larger sites, or where chemicals cannot be used, the Panel recommends that Action Levels be specified.

Advanced systems lend themselves to Numeric Limits because of historically reliable treatment, while non-active controls are less predictable. Advanced systems have been in use in some form since the mid-1990s. At this time, there are two general types of systems. With each general system the stormwater is retained on-site, treated, and released more slowly. One system employs polymer coagulation and sedimentation. The second system employs polymer coagulation with direct filtration. Both types of systems are considered reliable, and can consistently produce a discharge less than 10 NTU. These systems have been used successfully at many sites in several states since 1995 to reduce turbidity to very low levels. Non-active erosion and sediment control BMPs, while effective when applied and adequately maintained, produce more highly variable in effluent quality, making setting Numeric Limits difficult, if not impossible.

An important consideration in setting Numeric Limits or Action Levels is that in many locations in California the natural background turbidity and/or TSS levels in stormwater runoff are quite high. This is particularly true in semi-arid or arid regions, which tend to have less vegetative cover. For example, natural runoff concentrations in Emerald Creek, on the Newport Coast, above any developed areas have been over 5,000 mg/l during runoff events. The Los Angeles County Monitoring Data sets included an open land use watershed that also showed TSS levels significantly above other types of urban land uses. Therefore, it is important to consider natural background levels of turbidity or TSS in setting Numerical Limits or Action Levels for construction activities. The difficulty in determining natural background concentrations/levels for all areas of the state could make the setting of Numeric Limits or Action Levels impractical from an agency resource perspective.

While the Panel concludes that Numeric Limits or Action Levels are technically feasible, the Panel has several reservations and concerns.

1. The active treatment systems have generally been employed on sites five acres or larger. While the systems are technically feasible for sites of any size, including sites or drainages as small as an acre or less, the cost may be prohibitive. The cost-effectiveness of active treatment systems is greatly enhanced for large drainage areas, at which construction occurs for an extended period of time, over one or more wet season. There is also a more "passive" active system that is employed in New Zealand that uses captured rainfall to release the chemical into flows entering a detention system that requires less instrumentation and flow measurement infrastructure. Even more passive systems such as the use of polymer

logs and filter bags are currently under development for small sites. Regardless, the Panel recommends that the Board give particular attention to improving the application of cost-effective source controls to small construction sites.

2. In considering widespread use of active treatment systems, full consideration must be given to whether issues related to toxicity or other environmental effects of the use of chemicals has been fully answered. Consideration should be given to longer-term effects of chemical use, including operational and equipment failures or other accidental excess releases.
3. Consideration should be given to the seasonality of applying Numerical Limits. There may be sites where summer only construction that complies with Action Levels may be preferred to year-round that sites that include winter construction that complies with Numeric Limits. In such cases, applying Numeric Limits to summer construction may be a disincentive to scheduling active grading during dry periods. Allowing summer only construction sites to comply with action levels would discourage winter construction activities.
4. Consideration should be given to whether Numeric Limits would apply to all construction sites or only those with significant disturbed soil areas (e.g. active grading, un-vegetated and/or un-stabilized soils). A site could meet certain conditions to be considered "Stabilized" for the runoff season.
5. Where Numeric Limits are not feasible or where they would not apply during designated seasons or site conditions, the Panel recommends that the Board consider the concept of Action Levels for sites where only traditional erosion and sediment controls are applied or construction sites that are considered "stabilized" for the runoff season. An Action Level indicates a failure of BMPs (within some storm size limits).
6. The Board should consider Numeric Limits or Action Levels for other pollutants of relevance to construction sites, but in particular pH. It is of particular concern where fresh concrete or wash water from cement mixers/equipment is exposed to stormwater.
7. The Board should consider the phased implementation of Numeric Limits and Action Levels, commensurate with the capacity of the dischargers and support industry to respond.
8. The Panel recommends that a Numeric Limit or Action Level should be compared to the average discharge concentration. The minimum number of individual samples required to represent the average discharge concentration for a storm will need to be defined.
9. The Board should set different Action Levels that consider the site's climate region, soil condition, and slopes, and natural background conditions (e.g. vegetative cover) as appropriate and as data is available. With active treatment systems, discharge quality is relatively independent of these conditions. In fact, active treatment systems could result in turbidity and TSS levels well below natural levels, which can also be a problem for receiving waters.

10. The Board should consider whether the Numeric Limits or Action Levels should differ between receiving waters that are water quality limited with respect to turbidity, sediment or other pollutants associated with construction, from those water bodies that are not water quality limited.
11. The Panel recommends that Numeric Limits and Action Levels not apply to storms of unusual event size and/or pattern (e.g. flood events). The determination of Water Quality Capture Volume should consider the differing climate regions to specify these events.
12. The Board should set Numeric Limits and Action Levels to encourage loading reductions as appropriate as opposed to only numeric concentrations. Examples include phased construction (e.g. limited exposed soil areas or their duration), infiltration, and spraying captured runoff in vegetated areas as means to reduce loading.
13. The Panel is concerned that the monitoring of discharges to meet either the Action Levels or Numeric Limits may be costly. The Panel recommends that the Board consider this aspect.

Panel's Findings on Feasibility of Numeric Effluent Limits Applicable to Industrial Activities

Industrial Observations

The Panel believes that Numeric Limits are feasible for some industrial categories. Industries have control over their facilities. They control access, construction practices, product substitution to affect pollution prevention and the types of treatment systems to be used to mitigate stormwater runoff. There are many treatment systems or prevention practices that have been in place for lengthy periods, extending back to the 1980s in many cases. For example, there is much known today about construction materials, such as roofing materials (roofing composition, gutters, paints and coatings, products that abrade or tend to create solids or litter, etc). Other examples include development of pervious surfaces, or infiltration methods.

The decision for the value of Numeric Limits should be made in one of two ways. When there is a TMDL that defines the permissible load for a watershed, the Numeric Limits should be set to meet the TMDL. Consideration must be given for both the pollutant concentration as well as the volume of runoff, since both contribute to the impacts that required the TMDL to be implemented.

When there is no TMDL, the Numeric Limits should be based upon sound and established practices for storm water pollution prevention and treatment, using an approach analogous to that used in the NPDES wastewater process in the 1970s. In this approach phased, Numeric Limits were first set that were based upon the use of best currently available technology, and permittees were given a defined period for compliance. Permits were established based upon industry types or categories, with the recognition that each industry has its own specific problems and financial viability.

To establish Numeric Limits for industrial sites requires a reliable database, describing current emissions by industry types or categories, and performance of existing BMPs. The current industrial permit has not produced such a database for most industrial categories because of inconsistencies in monitoring or compliance with monitoring requirements. The Board needs to reexamine the existing data sources, collect new data as required and for additional water quality parameters (the current permit requires only pH, conductivity, total suspended solids, and either total organic carbon or oil and grease) to establish practical and achievable Numeric Limits.

In cases where the industrial activity is similar to activities covered by the MS4 permit (roofs, parking lots, etc), the approach or limits for industries should be the same as for MS4 permittees. In cases where the industrial activity is similar to land disturbance activities (e.g. landfills, gravel mines, etc.), there exists data and design experience with runoff control, capture and advanced treatments systems (e.g. systems using polymer to enhance total suspended solids removal – see

the construction section) that may make Numeric Limits feasible for new facilities, and the approach and limits should be the same as for construction permittees. The same conditions and issues related to active treatment discussed in the construction section apply here.

In cases where there is less certainty in the data for both stormwater characterization or BMP performance to establish Numeric Limits, there maybe sufficient data to establish Action Levels. Action Levels set for industrial sites that discharge to MS4s should not exceed those set for MS4 permittees.

The Panel recognizes that existing and new facilities may have to be treated differently and recommends the approach in **Table 2**.

Table 2- Approach to Establish Numeric Limits or Action Levels at Existing or New Facilities

		Numeric Limits	Action Levels	Notes
Existing Facility	Indoor	No	Yes, similar to MS4	
	Outdoor	Yes if data are adequate for the specific industrial activity and BMP	Yes, using industrial database	Action Levels should approach MS4 action levels.
New Facility	Indoor	Yes – BMP Database		Technology based, similar to MS4 New Development
	Outdoor	No, unless sufficient data exist for the specific industrial activity and BMP	Yes when sufficient data are available	

Industrial Recommendations

The Panel has several reservations and concerns:

- The Panel recognizes the inadequacy of current monitoring data sets and recommends improved monitoring to collect data useful for establishing Numeric Limits and Action Levels.
- Required parameters for future monitoring should be consistent with the type of industrial activity instead of the current parameters (i.e., monitor for heavy metals when there is reasonable expectation that the industrial activity will cause greater heavy metals concentrations in the storm water).
- Insofar as possible, the Panel prefers the use of California data (or National data if it can be shown to be applicable to CA) in setting Numeric Limits and Action Levels.
- The Panel recognizes that economies of scale exist for large facilities and large groups of single facilities.
- Industrial facilities that do not discharge to MS4s should have to implement BMPs for their non-industrial exposure (e.g., parking lots, roof runoff) similar to commercial facilities in MS4 jurisdictions.
- Regardless of Action Levels or Numeric Limits, the permittees should implement a suite of minimum BMPs – good housekeeping, employee training, preventing materials from exposure to rain, etc.
- SIC categories are not a satisfactory way of identifying industrial activities at any given site. The Board should develop a better method of characterizing industrial activities that can impact storm water.
- The Panel recognizes this is a large task and recommends prioritizing the implementation of this approach to achieve the greatest reduction of pollutants statewide.
- Increasingly, a number of industries have moved industrial activities indoors, preventing storm water pollution. The Panel recognizes that these facilities should be granted some sort of regulatory relief from industrial Numeric Limits or action levels, but should still be required to comply with MS4 permit requirements.

The Panel recognizes the need to make progress in monitoring and reducing storm water discharge from industrial facilities, but urges the Board to consider the total economic impact and not unduly penalize California industries with respect to industries outside of California.

EXHIBIT "E"

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUL 31 2002

THE ADMINISTRATOR

The Honorable Stephen Horn
U.S. House of Representatives
Washington, DC 20515

Dear Congressman Horn:

Thank you for you letters of April 8 and July 19, 2002, concerning recent actions by the Environmental Protection Agency (EPA) and the State of California to address trash and other pollutants in waters in the Los Angeles area. I understand that you have had productive discussions concerning these issues with Assistant Administrator for Water, Ben Grumbles, and Region 9 Administrator, Wayne Nastri. I appreciate your efforts to find workable solutions.

As you may be aware, the State of California has recently submitted the two trash TMDLs to us for approval. Although we have not yet completed our review, we expect to approve the two State trash TMDLs in the week ahead. Our approval would result in superseding EPA's TMDLs, as the State's trash TMDLs would be the applicable TMDLs with respect to the Clean Water Act.

EPA believes that the TMDLs developed for trash and the separate implementation plans developed by the State of California provide the flexibility and the time needed for the cities to implement effective, and cost-effective, controls on trash through the municipal storm water permit. In the detailed enclosure to this letter, we have tried to clarify the actions taken and their implications for permitted dischargers. Unfortunately, there are some misunderstandings over what is required, and the enclosure responds to the detailed issues and concerns raised by the Coalition for Practical Regulation and the City of Signal Hill, (enclosed with your letter to me).

Your April 8 letter also asked for EPA's support for a $4 million two-year demonstration project for the cities to test more cost-effective management of storm water runoff. We do not have funding for such a project in EPA's FY 2002 budget. There are State funding sources, however, that may be available to undertake this project. The State may be able to provide funds through the federally-funded State Revolving Loan program. Furthermore, we understand that several cities have obtained and may still apply for funds available for these kinds of projects through California Propositions 13 and 40.

EXHIBIT "E"

Over the next three months, we and the State will continue to work with the cities and other key participants to clarify the TMDL process, and identify additional opportunities for participation in the State's TMDL development and implementation planning. Meanwhile, EPA and the State of California must continue to develop TMDLs for several waters in your District, and in the surrounding area. We look forward to working with your office, and others, as we develop these TMDLs.

I hope that this letter and detailed enclosure help to clarify the issues and to demonstrate EPA's efforts to work with your communities. Should you need additional information or have further questions, please contact me or your staff may contact Tom Dickerson, Office of Congressional and Intergovernmental Relations, at (202) 564-3638.

Sincerely yours,

Christine Todd Whitman

Enclosure

Detailed Response to Concerns Raised by Congressman Horn, the Coalition for Practical Regulation, and the City of Signal Hill, California

Background

The key issue before EPA and the states concerning TMDL development and TMDL implementation through storm water permits is not whether TMDLs should be done, but when and how they are completed. Congress required TMDLs for waters identified as not meeting applicable water quality standards under Section 303(d) of the Clean Water Act, but did not set a firm date by which all TMDLs are to be established. EPA's national policy is that all TMDLs should be established within 8-13 years of the date the water is identified on a state's 303(d) list. The state is responsible for developing TMDLs, and EPA's role is to approve or disapprove them. EPA must establish the TMDLs if EPA disapproves a state submission. TMDLs are not self implementing--they may be implemented through permits for point sources (including municipal storm water discharges in the Los Angeles area), as well as through other federal, state, and local regulations, ordinances, or voluntary and incentive-based programs.

The progress of state development of TMDLs prior to the late 1990s was slow. Because of this slow pace, citizens filed lawsuits in 39 states, including California, to force EPA to establish TMDLs. Many of these cases resulted in consent decrees or court orders requiring that EPA ensure TMDLs are developed for all waters identified on the states' section 303(d) lists. Several cases were filed in California during the late 1990s. Because of the unfavorable facts in these cases, EPA settled the litigation, and as a result, the TMDL program is operating under consent decrees in the Los Angeles Region, Newport Bay, and North Coast of California. More recently, EPA successfully defended the California TMDL program in other regions of the State based on the increased pace of TMDL development by the State. San Francisco Baykeeper, et al v. Whitman, 287 F.3d. 764 (9th Cir. 2002).

Los Angeles Region TMDLs

In 1997, Heal the Bay and the Santa Monica Baykeeper filed suit seeking to compel EPA to establish TMDLs for the Los Angeles Region. EPA settled the case by signing a consent decree in which EPA commits to ensure that TMDLs for impaired waters in the Los Angeles Region will be completed within 13 years. This is one of the longest TMDL schedules set by any litigation in the country, thereby providing the State and EPA a significant amount of time to

develop the necessary TMDLs. During this period, 92 TMDL Analytical Units[1] addressing 163 waterbodies will need to be completed.

If the State adopts TMDLs in the timeframe provided by the consent decree, then EPA's role is to approve or disapprove, and, if the TMDL is disapproved, to establish, the TMDLs. For example, EPA approved a TMDL for trash (zero) adopted by the State for East Fork San Gabriel River in 2000. If California does not adopt TMDLs in the timeframe provided by the consent decree, EPA must establish the TMDLs. If California later adopts its own TMDLs and EPA approves such TMDLs, EPA's TMDLs will be superceded.

TMDLs for Trash and Implementation

The State of California set development of TMDLs for trash as its first priority. Although EPA recognizes that trash can be a difficult pollutant to address through TMDLs, EPA supports this priority due to the clear impacts of trash on aquatic life, wildlife, and recreation. The TMDLs for trash adopted by EPA and the State of California are the same: zero trash in the water bodies.[2] EPA's TMDLs do not contain implementation plans. However, EPA supports the implementation plans for these TMDLs adopted by the State Water Resources Control Board ("State Implementation Plan").

EPA understands that the State intends to implement the TMDLs through modifications of the compliance provisions of the existing municipal storm water permit. Under the Clean Water Act, TMDLs are not self-implementing. The cities are required to comply with their existing storm water permit provisions. The TMDLs for trash do not, by themselves, effect a change in these permits. The Regional Water Quality Control Board for the Los Angeles Region has addressed EPA's issuance of the TMDLs for trash and their effects: "Quite simply, the zero target is not currently incorporated within the Municipal Storm water permit. That permit provides a built-in compliance framework that is operable until the Trash TMDL is formally incorporated." Letter from Francine B. Diamond, Chair, Regional Water Quality Control Board, Los Angeles Region, to Nate Holden and Jan Perry, Councilmembers, City of Los Angeles (Apr. 8, 2002) at p. 5. (Attached.)

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[1] The consent decree uses the term TMDL Analytical Units because the regional board had organized groups of related water quality-limited segments and associated pollutants for which TMDLs would be developed. Therefore, the actual number of TMDLs will be larger than the number of TMDL Analytical Units.

[2] The State of California has adopted TMDLs for trash in the Los Angeles River and Ballona Creek watersheds, but has not yet received concurrence from the State Office of Administrative Law nor submitted the TMDLs for EPA approval. Hence EPA established the TMDLs on March 19, 2002, as required to meet the consent decree deadline.

EPA recognizes that the State intends to provide an appropriate compliance schedule for point source dischargers that would have permit conditions in new or renewed permits consistent with the TMDLs. EPA supports the State's approach to providing an appropriate and reasonable compliance schedule as authorized by California Water Code 13263(c) through the State Implementation Plan. The State Implementation Plan provides:

- No required trash reductions for the first two years, only monitoring to better understand trash generation
- A 14-year phase-in period, with gradual reductions in trash loading over time
- A clear understanding that cities are in compliance with the storm water permit if they achieve the load reductions targeted for each year in the State Implementation Plan (calculated as a rolling three year annual average) and incorporated through a compliance schedule in the permit
- A clear understanding that the cities are in compliance with the storm water permit if they install the best available trash capture technology or its equivalent (in other words, use of certain technologies is defined as being equivalent to zero discharge) (Letter from Francine B. Diamond at p.2)
- Opportunities to monitor and conduct studies to support interim revisions to the TMDLs, allocations, and/or implementation plans

The implementation costs for these TMDLs are expensive but probably much less than the $1-3 billion estimated by the cities (based on universal installation of the most expensive technology). The state estimates likely implementation costs in the range of $40-300 million, based on a mix of low-tech and high-tech trash control approaches. This figure covers over 80 cities with millions of people over a 14-year time period.

The Regional Board has clearly made a commitment to re-evaluating the zero allocation once a trash reduction of 50% has been achieved. (See letter from Francine B. Diamond at p.2.) If necessary, the TMDL and allocations could be modified at that time.

Consent Decree Development

The cities were not parties to the consent decree governing TMDL development in the Los Angeles Region. The point-by-point responses to the questions raised in the memorandum by the City of Signal Hill address these concerns. TMDL development is required for waters on the section 303(d) list regardless of the consent decree provisions, and the 13-year consent decree schedule is consistent with the 1997 EPA national policy that all TMDLs should be completed within 8-13 years of a water appearing on a state's section 303(d) list.

Although the cities in the Coalition did not intervene in the litigation against EPA, the California Association of Sanitation Agencies (CASA), and the Southern California Alliance of Publicly-Owned Treatment Works (SCAP) did intervene in the case and were involved in the

settlement negotiations with EPA, the environmental group plaintiffs, and the State of California. CASA and SCAP represent more than 100 cities and municipal agencies, including the City of Los Angeles. EPA is not authorized unilaterally to invite other organizations to participate in confidential settlement negotiations without the permission of the other litigants.

The Signal Hill memorandum implies that the consent decree should not have been agreed to, or should now be modified, in light of recent Congressional action and the National Academy of Sciences (NAS)/ National Research Council (NRC) report concerning the TMDL program. This lawsuit was settled in 1999, well before Congress raised its concerns about the TMDL process or ordered the preparation of the NRC report. Neither the appropriations directives concerning the TMDL program nor the NRC report recommended or required that TMDL development nationally or in California should slow down or stop. Moreover, EPA cannot revisit consent decree schedules without the concurrence of the other parties to the consent decree and/or order of the court.

EPA and the State have created opportunities for the towns and the public to participate in the development of TMDLs in the Los Angeles Region. For the Los Angeles River TMDLs for trash, more than 10 public workshops, meetings, and hearings have been held over a two-year period to invite public participation and comment. Many cities in the Coalition along with counsel to the Coalition participated intensively in the public participation and comment periods.

Appropriations Bill Report Language

The Appropriations Bill language questioned EPA Region IX's role vis-a-vis state authority regarding the water quality program. Region IX has never overruled a state TMDL decision and has very rarely disagreed with any aspect of a state's section 303(d) listing decisions. Region IX has supported every TMDL developed by the state for the Los Angeles Region. Region IX has approved every TMDL submitted by its states and has established several dozen TMDLs developed in partnership with its states in order to meet consent decree deadlines. EPA supports the state TMDL programs in Region IX through a combination of funding assistance (more than $6 million per year in grants and in-kind contract support), technical assistance, training, and outreach.

The Appropriations Bill Committee Report also addressed Region IX's TMDL Guidance, but refers to a draft Permitting Guidance document issued for comment by Region IX. To clarify, there are two separate guidance documents. Region IX, with EPA Headquarters concurrence, issued "Guidance for Developing TMDLs in California" on January 7, 2000. EPA developed this guidance at the request of the discharger associations, CASA and SCAP, during the settlement negotiations concerning the Los Angeles TMDL litigation. EPA developed the guidance with input from various groups, including representatives of wastewater agencies, storm water permit holders, industrial and farming interests, the State of California, and environmental groups. The TMDL Guidance explains existing regulatory requirements concerning TMDL content and has not been applied in the context of any permit proceedings.

Region IX also released draft Interim Permitting Guidance in 2000, which discussed how permits should be developed for discharges to impaired waters prior to TMDL development. Region IX never finalized the interim permitting guidance document referred to in the Appropriations Report and never vetoed or formally objected to any permit based on the draft guidance. All remaining issues concerning specific permitting actions that were raised at that time by California dischargers have been resolved to the satisfaction of the dischargers, the state, and EPA.

Status of TMDL Regulation Revision

On August 9, 2001, EPA proposed that the effective date for the July 13, 2000 TMDL regulation be extended to April 30, 2003. This proposal became final on October 18, 2001. At the same time, EPA has been engaged in a process designed to reconsider the July 2000 rule. Between September and December 2001, EPA held five public TMDL listening sessions to obtain input on issues associated with the TMDL program including listing, scope and content of TMDLs, TMDL implementation, particularly with respect to nonpoint sources, and EPA's role in the program.

Meanwhile, EPA and the states are continuing to implement the TMDL program pursuant to the TMDL regulations issued in 1985 and amended in 1992. One of the key recommendations of the NAS/NRC report on the TMDL program, which was required by Congress in the FY2002 Appropriations bill, was that states and EPA should move forward with decision-making and implementation of the TMDL program in the face of scientific uncertainty. The report further concluded that adaptive implementation is needed to ensure that the TMDL program is grounded in good science and not halted because of a lack of data and information. We intend to employ this principle as the TMDLs for trash in the Los Angeles Region are implemented.

Response to Comments in Coalition for Practical Regulation Letter and City of Signal Hill Memorandum

EPA carefully reviewed the comments in the March 18, 2002, letter from the Coalition for Practical Regulation and in the March 29, 2002, memorandum from Ed Schroder, Director of Public Works to Ken Farfsing, City Manager, Signal Hill, California. This section focuses on comments not addressed in the letter to Congressman Horn.

Comments in Response to the Letter from the Coalition

Comment 1. We are pleased that EPA agrees with the recommendations of the National Academy of Sciences report concerning the TMDL program. The report recommends that consensus be reached on a region's Basin Plan prior to moving ahead with TMDL adoption.

Response: EPA generally agrees with the NAS/NRC report recommendations but notes the report's acknowledgment that implementation of these recommendations may require substantial increases in state and EPA funding and/or changes in statutory authority. The State of California, supported by EPA, has reviewed and proposed revisions to several water quality standards concurrent with TMDL development. Absent a substantial increase in resources for water quality standards revisions, it would be infeasible to review all water quality standards prior to developing all TMDLs. In addition, the pace of TMDL development in the Los Angeles Region is established by the Consent Decree.

Comment 2. EPA and the State of California are improperly moving away from the "Maximum Extent Practicable" standard for municipal storm water discharges toward a so-called maximum extent possible standard.

Response: The Clean Water Act establishes the Maximum Extent Practicable (MEP) standard simply as the level of action required under municipal storm sewer permits. *In* Defenders of Wildlife v. Browner, 191 F.3d 1159, 1166 (9th Cir. 1999), the Ninth Circuit held that the statutory section establishing the MEP standard authorizes the NPDES permitting agency "to determine that ensuring strict compliance with state water-quality standards is necessary to control pollutants." That section provides for incorporation into an MS4 permit of other, more stringent or more prescriptive provisions determined appropriate for the control of pollutants, including those necessary to meet water quality standards.

More significantly, the State has specified the level of performance needed to ensure compliance with the TMDLs for trash in terms of operation and maintenance requirements for trash removal from catch basins (i.e., prioritized cleaning schedules), as well as public outreach targeted to trash abatement). These requirements clarify the permittees' obligations and are designed to ensure achievement of water quality standards.

Comment 3. EPA and the state are ordering cities to implement expensive, unrealistic, and untested TMDLs, based on unrealistic beneficial uses and an unreasonable timeframe outlined in the consent decree. The consent decree requires completion of over 90 TMDLs in the next 5 years.

Response: California is authorized to implement the Clean Water Act permitting program and will decide how to implement the TMDLs through NPDES permits. The State has not yet ordered the cities to take any actions beyond those required in their existing MS4 permits to implement the TMDLs. As discussed above, however, EPA and the State believe the TMDL implementation approach developed by the State, based on use of currently available technology and practices, is affordable and feasible.

The TMDLs recently developed for Los Angeles are based on California's adopted beneficial uses. Unquestionably, members of the public extensively use rivers and beach areas in Los Angeles for recreation, and those rivers and beach areas also serve as habitat for wildlife and

aquatic life. Clean Water Act regulations do not authorize the removal of beneficial uses that are also existing uses.

The consent decree establishes no timeframes for on-the-ground implementation of the TMDLs. EPA supports the TMDL implementation timeframes adopted by the state. The consent decree provides a 13-year timeframe for developing the 92 TMDL Analytical Units required for the Los Angeles Region. EPA and the State negotiated this lengthy schedule, compared with other court-imposed schedules, in the consent decree in order to provide time needed to gather data and meaningfully involve the public in TMDL development. We have since devoted extensive resources to data collection in partnership with local communities and engaged in dialogue with interested stakeholders in the development of TMDLs covered by the consent decree.

Comment 4. The zero trash TMDL is a hard and fast rule that must be strictly complied with.

Response: As discussed under Comment 1 above, the State Implementation Plan, which EPA supports, does not require immediate compliance with the zero target. Instead, it establishes a compliance schedule of gradual reductions and dischargers will be required to meet the compliance targets established in their NPDES permits. Additionally, it defines certain trash capture technology as being equivalent to zero discharge. Letter from Francine B. Diamond at p.2.

The State developed the TMDLs for trash based on an analysis and interpretation of the applicable water quality standard. EPA confirmed the state's analysis based on our independent research, and established the TMDLs as required under the consent decree. In this instance, non-zero TMDLs for trash probably would have been inconsistent with the applicable water quality standard, as well as State and local laws banning littering and trash dumping.

Comment 5. The cost of implementing over 90 TMDLs for Los Angeles County is estimated at $54 billion.

Response: As noted above, city estimates of the costs of implementing the TMDLs are more than ten times higher than the implementation costs estimated by the state. EPA's national TMDL costing study required by Congress estimated TMDL implementation costs for the most costly TMDLs to be about $215,000 per waterbody per year ("The National Costs of the TMDL Program," August 2001). Assuming a 20-year implementation timeframe, the total estimated implementation cost for the 92 TMDL Analytical Units to be established in the Los Angeles Region would be approximately $400 million.

Comment 6. EPA is required to complete a review of the Basin Plan by 2004. This review should be completed before TMDLs are developed. The cities offered to assist in funding the review, but the Regional Board rejected the request.

Response: A settlement agreement signed at the same time as the consent decree requires EPA to review the Basin Plan to determine whether the Plan includes TMDL implementation provisions. While EPA will review any new or revised water quality standards submitted by the State, EPA's review of the Basin Plan pursuant to the settlement agreement will focus only on the scope of TMDL implementation provisions. The consent decree and settlement agreement provide that TMDL development is to proceed on schedule regardless of the timing or outcome of the Basin Plan review.

To the extent the comment refers to the Regional Board's regular "triennial review" of the Basin Plan and water quality standards contained in the Plan, we note that EPA already provides grant funding to California which is used, in part, to fund triennial review and water quality standards revision activities. The State has also provided several opportunities for interested parties to participate in the Basin Plan triennial review process. In addition, the State can revise and resubmit the TMDLs at any time.

Comment 7. The TMDL process should be stakeholder driven, with sufficient time for stakeholders to participate in TMDL development. The cities receive only a 30 day notice of the TMDL prior to the Board's public hearings. The cities have been given no opportunity for city input at the development stage of the TMDL.

Response: The State and EPA have conducted dozens of individual and group meetings, workshops, and hearings with stakeholders in the Los Angeles River basin over the past five years to solicit ideas and comments on TMDLs completed and currently under development. The public and other parties have had several opportunities to become involved. The level of public involvement in Los Angeles area TMDLs exceeds minimum federal and state requirements. Local agencies, academic researchers, Southern California Coastal Water Research Project, local watershed councils, and environmental groups are cooperating in data collection and sophisticated model development for future TMDLs for Los Angeles and San Gabriel Rivers. Moreover, the State is working with refineries and the Department of Energy on studies to support toxic pollutant TMDLs for Dominguez Channel.

The Coalition, its member cities, and its counsel have participated in many of these meetings, workshops, and hearings, and filed extensive comments on the TMDLs for trash. The cities' views and comments were considered in the final TMDL decisions.

Comment 8. EPA should insure that the state receives adequate funding for data collection and TMDL development. Minimal state resources are being expended for TMDL development in California. The trash TMDL is based on one data collection point.

Response: EPA provides California with more than $4 million/year in grants, contract assistance, and staff support specifically for TMDL development. The total California TMDL development budget exceeds $12 million/year, and more than 100 staff are working to develop

TMDLs at this time. California has, by far, the best funded TMDL program in the country at this time.

The TMDLs for trash were based on State and EPA research concerning studies of trash generation and its effects from around the world. The baseline trash generation rates used in the TMDLs were based on two data points: one for municipal waste generation and the other for highway-related trash generation. This baseline was used to set a default against which the State TMDL's annual 10% reduction steps would be measured in the future. The State's TMDL establishes a two-year monitoring period during which trash generation data will be collected and an alternative baseline calculated for purposes of measuring compliance with annual reduction expectations. The annual reductions are not scheduled to begin until after the data are collected to develop the alternative baseline level.

Comment 9. The zero TMDL is inconsistent with the iterative process outlined by the NAS report.

Response: The State Implementation Plan, which EPA supports, establishes an iterative process involving follow-up monitoring, studies, implementation, and periodic reviews and revisions, as we believe was envisioned in the NAS report. The plan provides for collection of additional data, and the Regional Board is committed to re-evaluating the TMDLs once a trash reduction of 50% has been achieved to provide opportunities to adjust the TMDLs, allocations, and implementation measures based on new data collection. The plan provides 14 years to phase-in measures to reduce trash discharges.

Comments on Memorandum by City of Signal Hill (most comments addressed above)

Comment 10. TMDLs are presently being established for over 90 storm water pollutants in the Los Angeles Region. The technology may not exist to remove these pollutants, and/or the technical data are not available to support TMDLs.

Response: About ten TMDLs are currently being developed for waters in the Los Angeles Region; the remaining TMDLs will be completed by 2011. EPA is working with the State, several cities, industrial dischargers, civic groups, and academic institutions to collect additional data in Los Angeles River, San Gabriel River, Marina del Rey, and Ballona Creek for multiple pollutants to assist in TMDL analysis and modeling.

The State and EPA are carefully evaluating the level of pollutant reductions in storm water that can be achieved and will take that into consideration in allocating pollutant loading capacity in future TMDLs.

Comment 11. The consent decree and settlement agreement are evidence of a process where EPA, the State, and environmental groups developed a TMDL development schedule irrespective of the TMDL process established by Congress.

Response: As discussed above, EPA negotiated the lengthy schedule embodied in the final settlement in order to ensure that the State and EPA had sufficient time to gather data, conduct studies, and involve the public so as to improve the TMDL development process. TMDLs are required for all listed waters even absent the settlement. The settlement simply identified a TMDL development timeline consistent with EPA national policy that all TMDLs should be completed within 8-13 years of waterbody listing. The settlement and State and EPA TMDL development actions since the decree was finalized account for all required elements of the TMDL development process.

Comment 12. The consent decree requires EPA to review monitoring programs in the Los Angeles Region in an apparent effort to expedite the TMDL process. The state and EPA had already agreed to accept limited data for TMDLs. The trash TMDL was based on no scientific information.

Response: The monitoring review was intended to address the concern held by EPA, the State, and the environmental groups that insufficient monitoring data was available to complete high quality TMDLs at that time. Therefore, the monitoring program review was intended to yield recommendations on how to improve data gathering to help ensure that sufficient data is available to support high quality TMDLs.

The State and EPA obtained and reviewed numerous reports and studies concerning the effects of trash on aquatic life and wildlife. The available research uniformly concluded that trash in very small amounts has significant adverse impacts on aquatic life and wildlife. Therefore, we disagree that there was no scientific basis for the established TMDLs. The State Implementation Plan provides for the development of monitoring plans and studies to investigate whether there is a valid alternative to zero TMDLs.

Comment 13. The California State Water Board asked EPA to consider extending the consent decree deadline, but EPA showed no willingness to pursue the request.

Response: The exchange referenced in the comment took place at a public hearing less than one month before the consent decree deadline for establishing the TMDLs for trash. Cities concerned about the TMDLs for trash suggested a consent decree revision, and the State Board member asked EPA's views of the suggestion but did not actually request a consent decree revision. EPA replied that it was too late in the development process for the TMDLs for trash to consider a formal consent decree revision; EPA suggested that it would consider revisions to the consent decree schedules in the future if the other parties were willing. The State Board members appeared to be satisfied with this approach.

Comment 14. Why did EPA sign off on a consent decree to expedite and truncate TMDL development in the Los Angeles Region, when nationally they were being directed by Congress to evaluate the TMDL process?

Response: EPA negotiated the consent decree in 1999, before Congress ordered the TMDL program evaluation referenced in the comment. The Congressional action was prompted by the final TMDL Rule revisions promulgated in July 2000. In July 2000, Congress directed EPA not to implement those revised rules. In October 2001, EPA delayed the effective date of the July 2000 rules until April 2003. The existing TMDL rules and the statutory requirements for TMDLs remain in place.

Comment 15. Why has EPA not reconsidered the consent decree and reconsidered the accelerated TMDL schedule in Los Angeles given Congress' concerns? Shouldn't the consent decree be amended by the Court to incorporate a more realistic TMDL adoption schedule?

Response: As discussed above, the consent decree schedule provides 13 years to complete all the needed TMDLs for the Los Angeles Region. This schedule is consistent with both the national EPA policy that all TMDLs should be completed within 8-13 years of the date waters were identified as needing TMDLs, and the TMDL schedule adopted by the State of California in its 1998 Section 303(d) listing decisions. Congress did not ask EPA to cease or delay TMDL development nationally or in California.

Comment 16. Why did EPA enter into a consent decree and settlement agreement covering just the Los Angeles Basin, when the TMDL program is a statewide and nationwide program?

Response: The lawsuit brought by the environmental groups focused solely on the Los Angeles Region. EPA focused on this area of California in order to limit the area of the state that was subject to consent decree schedules and to preserve the state's primacy concerning TMDL development as much as possible. The State supported EPA's approach of settling the case solely for the Los Angeles Region.

Comment 17. Why did EPA not include Los Angeles municipalities in the discussions leading to the decree?

Response: As discussed in the letter, EPA did include the lead associations representing municipal dischargers (CASA and SCAP) in the settlement negotiations for this case because these organizations intervened in the litigation. Settlement negotiations were confidential, and the plaintiffs' opposed including others in the negotiations. The settlement only determined when individual TMDLs would be completed; the Clean Water Act already required that these TMDLs be developed. The municipalities have also had extensive opportunities to participate in development of TMDLs pursuant to the consent decree.

Comment 18. Has EPA considered going back to Court to revise the consent decree to account for the direction given by Congress and to open up the consent decree for public review?

Response: EPA believes the existing consent decree schedule is sufficient to allow development of effective, technically sound TMDLs with full provision for public involvement. Therefore, we do not agree that the schedule is unrealistic. However, EPA is willing to consider revisions to the consent decree if an alternative schedule for TMDL development is offered that will result in timely completion of all required TMDLs. No parties have come forward with such a proposal, but have instead simply sought to further delay development of TMDLs for waters that have been on the Section 303(d) list for up to ten years. The plaintiffs in the lawsuit have indicated that they too are willing to consider consent decree revisions, but only if the schedule is replaced with an alternative schedule that results in the same pace of TMDL completion. Congress has provided no direction to EPA to delay the TMDL development process nationally or in California. EPA may not unilaterally delay TMDL development in the Los Angeles Basin absent changes to the consent decree.

Comment 19. Why is the Basin Plan review being performed after the calculation of most of the TMDLs? What did EPA intend by agreeing to review the Basin Plan? How will EPA ensure that the county and the cities are involved in this review?

Response: The Basin Plan review being undertaken pursuant to the settlement agreement in the case is specifically intended to "determine whether (the Basin Plan) includes TMDL-related implementation measures that are consistent with the Clean Water Act" (Settlement Agreement at p. 9). The review was not intended to be a comprehensive review of the Basin Plan. The review was scheduled for 2004 based on the assumption that multiple TMDL implementation plans will have been incorporated in the Basin Plan by that time. EPA would be happy to discuss its review of Basin Plan implementation plans with interested parties.

EXHIBIT "F"

Transcript of State Water Board, Board Meeting
Item No. 8
October 5, 2005

Speaker	Comments
Chair:	Judging from the horrified reaction when I suggested a short break, and the fact that we have well over a dozen cards for Items 8 and 9, I want to suggest we take a short lunch break and resume at 12:30. And if there's no objection, since Items 8 and 9 are very similar and most of the comment letters have addressed both TMDLs in a similar manner, I'd like to suggest that we combine 8 and 9 for our next item. Any objections? Alright. 12:30.
Chair:	Resume the workshop. We're on Items 8 and 9 now and let's begin with some brief remarks from Mr. Frantz.
Mr. Frantz:	Yes. Good afternoon, Chair Doduc and members of the Board. My name is Greg Frantz with the Planning Standards and Implementation Unit, and I'd like to give you a brief presentation for the Basin Plan Amendments to incorporate a total maximum daily load for metals in the Los Angeles River and also Ballona Creek. I'll try to combine that discussion. These TMDLs establish both dry and wet weather load allocations for copper, lead, zinc and cadmium in the Los Angeles River and also those metals plus silver and selenium in Ballona Creek. These are based on the criteria contained in the California Toxics Rule. For the Los Angeles River during dry weather there are three publicly owned treatment works in the watershed that account for the majority of the flow in the river and therefore to the metal loadings. In Ballona Creek there are no POTWs that are in issue here. During wet weather for both watersheds most of the metal loadings are associated with storm water flows. As an example, the Los Angeles River, on an annual basis storm water contributes about 80% of the copper loadings, 95% for lead, 90% for zinc, and 40% for cadmium. In Ballona the figures are similar, especially for copper and lead, storm water contributes about 90% for each of those metals. TMDL would be implemented through applicable storm water permits that you've heard already through the installation, maintenance and monitoring of best management practices approved by the Regional Board. These BMPs would be both non-structural such as more efficient and more frequent street sweeping, and structural which could include infiltration trenches and sand pits – and sand filters – excuse me. In both watersheds the responsible parties include the County and City of Los Angeles and the various municipalities that are in the watersheds. The implementation for the Los Angeles River amendment would be a phased 22-year period, and for Ballona it would be a similarly phased 15-year period, Ballona being a much smaller watershed. We've received about 15 letters on these two items, most of them addressing both item 8 and 9 in them. We've received

EXHIBIT "F"

Speaker	Comments
	7 identical letters from various municipalities last week and an additional 8 letters came to staff only this last Monday. We are working on the response to all of those comments. Our preliminary review, however, strongly indicates that most, if not all, of these comments have been previously submitted to the Regional Board and responded to and responses are contained in the administrative record that we have here. As you note Mr. John Bishop is here with his staff Melinda Becker to answer any – or to help respond to any oral testimony you might get today.
Clerk:	Alright. Thank you. Chairwoman Cloke and Mr. Jonathan Bishop.
Chair:	I'm going to take comments on both Items 8 and 9 but if your comment is specific to just one of the TMDLs, please designate which one at the beginning of your comments. Thanks.
Cloke:	I'll make them both at this time. First I'd like to ask that the earlier comments that I made having to do with TMDLs and all the issues involved earlier be incorporated into my testimony on both 8 and 9, which I think you've already ruled. And so I want to speak – is that correct? Haven't you already ruled that? Yes. And secondly, I want to speak very briefly first to the Los Angeles River and again Mr. Bishop is going to talk to you about the specifics of the TMDLs, the science, and answer those kinds of questions. I want to tell you that the Los Angeles River in Los Angeles is undergoing tremendous attention. At our Water Quality Awards on October 20th to which you are all invited, we will be giving – one of the awards that we'll be giving will be given to, I think, 30 different groups, all for their work just on one small portion of the restoration and revitalization of the Los Angeles River and the tailor yards and the cornfield which are going to be parklands that are going to support the recreational – some of the recreational activities along the river. But the City Council people are looking at this river as becoming a recreational spine in Los Angeles. That they are really rethinking the whole, you know, the Los Angeles River, if you've ever seen the original pictures, which I will be happy to send to you if you haven't seen them, was really a beautiful, magnificent, if somewhat seasonal, river, at some times with great overflow capacity. And it's been highly channelized and the movement in Los Angeles from the City Councils, up in the, you know, the political organizations, the environmental organizations, and strongly supported by State funding from State parks has just given a huge grant to the Los Angeles River restoration for tailor yards and cornfield. Everything moves in the direction of the restoration of the river to a vital, scenic recreational iconic emblem for Los Angeles. And so the work of the Water Board on the Los Angeles River and all the TMDLs that we've done starting with the Trash TMDL which you approved previously, all are working to support this multi-group, multi-agency, multi-governmental effort that's going into the restoration of the Los Angeles River. And obviously it can't all be done at once but it's

Speaker	Comments
	amazing how quickly it's moving, how much support there is for it, how much public support, how much media support, and so on. And if any of you are down in Los Angeles, I'd like to take you on a couple of the tours showing you some of the things that are happening with the Los Angeles River right now and showing you some of the planning that's going on. So our TMDL in addition to being a water quality TMDL, which is our mission, is a TMDL that really is part of something that's very important to Angelinos and that is happening in Los Angeles right now and something to which not only is the City of Los Angeles putting tremendous resources and funding but the State of California is putting resources and funding. So that's my part of the Los Angeles River. The Ballona Creek is the same, we have the same kind of issues, in terms of what's happening politically. As you know, we've had a treatment wetlands planted, we've had huge State grants buying all of the property down at the estuary and going back up towards the city. It all now belongs to the Trust for Public Lands, it's all under their administration now and it's all going to be restored into natural wetlands and there's also going to be some park areas. So it's all moving into the public realm. And so, you know, yes, we're all about water quality all of the time but we're not absent in the discussion in our city about where we want to put our resources and our efforts and this really supports the wetlands restoration project that's going on there and where the land has been bought with state monies and where the restoration is going through under the Trust for Public Lands. So, again, we're part and parcel of everything that's happening in the City on these two TMDLs and we think that this is a great example of the synergy of different agencies coming together to promote the public good, each one bringing their own part, you know, each one bringing their own festive desert, dinner dish, whatever you want to call it, to the feast that we're trying to make in Los Angeles. Thank you.
Chair:	Mr. Bishop?
Bishop:	I actually have no additional comments. I made my comments to address all three of the overlying, pertaining to all the issues overlying. But as always I'm happy to answer any questions.
Chair:	Ms. Strauss, do you wish to make any comments?
Strauss:	Good afternoon, Madam Chair and Board members. I'm Alexis Strauss here on behalf of the U.S. Environmental Protection Agency. We urge the Board to adopt these TMDLs at your hearing later this month to enable the EPA to approve the State adopted TMDLs in December and avoid the need for federal establishment. These TMDLs – both the L.A. River metals TMDLs and the Ballona Creek metals TMDLs – meet all federal requirements under the Clean Water Act and identify a reasonable adaptive implementation framework to continue reducing metals loadings to both of

Speaker	Comments
	these water bodies while improving our understanding of the problem as we move forward. EPA provided over $300,000 in contractor support substantial grant funding for state staff and a great deal of our technical staff time to assist in developing these difficult TMDLs. The approach taken in these TMDLs is consistent with the methods used in many other TMDLs in California and elsewhere in the country including the Sacramento River, New York Harbor, and Bellingham Bay in Washington. The approach of setting different TMDLs for wet and dry weather conditions is also appropriate and consistent with the approaches being taken in many TMDLs here in California. These TMDLs are designed to meet California Toxics Rule standards. Some parties may suggest to you that CTR should not be applicable for development of TMDLs where storm water is at issue. Your staff and the Regional Board properly concluded the TMDLs must be developed at levels necessary to meet California Toxics Rule. The CTR standards apply to the water bodies regardless of the discharge source and are the applicable standards under the Clean Water Act. All TMDLs must be set such that applicable standards are met and the Los Angeles River, Ballona Creek are no exception. I think the central issue here may in fact be how TMDL allocations to point sources will be implemented. The Implementation Plan provides for, again, a BMP-based approach to the TMDL implementation if it can be demonstrated, as John Bishop had noted, that BMPs are sufficient to attain the waste load allocations. We and the Regional Board believe it will be feasible to implement reasonable BMP-based controls to meet these allocations. This approach is entirely consistent with the national guidance to which I had referred earlier. These two packages of TMDLs before you represent a substantial number of TMDLs in California's national commitment. The L.A. River TMDLs for metals represents a package of 23 TMDLs. The Ballona Creek metals TMDLs represent a package of 5 TMDLs. They were initially scheduled for State Board adoption almost a year ago and account for a large percentage with the earlier item which you had heard of what the State had committed to adopt in the past year but was not able to complete on time. I hope that it will be possible for you to approve these at your next meeting and for them to come promptly to us for our approval, and by doing so you will keep the state in the lead of TMDL development and avoid delays in actions to reduce pollutant loadings to this important watershed. Thank you.
Chair:	Thank you. Any questions, comments? Next we have a group presentation by Mr. Ken Farfsing, Dr. Gerald Greene and Mr. Richard Watson.
Farfsing:	Thank you, Chair Doduc and members of the Board. I actually have a PowerPoint presentation so I'll have to ask that I guess somehow be brought up. We also have put together a presentation folder for you in blue so you can follow along.

Speaker	Comments
Chair:	Mr. Farfsing, am I to understand that you are directing your comments to item 8 only?
Farfsing:	Yes, the Los Angeles River. Yes, thank you for that clarification. Thank you. Okay. I will outline our major non-scientific concerns while Mr. Richard Watson and Dr. Gerald Greene will outline the scientific and technical issues. Local government desires to work with the State and Regional Boards to complete the science necessary to have successful TMDLs. The major local government concern is that the scientific underpinnings are incomplete in these TMDLs. This lack of sound science is in turn driving an unrealistic Implementation Plan estimated by the Regional Board to cost a minimum of $1.4 billion. This lack of sound science has led to unsupportable waste load allocations such as requiring local government to be responsible for atmospheric deposition even though it is outside of our regulatory control. We are requesting a remand of the TMDLs to the Regional Board due to these and other outstanding scientific and implementation issues. The TMDLs recognize the scientific deficiencies by calling for the regulated community to fund several studies that should have been completed prior to adoption. These include reviews of atmospheric deposition and water effect ratio studies in determining the metals coming out of the Angeles National Forest. Although there are serious economic CEQA and implementation issues with the TMDLs, we believe that the inadequate science alone is sufficient for the remand. EPA has indicated today that they will adopt the scientific portion of the TMDLs in order to comply with the deadlines in a Consent Decree. Apparently the Consent Decree schedule was determined by factors other than the real time needed to complete adequate scientific studies. This oversight should not drive the Board to make rush decisions and EPA should not approve TMDLs with this number of significant scientific deficiencies. Now, these are our major non-scientific concerns. First, the National Park Service should be a participant in the solutions. The Angeles National Forest comprises 32% of the land area of this TMDL. It's 200 square miles. The forest is a significant source of metals from soil erosion and atmospheric deposition. The proposed TMDLs hold local government responsible for these metals as soon as they leave the forest boundaries and enter the flood control system or as forest fires deposit metals in the watershed. The Regional Board did not include the National Park Service as a responsible party despite our requests. This ignores the precedent of their adopted Trash TMDL on the east fork of the San Gabriel River under which the National Park Service is responsible for trash removal programs in the forest. Why should a major stakeholder with significant federal financial resources be left out of this TMDL? Also, as Jonathan has indicated, there really is no recognition of the difficulties of controlling wet weather discharges. The TMDLs are silent on storm size,

mandating that local government plan to meet the metal limits for the largest known storm events. This is unreasonable, unworkable and extremely expensive and it conflicts with other adopted TMDLs in the SUSUMP program. We need some type of referenced storm to design to. One of our major issues is in the CTR and the flexibility of the application of the CTR. The CTR record states that USEPA did not expect local government to go beyond best management practices to comply. EPA concluded that the scenarios of local government compliance through water quality based effluent units or costly end of pipe controls are not valid. The question is not whether CTR could be applied to storm water, but rather is local government going to be made to strictly comply? In response to comments on the direct question of whether CTR was to apply to municipal wet weather discharges, quote "EPA believes the applicability of water quality standards to storm water discharges is outside the scope of this rule." EPA has now punted on the CTR with the statement that the State has the "flexibility in the application of CTR to storm water." We have yet to see this flexibility. The TMDL will impose strict CTR numeric limits which must be met for both dry weather and wet weather conditions. A 50% reduction in dry weather loads and 25% reduction in wet weather loads is mandated in the next 6 years, while the very studies defining the load allocations are still underway. If found reasonable and necessary numeric targets should only come after the science is completed.

This is a graphic of the Los Angeles River watershed overlaid on the U.S. Census looking at the rates of poverty. This socio-economic study was completed by the Gateway City Council of Governments and it disclosed that over 948,000 persons in the Los Angeles River watershed are living either at or below the poverty level. This is a full 20% of the watershed's residents. Many census tracts have over 50% of their residents living in poverty. Those are the areas that you can see there in the darker colors. These are the same residents that will be asked to pay for the fees and taxes for sand filters, infiltration trenches, dry weather diversion cisterns and other devices called for in the TMDL. Sound science and the 13241 factors should shape the Implementation Plan. We believe that the scientific studies are necessary to guide the dry weather and wet weather implementation programs needed to implement the TMDLs. Since local governments are financially constrained, section 13241 requirements must be considered when developing the implementation program.

Now we're going to present a series of options for you to take a look at. Option 1, obviously, remand the TMDL to the Regional Board with directions for needed revisions.

Option 2 is refrain from approving the TMDLs at this time, which would be table the TMDLs on the basis that they are exceedingly complex and more time is needed for review and action by the State Board. Water Code

Speaker	Comments
	Section 13246(b). This option would allow the State Board to take the time necessary to resolve the major scientific and technical issues and determine if numeric limits, and by extension numeric waste load allocations should be in storm water permits. EPA should be asked to negotiate a further time extension to allow resolution of the scientific and technical issues. Option 3, approve the TMDLs for only the listed segments contained in the Consent Decree known as Analytical Unit No. 13. Option 4, approve the TMDLs as technical TMDLs without an Implementation Plan and direct the Regional Board to revise the Plan after completion of the special studies by the regulated community. Let me now introduce Dr. Gerald Greene from the City of Downey and the Executive Advisory Committee as well as Mr. Richard Watson.
Greene:	Thank you, I'm Dr. Gerald Greene and I'm speaking on behalf of the Executive Advisory Committee for the Los Angeles County MS4 Permittees. I'd like to start with a quick review, and I do mean very quick, of some of the issues that we have tried to address with the Regional Board that they have tried to in many regards but we do not feel have yet adequately addressed. We feel that the CEQA checklist and negative declaration to accompany this document was insufficient in considering the impacts that will happen on the Cities and our supply of services. Potable water, a significant degree of the hardness has been identified in several of the reaches, has been attributed to the Cities. The Cities provide harder water than is found within these reaches, so it's very hard for us to understand how this can be directly attributable to us. We may be a contributing factor or a contributing source but not a sole source. We feel the TMDL as it currently exists gives too much leeway to the industrial and construction discharges to exceed CTR values, and then essentially discharge onto the Cities or into City systems that we then are responsible for meeting CTR values. So essentially a State permitted discharge is then being foisted onto the Cities to deal with. The models used in the TMDL, they reflect one group of professional experience, they do not necessarily reflect the experience of our participants. Application of numeric CTR values has already been alluded to multiple times and perhaps is one of the greatest reasons why we have concerns about promises as to where things where go in the future because we see that promises seem to change or commitments seem to change over time. We are not the control source for several of the – we are not the authority for several of the sources that are being discussed. As an example, brake pads have been reiterated. We don't reformulate brake pads. We do not regulate aerial deposition. We appreciate, and I strongly want to reiterate that, the Board's commitment to help work with the aerial board, excuse me, the Air Quality Management Districts to resolve this issue, but the TMDL does not state that and we are

very concerned on its long term implications that if those efforts are unsuccessful that we may again have to deal with another problem.

The TMDL does not provide sufficient incentives for proactive efforts. This is a comment that we share with the River Group, an environmental group, that we need to do a better job of incentivizing this to help get the cities more involved in getting the right answers. And I'm a strong believer in that. And the cost estimates for the structural BMPs are inaccurate and need to be greatly modified. As an example, I would like to talk about an infill trench, an infiltration or rock trench that was constructed in the City of Downey. The TMDL identifies that approximately 12,000 infiltration units will need to be constructed to handle about 20% of the urban watershed. Each of these would be sized for a half inch rain coming from 5 acres of impervious area, a fairly large parking lot but a typical parking lot type construction path. The TMDL currently contains no design storm. I again want to acknowledge the Regional Board's effort to consider that, but there is no minimum value, there is no forgiveness, there is no safe harbor for a gully washer. The total construction cost for this particular item, these 12,000 trenches, was just over a half billion dollars. That works out to about $46,000 per unit. For this particular transportation yard constructed in the City of Downey, the rocks, trenches, there are several of them on the property, were sized for a 2.9 acre parking lot essentially, for a .75 inch SUSUMP design storm. We did not have to get into trench acquisition or land acquisition costs, it was already owned by an agency. If I had to look at it, say we had to take about 10% of that site because of encroachments as well as the trench itself, that's probably a million dollars worth of property in North Downey for commercial. The construction of this trench according to that agency was $150,000 for the 2.9 acres. That works out to about $250,000 for a 5 acre site and a ¾ inch storm. Approximately 5 times as much as the TMDL indicated this sort of project would cost.

Unknown assimilative capacity and effectiveness of structural BMPs. A TMDL is based on CTR, the assimilative capacity of the water. As I've already started to allude to, the Rio Hondo, which is a tributary to the L.A. River, has the lowest numeric standards because of the low hardness that was measured in the Rio Hondo – 140 milligrams per liter. My City puts out water at about 230 milligrams per liter and I checked the six cities closest to us and they all are in the same range of like 200 to 240. So unless there's a mad or a distilled water discharger, we don't know where the extra water is coming from that diluting the hardness that we put out. What did that get us? Well, for copper, as an example, we have a standard that results from this of 13 micrograms per liter as total recoverable copper. That is 1% of the drinking water action level of 1300 micrograms per liter. If we look at Downey in particular, we supply water with copper, the 90th percentile of our water supply, is at 200 micrograms per liter that will then

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	be going into a watershed that handles, or is allowed to have 13 micrograms per liter. Essentially I am very concerned that every time somebody goes out with a hose to the curb, I will be in violation because now I am putting in a water that's coming into my MS4 that's going to very quickly end up in a river downstream and be in violation. Burbank and the City of Los Angeles are funding water effects ratio studies, this is again getting back to assimilative capacity, because they believe that the watershed, the water in there, the organisms that would be conveyed in that water, can handle something different then CTR and to this point they seem to be getting some very favorable results and hopefully that information will become available over the next couple of years when the remand comes up, but we should be getting this information before we're having the remand, excuse me, before the reopener occurs. But this is science that should be available to us before the TMDL is in rather than having to be negotiated or back negotiated when the reopener occurs. This study will cost about $750,000. That's actually a fairly typical number. Three-quarters of a million dollars per watershed per metal for a water effects ratio study. We have five metals considered.
Baggett:	The studies you're talking about are to do with the implementation plan, not the technical TMDL?
Greene:	I would say that that would be correct. It would be involved with more the implementation plan, what actually happens. But certainly the two are related documents. Copper concentrations – I alluded to this a moment ago. These are water supplies for several of our major participants in this watershed. The City of Pasadena supplies water, the 90th percentile of water supplied is at 190 micrograms per liter. By the way, recognize the hardness for these Cities is a bit higher so that 13 value I gave, that will rise up, that might go up to 30 micrograms per liter right outside of Pasadena, as an example. But again, the water coming out of the City pipes to somebody's front yard is basically at 190 micrograms per liter. The City of Los Angeles, 774; Signal Hill, 210; Pomona, 240. We are putting out water right now that is going to frankly put a lot of our residents, it's going to cause a lot of conflicts between the municipalities and the residents. I think this needs to be addressed more fully. Conversion between dissolved and total metals. Very quickly, the Y axis is observations. The X axis is a ratio of dissolved metals to total metals. So when you look over to the left hand side of the chart you see things like 0.0, 0.2 – that's basically saying almost all of this metal is in a particulate form, it is not dissolved, it is not bio available. As you move over to the far right hand side, ignoring those last couple of values where you find from this study that there was more dissolved than total, you find that those are the very dissolved fractions. For the TMDL we had a copper conversion of .65 and basically, if you look at that lower legend box, all those values were

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	assumed in that range. Taking lead which I don't like to have to take but it's the most extreme example, for the TMDL the lead conversion factor was .82, saying that most of it's in the dissolved fraction. When you look over there at the number of observations, most of it was factored into the particulate fraction. Cooper and zinc are similar, not nearly as extreme. Copper and zinc are nutrients. We would greatly appreciate that that be considered and especially for things that have a micronutrient function, some greater latitude in the conversion factors. Finally our conclusions. Yes, we do know the permittees do need to do more, and I agree with the Regional Board on that. I will go to many a permittee meeting and immediately chew out my cohorts for what they haven't done. But we need to know more about what we are going to do and how to accomplish it. That rock infiltration trench is a classic example. If one of my colleagues had used those values in trying to put together a proposal for their City they would have been off by 5 fold – that's a tough one for us to deal with. We are going to spend more than we know. Well that was just a quick example of that. We would like to recommend that this TMDL be remanded in favor of one with better technical data and one that provides better incentives to those who are trying to provide the solutions. And by the way I would like to reiterate what Suzanne Chair Cloke said that we need to do a better job of incentivizing. We need to do a better job of getting the water back into the ground. And I pointed out several examples there on that screen of things we are doing in Downey. All those projects have major infiltration functions with them. But I can also tell you that for every one of those projects I learned a lot in engineering, and the developers learned even more, and their contractors and consultants learned some very painful lessons. Thank you very much.
Chair:	Thank you.
Secundy:	Chair Doduc. May we have a staff clarification on one of the comments?
Chair:	Please.
Secundy:	Mr. Greene perhaps you could articulate precisely what it is about the CEQA Checklist that's inadequate, and you mentioned supplies services. Could you please explain for us?
Greene	Sure. We've presented that previously I think in some of the written letters not for thus, but down at the Regional Board level.

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Secundy:	Specifically, we need to know precisely how the Regional Board's response to your comments was inadequate?
Greene:	I believe they said that the Negative Declaration was sufficient, that there was no need to deal with it. They basically in the Checklist indicated it would have a no significant impact on the municipalities – on the MS4s.
Secundy:	And what significant impact is there that was not addressed by the Regional Board?
Greene:	If I have to go out and buy the land to install a sand filter or treatment, I'm sorry instead of treatment a treatment device, the land for a treatment device, whether it be a sand filter or an infiltration trench, that's obtaining property from private citizens generally, and certainly constructing a device. Currently we're having our developers install them. And I will continue to do that and that's not a bad approach, but I don't think I'm gonna replace every building in my City within the next twenty years.
Secundy:	Once again, I'm sorry, I'm having trouble understanding what the significant adverse environmental impact is associated with those comments?
Greene:	As I recall, the Checklist refers to the provision of City services. I believe that this will cause a significant diversion. We pay for our general, excuse me, we pay for our storm water fund out of our general fund. And so I believe that if we have to buy land and install devices of the type proposed in the TMDL, that that will be a diversion of other City services, including public safety as well as public recreation enjoyment.
Secundy:	Thank you.
Greene:	Sorry.
Chair:	Thank you. Mr. Watson the speakers before you normally have taken up to 5 to 6 minutes or your colleagues --
Watson:	I'm gonna go quickly, thank you.
Chair:	Okay, so I would appreciate your conciseness.

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Watson: There's an exhibit that you had before you just to demonstrate what Susan Cloke had to say about the LA area, that it is a complex area and it is polluted. You'll notice those atmospheric deposition clouds around there. And we have a tremendous air quality problem that is impacting the water quality impairments. And the area is complex with the planes, trains, and ships that neither the State nor the AQMD control. We do have a lot of variety in our soils too. We're not sure about the suitability for infiltration. One estimate was somewhere around 10% of 15% might be appropriate. One of the things that I'd like to focus on is atmospheric deposition, and I was pleased to see that that came up. There was a recent study done by researchers at SQRB and UCLA that indicated something like 57% to 100% of the trace elements in this study that were in the runoff came from atmospheric deposition. And they also concluded that dry deposition appears to be the dominant mechanism, not wet mechanism. And although the technical document acknowledges the deposits on land from atmospheric deposition are much higher than the deposits to the river. The assessment, the source assessment really doesn't deal adequately with indirect deposition. And that's the whole area that could be washed off into the river and its tributaries. The source assessment needs to have a much more detailed analysis. And as the Staff Report itself says the contribution is probably on the order of several thousand kilograms per year from atmospheric deposition to the watershed. Unfortunately, the TMDL seems to ignore indirect atmospheric deposition by asserting that it's covered, you know, accounted for in the estimate of the storm water loadings. Just as an indication, this chart which is from a previous study by SQRB indicates those red bars are indirect deposition. So that tends to show you the dominance of indirect deposition in this LA River watershed, and for basically all those metals. We agree with the suggestion by the Regional Board that we should first focus on source reduction, that's said in the TMDLs. We think that this major source needs to be addressed, that is, atmospheric deposition. And we need to have a collaborative effort between the Regional Board, USEPA, the Air Boards, etc. to develop these mechanisms, and we think there are ways of doing that. Primarily we think that if that was handled we could handle the rest of the stuff in a cost effective manner. If there were allocations given to the Air Boards, etc. and they use their regulations to control those atmospheric sources, we could control the rest.

The second point I want to make very briefly, there's some allocations of some unlisted segments in this TMDL which are inappropriate. They're specifically mentioned in the TMDL in order to control downstream sources. And we think that's actually contrary to Section 13360 because they're specifying a manner in which compliance may be had. This is just a demonstration. All those red cells are water body segments for which there

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	are allocations in the TMDLs, either a TMDL assigned or allocations other than a TMDL. The ones in blue are the only ones that are listed in the 1998 303D list, and that's the list that's controlled by the Consent Decree, so those are actually the only ones that need to be done. And this is just some of the reasons why you might want to just consider only approving it for that 1998 list. The TMDL itself says it's focused on that and has a table that says which ones are involved. And clearly points out that the more recent listing are not subject to the Consent Decree. So they do not have to be done at this time and we could focus on the ones that have to be done. These are the same options you saw before, we just suggest that there are some options that you have there, and one of which would be just listing for those segments that were in the Consent Decree. Thank you.
Chair:	Questions, comments?
Baggett:	Yeah, question. Richard would the – so your one proposal is to adopt the Consent Decree TMDLs and that's with Implementation Plan?
Watson:	Well what, I could see it being done either way. The way I said it in there was that way. I think you could actually adopt the – for the analytic unit 13 without an Implementation Plan, direct the Regional Board to come back and refine the Implementation Plan. And you could perhaps in your continuing planning process, spell out a process by which they would do that and have those technical studies done first. We're really appreciative that the Regional Board is reaching out to the Air Boards. And as you know, you and Jonathan Bishop both participated in that CASQA session we had back in May dealing with this issue, and it's a major issue for the whole State. And this just happens to be one of the first TMDLs to come up where it is the critical issue because we're getting most of the pollutants from atmospheric deposition.
Baggett:	I would agree.
Chair:	Next speaker is Mr. Rodney Anderson from the City of Burbank.
Anderson:	Good afternoon. My name is Rodney Anderson and I'm with the City of Burbank Public Works. And I would like to address three items today for you on this – and I'm speaking directly at Los Angeles River Metals TMDL. If you've gone over the TMDL Burbank has a POTW and we're one of the three POTWs in this watershed, Los Angeles owns the other two. In dry weather POTWs add 70% to 100% of the dry weather flow. So we're a major player in dry weather flow. And as you know in Southern

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California it's almost always dry weather. We don't get rain but maybe 30 days a year. My three comments are, first of all cadmium and that it should be removed from the TMDL; secondly about POTWs and the implementation strategy is absent, as well as the associated costs with implementation, and POTWs must have a compliance schedule specified much greater than what's in the TMDL right now.

First of all for cadmium, a TMDL guidance policy says you first look and see when you're writing a TMDL is it meeting water quality objectives, and should you continue to go forward with it. For cadmium the data clearly shows that there is not an impairment. If you look at the 303D listing policy, all the data shows it should be de-listed. In fact, the draft list 2006 list that's coming out has it de-listed. So we're looking at proposing to do a TMDL now and at the same time looking at de-listing it, which is an odd thing. Now I came before you for the 2002 list – actually in 2003 for the 2002 list and said hey this should be de-listed there's no reason to do this. But it was said oh continue to collect data before the TMDL comes out we'll de-list it, don't worry about it. Well here we are and here's the TMDL and it wasn't de-listed, it went forward. So why is this a big deal? If cadmium's not a problem all our data shows that it's not a problem, the TMDL even says cadmium really isn't a problem. Why do we are that cadmium is in this TMDL? Well it sets a bad precedent. Why are we having all this monitoring? Having all this work on this TMDL and cadmium, when it's really not a problem. Secondly, it's a waste of resources. There are problems in the LA River. And I think anyone will admit to that, but it's not cadmium. Let's spend our money on where there are problems. And third it's inconsistent with other things going on like a 303D list and with the TMDL guidance policy. So, we do believe that cadmium should be de-listed. Now, whether you can remand it today and get that de-listed, or scratch it out while you're approving it. I don't know. And that's why you're up there and I'm down here.

My second point is POTW compliance strategy. Again POTWs are 70% to 100% of the dry weather flow. In the compliance strategy it says well maybe advance treatment is needed, and that's about it. No costs are even looked at on what advanced treatment would be. As an engineer and as a representative for the City, we've look at what advanced treatment means. It probably means reverse osmosis. Obviously that's a very expensive option. And if we had to go that way the issue comes up about Brian disposal. Now why wasn't this mentioned in the TMDL? Well you don't want to bring up Brine disposal in a TMDL. It adds a lot, especially when you're talking about the CEQA and having to gain right-of-way all the way from Burbank to the Ocean. That's quite a ways. So we would ask, or we believe it should be remanded in language regarding advance treatment and what that actually means, and the costs associated with it be included.

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	The final item is the proposed compliance schedule for POTWs is inadequate. The way it's listed out in the TMDL for Implementation Plan is POTWs have 4 years to conduct studies to see whether they can meet limits. At the 4th year they need to determine whether they need to build advance treatment or not and they submit that to the Regional Board. The Regional Board has a year to get back to us and say at year 5 whether, if you do need advance treatment we'll give you another 5 years or not. Now put yourself in my place, if after 4 years you've done studies, and we've put a quarter of a million dollars towards this copper water affects ratio study already, and probably putting more money towards it. We put $250,000 and that's us, the City of L.A. put $500,000. Now in Burbank $250,000 is – considering we have 100,000 people, residents, that's $250 per person. I don't make that too public in Burbank because I don't think people want to spend $250 each towards the copper water affects ratio in LA. But that's part of what we need to do and we're going forward with that. Now we're doing this study, we believe it's gonna get us so we don't have to do advance treatment. We submit that at year four. All we have is a compliance schedule for 5 years at this point. At year 5 we get back whether we have the additional 5 years or not. Well if the answer is no at year 5, we're in immediate non-compliance and in criminal violation. So should I wait until year 5 to find out whether I'm gonna get this additional 5 years? Or do I start building now for year 5? Now even if I did get that approval at year 5, I'm given 5 years to build reverse osmosis at our plant. That's not enough time, frankly, to do pre-design, design, to get approvals, to do CEQA, and certainly not to construct a Brine line. So additional 5 years just wouldn't be enough. So the choice before you, I guess is to remand today and have these things fixed, or you can make quick changes. Now obviously I think it needs to be remanded, cadmium be taken out, really look at POTWs which is the major flow for most of the year. But if you can't, I would say at a minimum, the POTWs should be given 10 years from that 5 year reopener, not 5 years after the 5 years. So it would be a 15 from the TMDL approval. And that would at least be a realistic where we might be able to get it constructed, although it's hard to promise that but it would be a little more realistic.
Chair:	Okay.
Anderson:	Do you have any questions?
Baggett:	Yeah I have one. Probably if Michael – so can we delete the cadmium without and adopt the rest? That wouldn't require remand I assume? Or remand just –

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Levy:	[inaudible] already dead. There is no cadmium limit waste load allocation for dry weather that's applicable to Burbank.
Male:	For dry weather but for what weather there is.
Anderson:	But the wet weather listing is not proposed for de-listing, only the dry weather listing.
Male:	I'll have to look at the 2004 – 2006 list. But I think it just says cadmium, not dry weather cadmium. But we can look at that.
Secundy:	Mr. Bishop would you want to add something to that?
Bishop:	Yeah, we took these comments to heart when we were putting together the TMDL and when these were brought to our attention we realize that all the exceedance data was from wet weather. And so if you separated it out and looked at just the dry weather, which is the POTW flow during the dry weather there wasn't a need for it. So we removed that portion in the TMDL. There is still an exceedance in there when you look at wet weather. And so that's why it's still in there.
Secundy:	Alright, thank you.
Baggett:	One would assume that the POTWs aren't held liable for it during wet weather if they weren't during –
Bishop:	Well they have an allocation during the wet weather because they contribute during the wet weather.
Baggett:	Why would they contribute during the wet weather and not the dry weather? I mean it's a POTW –
Bishop:	Well –
Baggett:	It's not a combined sewer overflow. I mean –
Bishop:	I understand what you're saying but they –

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Baggett:	They have more people in the winter than the summer?
Bishop:	They are one of the sources during the winter and they have contributed – I would like to remind the Board that the values for CTR are required by POTWs to meet under the NPDES Permits irregardless of this TMDL. So, those – these are not different, or new, or additional requirements of the TMDL.
Baggett:	I was just wondering, but how could they be different than the summer than in the winter for the end of pipe POTW. I mean this just defies logic to me unless they add more population or have a greater – they flush more toilets in the winter than the summer. I mean I don't understand.
Levy:	There are other sources in the winter –
Baggett:	From the POTW?
Levy:	They're one of many sources. They have to receive a waste load allocation being one of the many contributing sources. If there's no impairment during dry weather, there's no allocation applicable to anybody. So the point is the water body is characteristically different in dry weather than wet weather.
Chair:	Thank you.
Levy:	It's not that they're not a source during dry weather. They're still a source, but the levels aren't enough to break standards.
Chair:	Thank you Mr. Levy. Mr. Secundy.
Secundy:	Mr. Bishop would you come back up please. Let's talk a little bit more about aerial deposition.
Bishop:	Uh huh.
Secundy:	Because I have a feeling we're gonna hear that time and time and time again. And I'm getting a distinct feeling that from the dischargers point of view they feel that a large amount, if not the majority, of the metals are

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	being deposited through aerial deposition. Have we come to that conclusion? By we, I mean the Water Boards?
Bishop:	We agree that aerial deposition is a significant source to the urban watershed. And the reason it's a significant source is that if we move that material off of impervious surfaces directly to the water bodies. When you look at the studies of areas that are completely paved and you look at the deposition that you would expect and you look at what's in the water, you've got an almost 1 to 1 relationship. When you look at a real watershed where you have some areas that are impervious and some areas that are pervious, you get a much lower amount of metals in the water than you would expect from the aerial deposition because the impervious – the previous surfaces have an impact on it. It – you get a reduction. If you look at the upper areas of the watershed, which are part of the aerial deposition the forests, the upper reaches aren't impaired in wet weather. We're not seeing that direct relationship. So there is a relationship between aerial deposition and water quality. That relationship changes when you – when you change the nature of moving storm water from impervious surfaces to the streams as fast as possible. That's a function of the MS4 permit. That we think makes them partially responsible.
Secundy:	Maybe you just answered my last question which was indeed who should be responsible? Obviously in the best of all possible worlds we would be going after the sources themselves. We would be changing break linings. We would be changing lead weights on tires. We would be eliminating zinc in the tires themselves. But if indeed we are not going after those primary sources, who should hold the ultimate responsibility?
Bishop:	Well I think we do need to be involved in the process of going after the ultimate sources, this is why we have initiated that dialogue. But our requirements, you know, be as they may, our requirements require us to make sure that point sources of discharge aren't causing or contributing to water quality exceedances. Our laws of the Clean Water Act says that a storm water discharge is a point source discharge. And so we have an obligation, as a Regional Board, to make our requirements at that point source discharge location. It may not be a very satisfying answer, but it's the answer that we function under. I agree, and we are working to try and help address the ultimate source. That will not eliminate the need to have treatment or BMPs at the storm water. If we eliminate the source from aerial deposition, there are other sources involved besides the brake pads and the tire linings, there will still be a requirement. But they would just be lower.

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Baggett:	And might be below the threshold like drivers as wet weather.
Bishop:	Right. Uh huh.
Secundy:	So basically, and I'm not trying to draw any conclusions at this point in time, but from the equity point of view the POTWs are simply right now out of luck. They're at the end of the pipe. Everything washes down to their particular facilities and you are under an obligation to regulate those facilities. Is that –
Bishop:	It's not the POTWs, it's the municipal storm water system.
Secundy:	I'm sorry. I misspoke, yes. Is that fair, my characterization?
Bishop:	That's correct.
Secundy:	Alright. Thank you.
Chair:	Actually Mr. Bishop I do have one question for you. Could you please summarize the results of – very briefly – the results of the external or scientific peer review that was conducted for this TMDL?
Bishop:	Sure I would ask Melinda to come up there because I can't remember at that level of detail. Melinda could you come up?
Becker:	I'm sorry I don't have the specific peer review comments before me. Were there specific comments in the peer review that you wanted me to answer?
Chair:	Nope. We've just heard some comments that question some of the scientific aspects of this TMDL and I just wanted to know in summary, what were the concerns anyone expressed by the external scientific peer reviewers for this TMDL?
Becker:	I don't recall that there were any outstanding issues that we had not addressed in the peer review. I will say that we went to great lengths during this TMDL to try to find reached specific hardness data to make sure that we did not set numeric targets that were more stringent than necessary. The default hardness value under the CTR was 100 milligrams per liter.

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	Significantly more stringent than the hardness values that we used. We went to great lengths to try to find site specific data regarding translation of total to dissolve metals.
Chair:	Alright. Thank you. Ms. Sharon Greene, Sanitation Districts of LA County.
Ms. Green:	Good afternoon Madam Chair, Members of the Board. I'm Sharon Greene with the Sanitation Districts of Los Angeles County. Just to give you a really brief overview, the Sanitation Districts not only provide waste water treatment services to over 5,000,000 people in LA County, but we also provide solid waste management services. In total we have 11 waste water treatment plants and 6 active and inactive landfills. And I'm gonna be focusing more on one of our landfills today than on our waste water side.
Chair:	I'm sorry, your comments are directed at Item 8.
Ms. Green:	Yes they are. I'm sorry I meant to clarify that. Thank you. I guess I'll start with the bottom line which is that we do believe that there are sufficient data gaps and gaps in the implementation plan that weren't remanding the TMDL or, at a minimum, holding it off on the approval of the TMDL. We have one facility, the 310 acre Scholl Canyon Landfill in Glendale that will be affected by this TMDL. We anticipate that just to meet the interim waste load allocations would cost $39 million for us to install extended detention basins and other storm water treatment technologies that would be necessary to meet the EPA benchmarks being prescribed for the general industrial waste water – or storm water permitted sources. At this point we still don't know if we would consistently be able to comply with the benchmarks. And my main point really though, is that we really don't know how we would be able to comply with the final waste load allocations and whether that's technically feasible and we have no idea how much it would cost. I did want to mention that we also have an interest in this TMDL because we do have other facilities, of course, and other watersheds primarily the San Gabriel River watershed. And that is due for a Metals TMDL to be established, if not by the State, then by EPA by March of 2006. We get to see a draft of that TMDL and I have to say that we can only assume it will be modeled after this TMDL and use many of the same types of assumptions. The two issues I want to briefly mention are, as I mentioned, the issue of whether it's feasible to apply the numeric effluent limits in storm water permits based on the waste load allocations. We know you've been looking at that. You've had an expert's panel, but my understanding is that it will be still some time, hopefully not very long, but before they report back to

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	you and give you some recommendations. And then of course you will be deciding kind of what the Statewide policy is on that is my understanding. It seems like that is very relevant to consideration of these TMDLs before they move forward.
Baggett:	But in fairness isn't that a separate issue. I mean the storm water issues you're looking at actual permits. This is numerics for a TMDL which are – I mean it's like apple and oranges.
Ms. Green:	I don't believe it's apple and oranges. Maybe I'm mistaking, but I believe the TMDL will lead to permit requirements which most certainly could include numeric permit limits. As Mr. Bishop testified it doesn't have to include those –
Baggett:	Right.
Ms. Green:	– if the permit rider can demonstrate BMPs will attain the water quality – or the waste load allocation put into the TMDL, then I guess they can do a BMP-based approach within a permit. Our concern is that we don't know that BMPs can get us there and that we can demonstrate that for a landfill facility. You have a large pervious surface, but it's by design to be impervious. We're not allowed by landfill regulations to allow water to infiltrate into the landfill. And we don't really have extra space there, so we would need to acquire land, you know, etc. So, you kind of have some conflicts in your different sets of regulations in that regard. Particularly when you're talking about recharge as a goal of the region which is a very allotable goal and we very wholly support that in other context.
Baggett:	It's not for landfills.
Ms. Green:	Just not for landfills, that's right.
Baggett:	That's good.
Ms. Green:	Laughter. Good. I'm glad we agree on that. The only problem is where does the storm water go from the landfill. I also just wanted to briefly mention that we really do believe we – I kind of wanted to echo the concerns about the air deposition. I guess, and I'm very encouraged to hear that the Regional Board is talking with the Air Quality Management District and the California Air Resources Board. But I don't believe there's anything in the TMDL to actually document that and tell the rest of us how

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	those issues are going to be take care of. And I think – I mean the comments that preceded me pretty much focused on that, and it seems like it – I mean it's at least a Statewide issue if not a national issue on some of these things. And I don't think we feel that it's fair to proceed with a TMDL with the presumption that the storm water permittees can manage this issue at the end of pipe and maybe we'll get a solution that's really the bigger picture but maybe we won't. We're gonna be held accountable and I don't know where the accountability is for the rest of the agencies that regulate all the other sources. So thank you very much. Those are the – that concludes my comments.
Chair:	Thank you. Mr. Gene Lucero. Everyone has been very good in staying around 5 minutes. Thank you.
Lucero:	I have a PowerPoint to accompany this. Madam Chairwoman, Members of the Board, my name is Gene Lucero, I'm with the law firm of Latham & Watkins. I'm here representing Universal Studios. I want to focus on some points about this rule that I think are extremely important. And to set up the framework for that I'd like to go to the first slide. Let me, and just very quickly, give you a picture of Universal Studios if you're not already familiar with it. It's a 420-acre facility, this is a picture of it. There are 28 outfalls, 5 dry weather flows, 23 wet weather outfalls, it fronts 2 miles of the Los Angeles River. At that point the Los Angeles River is channelized. The problem that we are concerned about is copper. In compliance with the waste load allocation for copper, there are no sources of copper on this facility. All of the allocation comes from – or all of the source comes from brake pads and automobiles. Our current estimate of having to comply puts the price at approximately $5 to $10 million for this facility. And many parties in front of us have already made the comments on the problem with air deposition and that the real sources in this problem that everyone is trying to address are not really being attacked initially. I'd like to make this observation. The approach being taken today is to pick a hand full of significant indirect dischargers, in this case my client Universal, and say basically that you have to address the problem of copper and any other metals through this TMDL. That is a fairly extraordinary approach. Not one that's necessarily prohibited, but a fairly extraordinary approach. And as a result, it's an approach of an essentially to fix the cost of compliance on a few for a problem caused by the many. And under that circumstance because it's unique, I think this rule needs special scrutiny. Not just the normal deference given to the Regional Board whose worked very hard, we recognize to try to put together a rule that will pass muster particularly because of the deadline pressure. However, at a minimum, this rule needs to accomplish several things. It needs to have an accurate source assessment. It needs to have accurate

modeling that serve as a basis for the waste load allocations. It needs an economic and analysis so that one can appreciate whether or not these area reasonable choices built into the final proposal and the implementation plan. And finally, it needs to know that the structural BMPs at the end make sense and can be accomplished to achieve the results. What we have suggested in our comments which we filed in May [Tape 2 of 5 ends here.]

[Tape 3 of 5 picks up here.] comments we submitted last week is this rule on all of those points has serious weaknesses and the pressure driving towards the deadline is going to lock those weaknesses into this rule. And as all of us know who dealt with rulemaking that you know as well as I do that once these become law they're very difficult to fix. They take on a life of their own. And that's what we're concerned about. And what we're opening concerned about even though there's a process in the next several years for iterative BMP compliance as a way of sort of forestalling the ultimate problem in this case. We're going to be faced with a problem ultimately of not being able to achieve these requirements, and not knowing in advance whether the other sources are going to be addressed in that period.

[Next slide please.] Now, these are just quick summaries of some of the points that are discussed in detail. You can take a quick look at them. One of the key problems we see and as others already commented about it, there's a single air deposition study that the sources of air deposition are not completely understood. Their contribution is not understood. And, therefore, the structure of this TMDL has that serious weakness.

[Next slide.] We think it's based on faulty science. You ask the question [tape skips] here are several quotes from the external peer reviewers. "I would feel uncomfortable about basing TMDLs on the model results. There is no fundamental basis for any direct affect of hardness on metal toxicity. The issue should be revisited. The model failed completely to predict the response of the system. Using this results is poor engineering. There can be no reliance on the model results." Those are serious indictments of the science of this rule.

[Next slide please.] A serious defect that we worry about is that there's been no serious economic analysis to accompany this. The suggestion made by the Regional Board it was not necessary. They also take the position to the extent it was required or should have been done, the analysis they did in CEQA made sense and is adequate and that a full 13241 economic analysis to look at the cost of this compliance and whether it would achieve the outcomes you want doesn't exist. We think that is a serious defect.

[Next slide.] I think this brings us to a point that many others have

Speaker	Comments
	suggested as well. The Board really should be directing some additional analysis. Now I am a lawyer. I have worked for EPA. I worked with EPA. I work with you. I work with the Regional Boards. Consent Decrees can be renegotiated under appropriate circumstances. The Board has the – this Board has the opportunity in consultation with EPA and the Regional Board to raise the question of whether or not some additional time to try to deal with these problems would be appropriate. Even if one of the three parties to the Consent Decree does not agree, the State of California has the option of appearing before the Court and making its own motion to ask for additional time. You are not without some remedy to at least explore there. Secondly, EPA has suggested they are ready to produce this rule. And they have suggested they'd like very much the analysis that's been done and would incorporate, perhaps without the implementation plans, what the Regional Board has developed. I say, "Fine, let them do it." Because the defects that we see EPA will have to defend too, and that gives us another mechanism that will be a comment period. We can deal with the issues there that haven't been addressed in this rule if EPA's gonna rely on that. In the end, what I worry about – what my clients worry about – in this particular case is this is gonna get locked in with some general promises to try to address the most serious problems. And we logged the efforts of the Board to start a discussion about air deposition. We think that's extremely important. We also know the Board Staff has worked very hard in the short term to try to deal with some significant problems. But I think it would be a serious mistake in the time pressures that people have built on approving this rule to say you have to adopt it with all its warts and defects. Put it in law because it will be extremely difficult to rationalize later. You'll be stuck with the structure you have. Those are my comments. Thank you very much.
Chair:	Thank you.
Secundy:	Not for you actually. This is for Region 4. Please why don't you stay up at the podium. Mr. Bishop. Those are some rather devastating comments in terms of the a peer review. Are those cherry picked quotes or was that the general consensus of the peer review panel.
Bishop:	You never move forward with a TMDL that we haven't addressed all of the peer review comments. I don't have those with me. If I had known that was an issue, I would have brought them forward. And, you know, we will get to you the peer review documents and the responses to those so that you can see the changes and the issues and responses that were made before your hearing. But I don't have them in front of me to tell you.

Speaker	Comments
Secundy:	Alright.
Becker:	Can I [inaudible].
Secundy:	Sure.
Becker:	There is a well-recognized correlation between hardness and toxicity. And in fact the CTR builds hardness into the objectives. So we were required to consider hardness. And in fact, as I spoke earlier, we went to great lengths to get the reached specific hardness which in most cases were higher – significantly higher than the default hardness value in the CTR.
Secundy:	Thank you.
Chair:	Thank you. ____ Commenters. The first one is Mr. Clayton Yoshita the City of Los Angeles.
Yoshita:	Good afternoon. My name again is Clayton Yoshita, City of Los Angeles Bureau of Sanitation. I have one comment on the Ballona Creek Metals TMDL, but before I do that I would like to incorporate and support the comments made by Mr. Rodney Anderson of Burbank, especially in regard to the schedule. We submitted comments on the implementation schedule to the Regional Board in the past. And also – we also support the removal of the cadmium from the TMDL for the reasons that he stated. Now, as far as the Ballona Creek Meadows TMDL, I just have one comment. The State Board Staff has just released the draft proposed listings and de-listings for the 303D list of impaired water bodies. And the State Board Staff has proposed de-listing of some metals in Ballona Creek, namely cadmium, lead, selenium, silver and zinc. This would leave copper as the only remaining listed metal. Since the de-listing proposal is a finding based on the analysis of existing and current data by your staff, we request that the waste load allocations for lead, selenium and zinc be deleted from the Proposed Basin Plan Amendment. It's a similar issue is with the cadmium issue. And so that's my one brief comment. Thank you very much.
Chair:	Thank you. Our last commenter is Ms. Carrie Insione. We'll get your name right one of these days. From the LA County Department of Public Works.
Ms. Insione:	Don't bother getting my name right because I just got married so I'm gonna change my name [laughter in audience]

Speaker	Comments
Secundy:	What is your new [inaudible]
Insione:	Well actually my new last name is actually harder to pronounce.
Male:	[Laughter]
Insione:	It's twelve letters long. Actually, well first of all for the record my name is Carrie Insione, Senior Civil Engineer with LA County Department of Public Works. And all of the comments that I was going to come up and talk to you about have already been said by the previous commenters. Except that we would like to note that we did submit written comments on both TMDLs. And by the way my testimony is for both TMDLs. But I wanted to give one additional verbal comment today, which is that we request to strike language in both TMDLs. If you do go forward with approving the TMDLs, I think this is a minor change that you can accommodate. We request to strike language in the TMDL in the compliance or ambient monitoring section. That says, "Compliance or ambient monitoring must begin immediately after approval of the monitoring plan by the Executive Officer." We have had lots – not lots of experience, but we've had experience in compliance monitoring plans and submitted those to the Executive Officer for approval. And for the Cities and the County to begin compliance monitoring after – immediately after the approval is just logistically infeasible for us. We have to not only wait for the EO to approve the plan, but we cannot go forward with contracting, mobilizing, financing, until at least 6 months after the approval by the EO. I would also like to request that Mr. Clayton Yoshita comments with respect to the proposed de-lists for Ballona Creek be included in the record for our comments. And that does it for me. Thanks.
Chair:	Questions, comments of the authority.
Michael:	My question is for Ms. Insione. Can you please tell us what page the language you referred to is on in the Basin Plan Amendment?
Insione::	I'm sorry Michael I don't have the Basin Plan Amendment with me, but I'll –
Levy:	You could show me afterwards. Thanks.

Speaker	Comments
Chair:	Any other comments?
Bishop:	In general?
Secundy:	In general. Mr. Bishop. Since I'm the liaison to Region 4, obviously I have a very personal involvement in this. And I guess what I'm hearing time and time again is if we had "This is the road we had only taken to account aerial deposition none of the dischargers would have any problem with the TMDL that you are proposing. I'm not sure I buy that completely, but that is what I'm hearing. And that most of the major problems from metals at least is coming from aerial deposition. And since we are pretty much at an infancy stage in terms of working with the Resources Board and US EPA, as well as the State and Regional Boards when it comes to aerial deposition and it may be some time before we come to some conclusions there. Is this indeed premature? That's a question, not a judgment.
Bishop:	Right. And I think that if you were the Air Resources Board, you may be in a position to say this is – this is too soon. We don't know – we don't know what the attack sources of that copper are that are being deposited. We haven't done a resource assessment analysis that the Air Resources Board does. I can't remember their term, but it's a little bit different term. But if you look at the water in the receiving waters, they're exceeding the standards and they have been exceeding the standards for – well I don't remember when the first 303D list was put together – was in '96 or '94. They've been exceeding the standards for a long time. And those standards are based on toxicity to aquatic life. So we're not talking about a theoretical issue here from the water side of view. Is it – if we took out aerial disposition I'm not sure how you do that and still then regulate any discharge that has a component of aerial deposition. But, you know, theoretically maybe you could. You would still be facing exceedances in your receiving water which you're always responsible for addressing.
Baggett:	But didn't you – well wouldn't it depend if the study that's been cited a number of times – I'm not familiar with it but it was done by SQRB, which is I think everybody would recognize in the room is a fairly independent, well-respected scientific group which I know the Regional State Board relies on heavily. But you could end up in a position much like Burbank's cadmium discussion where you drop below the threshold. It appears to me if you take out – we're depending the constituent what was the – I'm just – I can't verify this, but they said 40%, 53%, 57% to 100%, depending on the constituent's air deposition. Depending on the metal.

Speaker	Comments
Bishop:	I can't confirm that either, but I do believe it's a significant source.
Baggett:	And we're hiding SCCWRP study, that all. Unless they decided the study.
Bishop:	Yes. If you were actually eliminating that. What I think that I was responding to was the suggestion that we segregate from the TMDL, the air deposition, and make the municipalities or the storm water permittees responsible for that amount of metal which is not related to aerial deposition. The aerial deposition's still there.
Baggett::	Yeah. What about, there was one proposal that we adopt the Consent Decree segments.
Bishop:	Uh, I mean I guess that's –
Baggett::	[inaudible] take care of EPA's. The rush to judgment here is because of those, correct?
Bishop:	I'm not – well I'm not sure I agree that this is a rush to judgment. We have been working on it for a number of years.
Baggett::	But we haven't, and this is the first. I guess we set a pretty high bar with the Mercury TMDL recently. And I think at least four of us on the Board felt that that was – and the environmental community particularly in that case, argued ad nauseam that this is the first of this is the first of this type of TMDL Statewide and we ought to make sure you send a message and get this implementation plan and get the technical part of this TMDL down so there's some template. And it seems to be we're in the same situation here – this is the first air deposition – air driven TMDL that we dealt with. And it's gonna set – well how many do you have alone in just Region 4 – it's gonna be coming down the list. So it seems to me – I hate to rush to judgment on this – maybe you talked about. One Regional Board there spent 6 years on their Mercury TMDL.
Baggett::	Huh.
Chair:	One point to consider though with respect to what you just said is that the Mercury TMDL in San Francisco was looking at a 120 year period in order to attain their standards and here we're looking at 2015.

Speaker	Comments
Baggett::	I would argue there's no way that you're gonna do this. How long is the Air Board been trying to deal with asthma in State of California, and the rates keep going up. Come on. This is not gonna be done in 12 years, or 15 years. We can pretend it is, but not if you add 600,000 people a year to Southern California.
Secundy:	Jon, Mr. Bishop excuse me. If you don't mind I would also like to hear from Ms. Strauss from US EPA. She's had an opportunity now to listen to all of the comments and I would also make an observation, there's a startling difference between the audience this time and what we just went through with the San Francisco Mercury TMDL. I don't believe I've seen a lot of people from the environmental community that are championing this TMDL. I know they have at the Regional level, but I'm a little surprised by their absence today.
Bishop:	Well I can give you – Because I asked why they weren't gonna be here. Because there was a mishap I guess with the comment letters, and it was unclear that there were comments received until yesterday by your staff. And so there was a belief there wasn't a need for people to be here. I'm sure they'll be here in a few weeks.
Secundy:	If not I guess they just heard the invitation.
Chair:	Ms. Strauss.
Strauss:	Boardmember Secundy if you wish me to address the aerial deposition issues?
Secundy:	Yes I would. Again, I'm just trying to look at it from a macro point of view. If indeed the supposition is correct and I do not know if it is correct, but if it is correct that a very significant portion, if not the majority of the metals are being deposited through aerial deposition in the Los Angeles Basin area, should we in some way be taking that into account in terms of this particular TMDL. Should there be some relief, if you like, in terms of municipalities, the MS4s? I'd be very curious as to what your views are.
Strauss:	I believe that the work that has begun through a number of different venues through SCCWRP as was referenced earlier through the Santa Monica Bay processes, there are many related endeavors under way to better identify atmospheric loadings. This is a vital part of our work. At the same time we're trying to tie in information from the National Air Monitoring Networks to try and identify for very specific pollutants what is coming into California as an international loading that we may have very little ability to

Speaker	Comments
	control what is coming from out of state and into California, and what do those air monitoring networks show us about what are some of the key sources for specific pollutants in Southern California or anywhere in the State. So, we're trying to bring together information that doesn't normally get put together. It doesn't very easily give you from some of these air monitoring networks, for example, quantitative reliable number for loadings to land. So I feel that the work that is underway in which the State Board, Regional Board, and others are engaged with ARB and the Air Districts is beginning to help us all get a handle on quantifying that number reliably for loadings to land, and then because of the storm water mechanism, loadings to water. It's at the Boardmembers behest to examine the record and determine if you feel that the TMDL itself, the so-called technical TMDL and then the Implementation Plan provide the requisite flexibility for folks over the next several years to, in fact, go to the BMP-based approach that the Regional Board has spelled out here and say well if that's at a certain point 5 years from now when presumably we will have taken great strides in being able to better quantify this loading, is there some consequence as the Board was referring to that would commit capital irreversibly. And is there a different way that you want to deal with the reopener, for example. I don't believe that the information before us is necessarily flawed, I just believe that we're all dealing with a level of knowledge that is not as sophisticated as we wish we would have in dealing with other water specific work that we're all more accustomed to. So I feel very positive that many of the commenters recognize we need to be doing this work. We're making great progress. We might need within the Cal. EPA umbrella to find easier ways to translate water-related loadings into air permits, for example, that I can struggle to try and do from Clean Water Act to Clean Air Act as well, but there's plenty of work for us to do in a workshop setting on this topic alone. And I think that we're well embarked. And you may choose to have your reopeners work differently so that nobody's in the position of an irreversible commitment of capital once we've really pushed BMPs as far as we think we can push them. And those continue to improve. I mean I think back where we were with various BMPs in heavily urbanized areas 5 years ago. And everyone is doing much much better. So, I'm continuing to be very optimistic that we're doing the right thing here.
Baggett:	I mean I think you've articulated my concerns very well. I mean I think it's the reopener, it's – I didn't hear much argument about the technical work. I mean that seems to be everybody agrees with that. It's how you're gonna implement it. And from US EPA and the Consent Decree's concern, its the technical TMDL that has to be done. I don't know if it's something we've considered adopting that on the next Board meeting, and then spending another month or two talking about the implementation part of it. So we – because I think it's clear none of us up here really understand the details of

Speaker	Comments
	the reopeners which were brought up today, and some of those other issues. And maybe it's worth not rushing that part because that's really where the action is, this implementation. That's where it was with Mercury. It's not the loading as much. We kind of – that's science I think everybody knows we've got a problem and can figure out where it's coming from, it's how do we deal with it. And that's where the big dollars are and that's where the policy debates are.
Strauss:	Might you also have an option of if you chose to adopt the entire package, might you have the option of having the Regional Board re-examine one or two key elements. I take obviously seriously the concerns – the comments made about this being, you know, rule of law. But I do see an enormous amount of iterative approaches in TMDLs and NPDES permitting among the Regional Boards. And might there be some trigger in the same way with Mercury TMDL that Board II has other work that it's embarked upon. Might there be something that you could still adopt the package and Board IV could come back to you with something that would happen at some point in the future with atmospheric loadings and revisiting it. I'm just throwing it out as an option because I would really like to avoid, if need be, a federal promulgation for LA River. But if I do, I would need to know whether you would adopt the Ballona Metals or not. So I'll leave that for the subsequent two week discussion.
Baggett:	Yeah, my proposal is at least off the top without – just to throw out to discuss, is if we adopt all the technical TMDLs –
Strauss:	Yeah.
Baggett:	Except for the obvious ones like cadmium and the ones that are up for de-listing. I don't know how you'd deal with those. And then take – do a 6 month remand – like we did with Mercury. Come back with an Implementation Plan. Let us better understand it.
Male:	Thank you very much.
Chair:	Thank you. Obviously we have a lot to consider. I think that finishes Item 8 and 9. And now we're on to Item No. 10.

EXHIBIT "G"

Transcript of State Water Board, Board Meeting
Item No. 7
October 20, 2005

Speaker	Comments
Tam Doduc Chair:	We're now on Item No. 7. I'm gonna keep Item No. 7 and 8 separate because I have much more comment cards for 7 than for 8. No. 7 Mr. Frantz.
Mr. Frantz:	Good morning Chair Doduc, members of the Board. My name is Greg Frantz with the Division of Water Quality and I'll be presenting items both 7 and 8 this morning. And I guess I just heard that you want to take them separately, so, although my comments will apply both to 8 as well in terms of Staff action since Workshop. Since Workshop we've been working with the Regional Board Staff and with USEPA to address the issue of indirect air deposition, which was an important issue raised at the Workshop. And by indirect air deposition we're talking about the way in which particulate metals are emitted first into the air and then deposited onto impervious surfaces, later to be washed in the storm water conveyance systems during storm events where they then become under the jurisdiction of storm water permittees. We've added new WHEREAS items in the State Board Resolution. I know you have copies of the most latest revision. We first revised the Resolution on October 17th when we posted it on our website per language we received from the Regional Board Executive Officer. Additional revisions then were made just yesterday on the 19th to clarify the first sentence of Item 8 in the new language that's underlined in your Resolutions. You've been provided with that and you have the most current version with you. Oh, and I also need to add that we have copies of the most current version on the table behind me and to the left for the public. It's right next to the blue cards over there.
Boardmember Secundy:	Mr. Frantz since the revision for October the 19th or 17th, I can't remember which, was posted but this latest one has not been, I understand copies are available. Perhaps you could just read the change in the sentence in 8 since that's very short and I think fairly clear as to why you did that.
Mr. Frantz:	Yes, I'd be happy to. Originally the October 17th version, the first sentence of Item 8 read: "The waste load allocations in the TMDL do not take effect for 6 years" and then ", during which period" and then the rest of that text. We have taken out that first part that I just mentioned and replaced it with "the TMDL implementation provisions require no specific pollutant reductions to be implemented within the first 6 years." Which is a much clearer way to express that thought.
Boardmember Secundy:	I would also interject, and this is really for both Items 7 and 8, the two metals TMDL for Ballona Creek and Los Angeles, and just speaking on my

EXHIBIT "G"

Speaker	Comments
	behalf as one of the Boardmembers. The Staff has put in these revisions in No. 5, 6, 7, and 8 really at the request of more than one Boardmember. And that's recognition of the fact that aerial deposition is an enormous problem. And although we are certainly required to clean up the discharges within the streams themselves, it is much more fruitful if we can stop those discharges to begin with. So as you read through this, please keep that in mind. What we want to do is be able to go after the root cause of the problem, whether it's copper and brake linings, or zinc on tires, or lead weights on balancing wheels. It would be much better to be able to go after those items than to try and clean it up at the end of the pipe itself. And that really is the reason for putting this in. So that we will study it, we will understand it, and we will come up hopefully with solutions to deal with those sources and if so then modify the TMDL once that has been determined. Thank you.
Katz:	Just following up on what Jerry said that, you know, we find ourselves in a position where the Air Board should be taking the lead and the Air Board should be addressing – and we're sort of dealing with the consequence of that not happening much in the way, you know, we, you know, I think we are – at least I have joked on occasion that, you know, if the Waste Board had been doing their job we wouldn't have to do a Trash TMDL. You know, we find ourselves having to deal with this here because of things the Air Board is not doing that technically we're not – we don't have the authority I believe in some ways to get to the sources. So, I mean, that concerns me in that we're not getting at the source. I think the reopeners one way to do it and I agree that we can't necessarily neglect the fact that it's on the ground and has to be dealt with or it's running off. You know, I just worry about being consistent as, you know, we go after – we look at, you know, impaired water and we don't hold the purveyor of the water if they're just a conveyance system, we don't hold them liable for what they take in that's bad and they just pass out that they don't do anything to. And to some extent I see, you know, the individual whose roof, or lawn, or whatever it is, you know, receiving this material involuntarily is also put in that same position. So I've got serious concerns of how we're addressing – I think the reopener is a good way to start, but we also – I mean the Air Board needs to step up.
Secundy:	Perhaps I could ask Ms. Cantu' too. I know we have had conversations with both USEPA, Region 9, as well as with the Air Board. You might want to bring the Board up to date.
Cantu':	We've initiated conversations of the Staff level with the Air Board to scope out how we might begin to get our arms around this issue. We're looking towards the future where we can have a joint Board Meeting with the Water Board and the Air Board to take public testimony and hear what the experts may have to add to this issue. We're going through the process at this point

Speaker	Comments
	of scoping out what those terms might be. And that's basically where we are right now. We expect that in the beginning of next year we'll be able to schedule that meeting with the Air Board. We expect that meeting to be able to take place in January or February at the very latest. That time is needed to be able to fully understand what the deposition questions are and how we might frame those issues in a way that we can describe them for our respective Boardmembers.
Secundy:	If you would indulge me Ms. Strauss would you care to comment on this?
Ms. Strauss::	We've been working with Board 4, and with the Santa Monica Bay Estuary Project on the ongoing studies. I find it interesting even with an EPA where the agency – there's no split of agencies. Our division is just upstairs from where we are and water division. How difficult it is to simply take the vast air monitoring network that has existed in this Country and the very superior one that exists in California alone. And simply be able to use that data and bring it across into the water programs. I think that there's a level of – as Celeste refers to – there's a great deal we can do between our various departments to try and understand how to reliably use those air monitoring network data on specific contaminants in specific basins and use that to inform our work. I think it's not very easy to just do, but there is an enormous amount as Chairman Lloyd knows of air data compared to water data. Thanks.
Katz:	As she said -- I think Alexis is right -- I just wondered given all that volume of air data and we keep hearing about the great Air Board model why they haven't addressed it. So, I mean I look forward to – I know we tried to do for about a year now – I think a meeting with the Air Board. And they've been reluctant to do so. Maybe they will finally come to the table now, so.
Chair:	Alright.
Mr. Frantz:	There's one more issue that I'd like to mention and bring to the Board's attention. Another concern that came up at Workshop was voiced by the Los Angeles County Sanitation Districts. They were concerned that if the monitoring program for these TMDLs were to begin immediately upon approval, that they would not have time to get their program up and ready for that. My understanding is, in fact I've seen, the Executive Officer has addressed this concern with a minor EO change to the amendments. And Mr. Bishop will explain that to you momentarily, and that would apply to also to LA River and the Ballona Amendments. Lastly, you should have received our draft response to comments on both written letters that we received and the oral testimony we received at the October 5th Workshop. That concludes my presentation unless you have any questions for me. Mr. Jonathon Bishop and the Senior Staff Melinda Becker are here to help answer any further questions and to explain the minor EO change that I've

Speaker	Comments
	just – that I mentioned earlier.
Chair:	Thank you. Hearing no questions from the Board. Mr. Bishop.
Mr. Bishop:	Good morning Madam Chair and members of the Board. For the record I'm Jonathon Bishop, the Executive Officer for the Los Angeles Regional Board. I just want to make two quick comments. First as Greg explained, you know, we've been working with your Staff to craft findings address the concerns on aerial deposition and ensuring that the Regional Board evaluate that information prior to imposing any reductions in the TMDL. And I think that those findings do that. I also wanted to comment that in addition to the work that Celeste and Alexis have been doing to bring in the air agencies. We have also had two meetings with the AQMD and the Air Resources Board Staff to – on the staff level to start looking at how we can incorporate endpoints – water quality endpoints into air permits. That information is just – that process is just starting, but as Boardmember Secundy knows that, you know, we have started that process and we're working at multi-levels now, not only at the Board level but at the Staff level. And then the second issue is we had heard at the last hearing that the LA County Department of Flood – LA County Department of Public Works had concerns about the timing of the monitoring. The way that the – that the Resolution – or the Amendment reads right now, or originally was after the EO approves it, these would immediately go into effect. Immediately is, you know, we did not mean that next day. We meant as soon as was practically possible. So to clarify that, we just made a non-substantial change to clarify that immediately would be within 6 months. And we have done that for both of those TMDLs and I have submitted those non-sensitive changes to the --
Frantz:	-- If I may correct myself, I referred to the Department of Public Works as the County Sanitation District, so I misspoke. Mr. Bishop is correct that it was the Public Works.
Mr. Bishop:	And I'd be happy to answer any other questions. Oh, yeah, excuse me, on the LA River metals there was an inadvertently the City of Bellflower was listed, they are not – they don't have any discharge to the LA River, they were removed. And that's non-substantive. There was just a inadvertent.
Chair:	Thank you. Ms. Strauss is listed as needed.
Ms. Strauss:	[inaudible.]
Chair:	Alright. And I – Ms. James and Mr. Jones I believe you've covered your comments already? Alright. Then we're on to Mr. Hoye from Universal Studios.

Speaker	Comments
Ms. Hoye:	Good morning Madam Chair and Members of the Board. I'm Maria Hoye of Latham & Watkins. Is that better? Better? Okay. I'm Maria Hoye of Latham & Watkins representing Universal Studios, LLC. I wish to comment on the Revised Resolution on Item 7. These comments supplement the comments on the Proposed TMDL submitted previously by Universal on May 12th, June 2nd, September 29th, and October 5th. Let me start by saying that it is still our view that the underlying evidence does not support the proposed TMDL and thus it should be returned to the Regional Board for further consideration. The TMDL is not supported by adequate scientific data. Peer reviewers and commentators have noted serious flaws with the modeling used to support the TMDL, which flaws have not been corrected. The TMDL does not adequately consider economic impacts as required by California law. And the available technology may not adequately achieve compliance. Numerous comments have specifically been raised about air deposition, even discussed by the Board today. At this point the Board cannot account for the source of the majority of the metals deposited into the Basin. And new studies indicate that the air deposition may be greater than previously thought. Based on this record, the port cannot determine if the TMDL will accomplish its objectives, whether dischargers will be able to comply with this TMDL, or the cost of attempted compliance. Thus, the Board cannot provide reasonable assurances that the TMDL will reduce metals loading in the river to the desired standards as required. From the recent revisions to its resolution and the discussion today, it appears that this Board recognizes the weaknesses in the TMDL. We appreciate your efforts to encourage further studies and your statement of intent to reassess the TMDL, but that merely acknowledges the problem and doesn't correct it. With the revisions, the Board seems to be saying that the waste load allocations can be revised before they take effect so its okay to move forward with unsupported allocations now. First of all, I have to say, I don't know that I really understand the statement in paragraph A that the TMDL does not require specific pollutant reductions in the first 6 years at least for all affected dischargers and further if the Board's solution for addressing the deficiencies with the TMDL is to plan to reassess it in the future, the Board should require reassessment of the TMDL by including it in its resolution as a sunset provision. At that time, the further studies can considered when the TMDL readopted or changed based hopefully on better science. Notwithstanding this suggestion for a sunset provision to the revised resolution, we continue to believe that the correction is to return the TMDL to the Board. If the rule is faulty, it is faulty, and it shouldn't be passed until the further studies are completed and can be considered. The Board should not be pressured into passing a faulty rule based on a deadline and a consent decree. The Board has other avenues that it can take to deal with the

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	consent decree. This Board has limited to review an extraordinarily complicated rule with voluminous record and we believe the Board would not be voting on the rule today were it not for the consent decree deadline. The correct action is to postpone adoption of the TMDL. But, if the Board approves the amendment, we urge you to include a sunset provision in the resolution that will force the further studies and reassessments that have been discussed here today. Thank you.
Chair:	Ms. Lisa Carlson from the City of Los Angeles.
Lisa Carlson:	Madam Chair, member of the Board, members of the Board, I'm Lisa Carlson. I'm representing the City of Los Angeles. I have two brief statements. One is to correct my card and say that the City of Los Angeles supports this TMDL. And the other one is to just comment on the recent revision to the resolution and state that it appears that with this, that there -- it would modify the schedule for implementation plans. And that's all I'd like to say. Thank you.
Chair:	Thank you. Mr. Rodney Anderson from the City of Burbank Public Works. Welcome back Mr. Anderson.
Rodney Anderson:	Thank you. Good morning and again, my name is Rodney Anderson and I'm representing the City of Burbank Public Works and I just want to make two comments and these will be very familiar because I talked about them just a couple of weeks ago. And the first one and the most important one for the City of Burbank Public Works is the implementation schedule. Specifically as it relates to the POTWs. We -- the TMDL lists out the schedule for POTWs that in 4 years we need to say whether advanced treatment is needed. The Regional Board then has one year to decide if indeed additional 5 years can be given. So at year 5 the decision is made whether we have 5 additional years. What that puts us in a position of is we are in the midst of studies that I mentioned before to see whether the water body really needs these low levels of copper in particular. We're doing a copper water effects-ratio study. So we will submit that at year 4 and then we will see whether an additional 5 years will be given, the way the TMDL's written, it will be considered. If it's not given at that point, we'd be put in immediate non-compliance and we would be facing criminal and civil liability for not meeting our discharge permit. If it is given, we have 5 years to build reverse osmosis. I'm sure you're aware that it would take a much longer time than 5 years to build that. So my alternative then is I can try and build it now and have it done in 5 years because I may not get the additional 5 years or I can wait and hope that it gets extended and then try and build it in 5 years. What we're requesting is that from the reopen date,

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	it should say that an additional 10 years is given to much more reasonable amount of time to build that kind of facility. My second comment and sure you're expecting it is regarding cadmium and that is an issue that was addressed but I believe there were some confusion last time I want to clear up. I had stated that there were extremely few exceedances for cadmium even as stated in the TMDL in fact the numbers were four exceedances out of 244 samples. Surely, it should be delisted. The question was raised would at wet weather, wet weather there's a problem. It's not dry weather. The TMDL itself says there's 3 out of 42 exceedances. 3 out of 42 meets the delisting standards. That's just what weather. In fact, the proposed delistings delist cadmium, both for Burbank Channel and LA River Reach 1 -- the only two reaches. So, --
Chair:	Mr. Anderson, Mr. Bishop, I believe, has already addressed this issue in terms of the delisting, the reopening.
Anderson:	I think it was addressed by saying it's really wet weather problem, so I want to address is wet weather is a problem? I think the comment was –
Secundy:	I think you're misquoting him. Mr. Bishop, would you clear this up very quickly?
Bishop:	Right now, there's a proposed delisting for cadmium in both Reach 1 for wet weather and for dry weather. If those are upheld and those are delisted, the TMDL, we will reevaluate the TMDL. We can't do it now 'cause it's a proposed listing.
Secundy:	In other words, he hears you loud clear, but there's nothing you can do right now. This is a proposal you're looking at. It's not final.
Anderson:	Can it be stricken? Because the data inside the current TMDL says it's not a problem, it can be written out of the TMDL.
Secundy:	TMDL can be modified to eliminate it once the 303(d) listing has become permanent and that is the recommendation of Region 4, but I don't think they can change it at this point.
Anderson:	And so, monitoring will continue until that is done?
Chair:	We do have some workshops in December regarding the 303(d) listing, so you're encouraged to attend those meeting and provide comments.
Anderson:	Certainly. And again, my biggest comment's on the implementation schedule for POTWs. This cadmium one I think is clear but it's not gonna be an issue of course, 'cause it's not a problem, but the implementation

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	schedule for POTWs is critical.
Chair:	Thank you very much. Right? Okay, Eileen Ilan Farfsing from the City of Signal Hill. My apologies. Ken Farfsing. Look.
Ken Farfsing:	I will confess to bad handwriting. Thank you Madam Chair, members of the Board. My name is Ken Farfsing.
Chair:	There's a huge gap between the slash and the K.
Farfsing:	Thank you Madam Chair. My name is Ken Farfsing. I'm the City Manager of the City of Signal Hill. We have a joint presentation today and we're gonna make it go quick. So – (setting up presentation.) Thank you. Okay. First, now we do want to say that we appreciate your thoughtful questions and comments during the last workshop and especially your working with the atmospheric deposition issue. We're very pleased that you're attempting to address that. Again, being true to our organization, we request that this TMDL be remanded back to the Regional Board with direction for the Board to complete the scientific studies and modifications to the Implementation Plan. Now, it skipped the first. There we go. Now, if the State Board feels compelled at this time to adopt the TMDLs because of the Consent Decree, the Board should really be adopting technical TMDLs without a Basin Plan Amendment. Oh no. There we go. Now, we have some recommendations for the resolution. First, the State Board's resolution should not approve the Regional Board's Basin Plan Amendment, but rather establish load allocations for the listed pollutant segment combinations. The resolution should contain a provision specifying that the TMDLs are not to be incorporated into or enforced through the NPDES Permits pending the completion of the Basin Plan Amendment. Now, in terms of Clause 8 which is a new clause or revised clause that's been substituted in the resolution, first we would like to see a sentence that would clarify that local agencies would not be required to achieve the dry and wet weather load allocations including the interim allocations until 6 years after completion of the special studies and modification of the implementation schedule. If you look at page 20 of the TMDL implementation schedule, it talks about what's the discharges are required in year 6. It says 6 years after effective date of the TMDL, each jurisdictional group shall demonstrate that 50% of the group's total drainage area served by the storm drain system is effectively meeting the dry weather waste load allocations, and 25% of the group's total drainage

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	area served by the storm drain system is effectively meeting the wet weather waste load allocations. We're concerned that we're gonna finish the study say in year 5 and we're gonna have a year to implement. So that's a concern that we have with how the resolution is worded. We also, again the second point indicates that agencies would not be required to implement BMPs during the 6 year study period. And then third one require that special studies include not only the atmospheric deposition but consideration of the wet weather design storm, review of the wet weather model and review of the metals leaving open spaces and the Angeles National Forest. We see some advantages to adopting a technical TMDL. Since the adoption of a technical TMDL is not a basin plan amendment, the State Board could refer to it immediately to EPA. It would not have to go to the Office of Administrative Law. We feel it's very similar to what happened with the trash TMDL. As that essentially was a technical TMDL adopted by EPA. And we believe adoption of this technical TMDL would then provide the time for the Basin Plan Amendment to be completed while complying with the spirit and intent of the Consent Decree. Let me now introduce Susan Paulson.
Katz:	Let me just ask one question because I've had two of our senior lawyers both shaking their heads in disagreement because what you threw out is significant but in terms of bypassing OAL and just going right to EPA so Michael, Andy, somebody -- you're both shaking your heads. So slightly flip and tell us why.
Michael Levy	Michael Levy, Senior Staff Counsel. The trash TMDL was a basin plan amendment, it was a TMDL and we have long taken the position that TMDLs in California do require implementation plans with them. The only technical TMDLs are promulgated by USEPA, but they're only technical in nature until it comes around to permitting. Because once we get the permits, there's an available waste load allocation we have to implement that into the permit anyway and so they won't get what they want by getting their technical TMDL. What they'll get is a strict limit with no compliance schedule to meet it.
Andy Sawyer	What there are in my opinion 3 ways for this Board to adopt a TMDL. One is approval of the Regional Board prepared Basin Plan Amendment as you have before you today. One is for the State Board to initiate its own water quality control plan adoption under Water Code Section 13170 which would take quite a while to do and would again, require OAL review in the same nature as the Basin Plan Amendment you have before you today. The third, which in my opinion you could do, is to adopt administrative

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	regulations for codification in the California Code of Regulations would have also require OAL approval.
Michael Levy:	I concur with everything Andy said. There are some additional ways they involve single permitting actions or certification but all of those have implementation plans associated with them.
Male:	Alright. Thanks. Hi Ken, good luck with the rest of the presentation.
Farfsing:	Thank you.
Susan Paulson:	Hi my name is Susan Paulson. Thank you for the opportunity to be here. Let me just -- before I go into what I plan to say, excuse me, respectfully suggest to the Board that I think there may be an alternative to adopting TMDLs and load allocations for listings that are erroneous, because I believe that is what the Los Angeles Board did in the Ballona Creek Toxics TMDL that you just adopted as the previous item. In that TMDL, there was detailed section in the Staff Report where they assessed the existing listings, the current listings, and concluded that many of those were erroneous and chose not to develop waste load allocations and TMDL implementation measures for those listings that were inaccurate or you know, faulty in some way. So, I respectfully suggest that there may be an alternative to adopting, for example, the load allocations and implementation measures for cadmium that were just mentioned. Moving to this, I was asked to prepare some information in response to some of the issues that were raised at the workshop a couple of weeks ago and I'd like to just go through very briefly a couple of things. One is just to put in context some of these other sources of metals that may be important from atmospheric deposition and other sources. And then to provide a little bit more detail on our review of the wet weather modeling. None of the information that I'm gonna present here I believe is new. I think it's all been in the record before. I'm just presenting in a slightly different format. First, this is very difficult to see. Let me go through one row in this table if I may. The TMDL concentration based wet weather load allocation or concentration allocation, excuse me, for copper is 17. So that's the number we need to compare to. Measured data from the LA County Department of Public Work show that the annual average LA River Concentration over a roughly 10 year period has been 39. That annual average concentration has ranged up to 100. The instantaneous maximum concentration of copper that was observed in roughly the same time period, a slightly shorter time period, was 805, as compared against the TMDL concentration based allocation of 17. The concentration at Wardlow in the first wet weather conditions after a severe wild fire, the fires of October '03 for copper were 295. And the concentrations in runoff from a 98% open space watershed,

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	this is Sawpit Creek adjacent to the City of Monrovia have been measured at 23. So the concentrations of copper and runoff from open space are in exceedance of the wet weather allocation. So that's just to put this in the context. We also did some estimates that you'll find in the previous testimony, or written submittal that show that the runoff concentration from native soils can be significant for copper up to 1½ micrograms per liter, perhaps more if you make less conservative assumptions could be due to copper from native soils. And we note that the 90% concentration of copper in tap water for the City of LA is 774. So any irrigation overflow of car wash water, etc. that runs into -- that makes a little bit easier -- again, I'm just going over that first row in here. If the 90% tap water concentration of the City of LA is more than -- almost 2 orders of magnitude higher than the TMDL allocation. So, again the purpose of this is just to put some of the TMDL numbers into context and the situation that we're dealing into context as well. We also did a similar table for loads. Again, let's -- the numbers are there for lead and zinc. You can take a look at them. But let's just, I'd like to just to focus on the copper numbers. The TMDL allowable load can be calculated by the concentration target for the TMDL times the runoff volume. We find that the annual average over a 8 or 9 year period is just under 2,000 kilograms per year. The allowable TMDL load over that same time period would range up to about 6,200 or 6,300 kilograms per year. The annual average wet weather load measured by the County is 6,100, but has in recent years ranged up to almost 37,000 kilograms per year. We further know that we can estimate from the known soil transport and the concentration of metals in native soil that copper in native soils transport 16,000 kilograms per year and we know that an estimate for the excess metals copper that was deposited to the L.A. region following again those October 2003 wildfires is only at 460 kilograms per year. So a large portion of the allowable metals loads. Again, this is just to put the numbers into context and give you a sense of what we might be dealing with. I'd also like to talk briefly about the wet weather modeling because I know there were some questions that were raised at the workshop.
Chair:	Excuse me, Doctor. Since our high technology failed, I'm resorting to looking at my wristwatch. Please wrap up.
Paulson:	Sure. Let me just say that – I understood we had 5 minutes, is that right? Okay, I believe I have about 2 minutes left. Okay, I'll be quick. Anyway, let me just say that the wet weather modeling, I believe the model itself was constructed according to sound engineering principles. But the difficulty for this region, this is a very large complex region that varies over spatial

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	and temporal time scales extensively and we don't have data to allow that calibration. Annual and monthly average model results were used to calibrate the model, but of course the time scales we're worried about are more on the order of days and hours and we simply don't have data. And the model didn't perform very well on those time scales in the vast majority of cases. Sometimes annual and monthly flows and loads were reproduced adequately, but again, not the daily. And I've just put a couple of figures in here to show. What you see on the bottom axis, the blue are the measured flow rates annual averages and the orange are the modeled flow rates and you can see that especially in wet weather events the model is significantly under-predicting the flows. Now, again, this is not concentration, this is flow volume in those channels on a daily basis. You can further see some calibration difficulties when you look at flows and concentrations predicted for a single event. Here's TSS copper and lead. The blue dots are the measured values, the orange lines are the model predicted values. And you can see we don't get very good agreement. Part of this is because the model is using potency factors, which is a term that relates the TSS to metals concentrations. They were developed for Ballona Creek and urbanized watershed. They assign a single metals concentration to a given TSS load and assume essentially that these potency factors are going to be the same in the downtown L.A. as they are in the mountains. Also, it's looking at all of this as particulate with no dissolved phase. Finally, we believe the model significantly underestimates the load for open space. If you take the numbers that are in the TMDL Staff Report and compute the model load from open space, you come up with about 5 kilograms per year of copper. If you look at SCCWRPs atmospheric deposition rates, assume that 20% of wetlands to the land, on the open space areas, runs off, which is what SCCWRPs measured, you get an annual copper load of about 1,400 kilograms. So, in conclusion, the wet weather modeling would provide a useful tool for allocating sources and loads if we had the level of detail and if we could tweak model parameters to account for differences in land use, land space, slope, etc. But it's not able to do this at this point and it's not reproducing reality very well, especially on the time scales we're really interested in for compliance. And that's it. Thank you very much.
Chair:	Thank you. Mr. Bishop, would you care to respond to any of those comments?
Bishop:	Would you like me to go through all of the speakers? I have just a couple of very quick comments.
Chair:	I think there are other speakers on this panel if you prefer to wait. We're just specifically referring to Dr. Paulson's comments.

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Bishop:	I think that the big issue that we should remember is that the TMDL is based on the CTR values times the flow in the rivers and the models are used to look at what's going on in the watershed. They're not used to calculate the waste load allocations in the TMDL and so you should keep that in mind. We understand that there are levels of detail in those models that would need to be refined if you're going to use them to evaluate your reductions in your Implementation Plan and we're working with the stakeholders to help do that. We developed this model. We've turned it over to them to help use that. We can talk about other issues.
Chair:	Alright. Thank you. Dr. Greene.
Greene:	Thank you. Again, I'm Dr. Gerry Greene. I'm speaking on behalf of the Executive Advisory Committee which represents the permittees. Sorry to start out with such a complex graph, but let's do it quickly. The X graph -- the X axis is hardness, the Y is a log of copper concentrations in various water. You'll note a green line coming up from the origin increasing. That is basically the CTR values we're dealing with today. There was an error in the calculation, in the formula in the Staff Report – that is the dash line just above it. Let's just deal with the green line. Then we move up to a pink line. That is for copper. The public health goal or maximum contaminant level goal. The red line at the highest is the copper rule at 1,300s. Please see what we're going to be dealing with. We have all these points, all these arrow lines in black of reaches along with L.A. River. Those are for those hardnesses, the standard we'll be dealing with. Those series of yellow lines up there, that's the hardness that cities provide. It's not one value. I didn't want to be misconstrued. They provide a range of hardness, but they are set at the horizontal level of the copper concentration. You can cleanly see that coming out of the tap for most of the cities in the watershed, we are an order of magnitude or more above the limits that are being proposed. That's what's going to be coming out of the cities, each house. I'm not ready to start advocating that we take copper piping out of houses. We've talked about the cost of the TMDL and especially as indicated in the Staff Report. Bottom line, Caltrans summed it up just a few moments ago. The Staff Report indicates about $1.4 billion. Their costs are about 10 times higher than that and we believe that's going to be very close to the truth. An order of magnitude higher, about $15 billion for installation, sand filters and infiltration trenches. Also, the design storm issue. I appreciate that Board staff has commented on it and will hopefully come up with some – we are working together, this is a good thing. But that greatly impacts the size of the structures that will be built and therefore the cost of the structures. And we really don't know yet what we're going to be dealing

with. Right now the TMDL basically says act of God. You have to deal with whatever size storm is coming through.

I put this in basically for Mr. Katz's understanding or review, it's from the last presentation. The last one was examples that came up from other people of how much the cost is. This is an example specific to Downey so I'm very much familiar with it. Installing this infiltration trench for this parking lot facility for MTA costs 5 times more on a per acre basis than the TMDL would have projected. We believe again the costs are going to be significantly higher. By the way, with the costs, none of this has talked about land acquisition costs and we believe in general land acquisition will be required for cities to meet this TMDL.

Finally, my conclusions. The permittees do need to do better. I think all the permittees agree with that. We all want better water quality. The permittees are begging for better BMP data. After the meeting on the 5th, I had the pleasure of going back and reading my water environment research journal on the flight home. And an article that came out of that spoke about the efficiency of inserts, which I can tell you quite candidly is being used by most of the cities in my watersheds. The efficiency – 10 to 40% in removal of suspended solids and hydrocarbons and in my opinion those are easier to remove. I've copied this. I have passed it amongst AC members, I have passed it amongst the San Gabriel River watershed members. This is the data, the kind of information we need for us to make decisions. Hopefully, they will be able to use this with developers, planning and city council when they require very costly, and they are costly, infiltration systems in comparison to central inserts. The inserts aren't doing the job.

We don't know what our compliance costs will be but we know that the permittees are terrified of having to deal with litigation. People comment about us liking litigation. We don't. We just don't like to be blocked into a situation where we have no control, where we have no ability to negotiate or find the right pocket. We don't like being a deep pocket for other people to blame.

What we need are solutions that remove the unknowns. If you would like a copy of this report, I have a few extras and I'd be glad offer it, but this was again something I submitted to help educate the Permittees because at this point we don't know what's the right answer. We're trying to find out what's the right answer.

Finally, I would respond back and I think Jerry, excuse me for being informal with another Jerry, mentioned it. What we need is not to assign blame to the cities, but we need to do a better job of source control and excuse me for paraphrasing it. Thank you.

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Chair:	Mr. Richard Watson.
Richard Watson:	Thank you, Chair Doduc, members of the Board. I'm here today representing the City of Bellflower. I'd like to focus on a couple of items and give a summation at the end. One of the areas that we talked about is a necessity of adopting TMDLs and you really do not have to approve TMDLs for unlisted water bodies. There are allocations in this TMDL for upstream reaches and tributaries that drain into the impaired reaches. And the staff and the L.A. Board, on page 2 of Table 7-13.1 which is attached, I think to your resolution, says that addressing the impairing metals throughout the Los Angeles River watershed will ensure that the metals do not contribute to an impairment elsewhere in the watershed and therefore they propose those allocations. Basically, they've told us how we have to address this and we think that's actually contrary to 13360. We think we should have the flexibility on how to address the impairments in the actual listed water bodies. This is a modification of a chart I had at the workshop, again, partially for Member Katz. But, yeah I changed it so that those three listings that are in yellow differentiate. The listings in blue were listed in '98. The three listings in yellow are from 2002. The 39 red cells are for unlisted segment pollutant combinations that the staff thinks they have to allocate for so that we can achieve, meet the TMDLs in the others, and we think that's unnecessary. One of the things, I really did appreciate Member Secundy's comment earlier or statement that we need to go after root causes. As you know, we've been advocating that. And also Member Katz's comments about the Air Board not doing its job and we fully concur with that. As Member Baggett knows, in another venue I've been really trying to get the Water Board and the Air Board to work together because you don't have some of the powers they do and the local Air Quality Management District doesn't have the powers that the Air Resources Board does about mobile sources and neither of them have the powers to address planes, trains and ships that the EPA has. So we've got to get those folks to accept their responsibility. The first clause, just to repeat for Member Katz, we had a study last time that indicated the amount of materials that come from atmospheric deposition, up to 100%. The second bullet addresses your new clause, actually a couple of them. The resolution, revision to the draft resolution, has two whereas clauses addressing atmospheric deposition fairly directly. But they don't, they're helpful but they don't really correct the deficiencies in the TMDLs, and they don't require that those deficiencies be corrected

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	before the waste load allocations take effect and we think that's a flaw with this. One of the things, I'll just remind you and I won't go into a lot of detail on this, as I showed you last time, is the source assessment in this TMDL is actually insufficient and the last bullet there talks about their assertion that by including these loadings in the storm water loadings they've accounted for them. And that's essentially also in your revised finding 5. So we think that's a real weakness in this draft before you. In conclusion, I think you've already solved the first one or Jon solved it for me. The City of Bellflower he said is being removed from that table so it won't be listed inappropriately and we appreciate that. We recommend that you can establish allocations only for listed pollutant segment combinations, not for all of those red cells that I mentioned in there. And that you can establish a schedule that specifies that the TMDLs are to be incorporated into and enforced through permits after the TMDLs have been reassessed and the implementation schedule has been modified as discussed in your new finding 8. We think you should also specify that any load allocations, including interim allocations, are to be achieved 6 years after completion of the special studies. That's another way of looking at that 6 year question because we've still got that problem of how to get there in year 6 the way it's written right now. So give us 6 years after they've reassessed it and modified the implementation schedule. And then clarify that we don't have to do the BMPs during that 6 year period and we think that you should require that specified studies, and those that were in Mr. Farfsing's presentation would be those that I would reference, but that those actually do be completed before either you or the Regional Board reassesses the TMDL. Thank you.
Chair:	Thank you.
Katz:	Jon, could I get just your response to the one chart that we just saw that had, it's one of the arguments that you've been making is that something may be delisted, but if a reach, but if one of the reaches is not, that's one reason why we still have the TMDL in place. And it seemed to me that they were listing – if you go back about 3 or 4, go back about 3 or 4 slides to the chart that had all of the little red blocks on it. Yeah, there you go. No, that was it. The one with the red blocks, yeah. There we go. Can you, now, explain to me why this doesn't address the issue you were addressing please. Or what's different here.
Jon:	I think that the issue is if you look at the reach 1, which is the bottom most reach in the river, what they're suggesting is that we do the TMDL for that reach only. Essentially that would mean that you would assign waste load allocations only to the cities that directly drain into that and discharges that

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	directly drain into that. All the upstream loads would then not be reduced and not be addressed. Essentially we'd be saying that we don't do a TMDL for the sources coming into the water, in from the watershed, just for those that are directly just into the listed reach at the bottom. I mean – your look is telling me that I'm not explaining that very well.
Male:	Let me try a different approach if I may.
Katz:	I think I understand what you're saying.
Bishop:	I'm just trying to put it in the context of what you'd said earlier when you were addressing reaches in a different water. Right, the other issue is when you start looking at, if we remove that reach 1 for cadmium on there, because let's take that for the example because that's the one that we're talking about most, that's the first column. If you remove that listing under the 303(d) list, all of the load allocations up the stream disappear because there is no need for them because there's no impairment at that first one. That all disappears.
Levy:	The federal regulations require us to assign waste load allocations to all sources whether they're discharging directly to that reach or upstream of that reach and so just because they're discharging to reach 6 doesn't mean they're not impairing reach 1, even if reach 6 isn't impaired. We still have to consider that there's discharges upstream or sources downstream and assign a waste load allocation to them.
Secundy:	Jon, would you, actually, would you go to the last slide, the conclusion slide? Jon would you kind of go through those various bullet points and give me your reaction to these conclusions?
Bishop:	Okay. Well, the first one we recognize that was correct, that's been taken care of. The second was what we were just trying to address, which is establishing load allocations for only the listed reaches means that the rest of the L.A. River all the way upstream gets no load allocations, there are no reductions required, how are you going to meet it? The third bullet is specify the TMDLs enforceable through NPDES Permits. We believe that that's true right now. What I think the – I'm trying to make sure that I read this correctly so I've got it – we are not requiring any load reductions until after the reassessment. Now, I think there is some concern that after the reduction there is requirements within a year, and how then do we address that? If what the Board is suggesting is that the reassessment is after 5 years. The first reductions under this TMDL are required after 6 years, okay? I would agree that you can't meet a reduction in one year. There would have to be some planning that goes into that to get there. Those are interim requirements that we put into pace the TMDL because you don't want to have a full reduction after 22 years, you know, you get to the end of

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	22 and you've just gotten there. So, I think there is some concern there that they've raised and if you want to jump up but, then I'll jump into the next one.
Becker:	Just to qualify that concern.
Secundy:	Please identify yourself.
Becker:	Belinda Becker, Chief of the Regional Program Section of the Los Angeles Regional Water Quality Control Board. We have far fewer exceedences during dry weather so that 50% of the drainage area meeting the dry weather waste load allocations is not as onerous as it may seem. There probably are already areas, you know 50% of the area that's already meeting those dry weather waste load allocations. I just wanted to put that in perspective.
Bishop:	The fourth item is essentially rearranging the schedule, that recommendation and conclusion would be essentially adding, changing, the way I read it would be, changing the 6 years after effective date to 12 years after the effective date, because they're saying 6 years after the effective have an additional 6 years after the studies before any reductions are required. And that would be, well we have 5 years of study, so that would be we would not require any reductions for 11 years. I think that's a long time before we have any changes in our water quality and that's why we didn't support that. The idea that we're not going to require any -- this would be required that we -- the change in No. 5, "Clarify that local agencies are not required to implement BMPs during the 6 years study of the TMDL," well essentially that would say that this, if we went ahead and did that that this TMDL would undermine our storm water program. Saying that we don't have to meet water quality standards, which is what this TMDL requires is meeting water quality standards but this TMDL would say that you don't have to do that, at least for the next 6 years. All of our dischargers are required if they're exceeding water quality standards under their storm water permit to implement iterative BMPs to try and address that problem. The TMDL just puts a codified time frame on that but they're required to do that anyway. And, the requirement that special studies be completed before the TMDLs are reassessed, that's what we plan to do and expect to do. Some of these studies, we need to be working with the dischargers and if they don't step forward and work with us, they're not going to happen. So they're not, we're not going to tie our own hands to say that we can't move forward unless these joint studies are done, if they're not done.
Secundy:	Jon, just one last question. When will the new 303(d) list be finalized?
Bishop:	When you adopt it and EPA approves it and if the past measure is correct,

Speaker	Comments
	you can jump in, it takes a little while.
Levy:	Probably about March, you're going to have hearings in December 1st and 6th.
Secundy:	Yeah, I'm leading that hearing, I know that, I didn't, so it's March.
Levy:	And by the way, just so you know, on page 18 of the TMDL, it says "5 years after the effective date of the TMDL the Regional Board shall reconsider the TMDL to reevaluate the waste load allocations and implementation schedule." So the studies come back in 5 years and they see something they can take a look at it, it's built right in here to do it before the 6 years are up.
Watson:	May I clarify that the point did not mean "all BMPs" in bullet 5. I should have said Special BMPs related to this TMDL.
Chair:	Alright, finally our last speaker, Mr. Arita, Steve, from WSPA.
Steven Arita:	Thank you, Madam Chair. For the record my name is Steven Arita with the Western States Petroleum Association. As you know we have been very involved throughout the development of this TMDL and certainly while we appreciate Mr. Bishop and his staff's efforts to try to address our concerns, we unfortunately still have a concern that the TMDL assigns numeric effluent limits in the form of CTRs as end of pipe limits for storm water discharges, and I just have to say that we are concerned with this because, as you know, given the fact that the State Board has just initiated a panel of experts on storm water and they just had met back on September 14 to determine the question whether it is feasible to assign numeric effluent limits for storm water discharges. In addition to addressing the feasibility question, the panel of experts has also been asked to address how compliance determination issues will be addressed for storm water discharges. And we also know that the L.A. Board, through their wet weather task force, has also initiated an effort to look at compliance and implementation issues for this TMDL. Now, I would just say that we strongly support both of these efforts. But as we all know, they are just getting underway and until such time that the special studies and the panel of experts' recommendations and the reports are completed, it is inappropriate to include numeric effluent limits at this time for this TMDL. Now, having said that, we understand that there is consent decree issues here that you're faced with and therefore we would recommend that the adopting resolution should be revised to acknowledge the efforts of the L.A. Board as well as the State Board's panel of experts and all their efforts that are currently underway and must be completed

Speaker	Comments
	before any limits become enforceable under these TMDLs. And in our comment letter, we had provided some suggested language which I'll read right now. And we would just suggest perhaps that this should be incorporated as an item 11 in the draft resolution. Our suggested language would be: "The State Water Board recognizes that a number of policy issues regarding storm water, including but not limited, to a state policy to address the feasibility of numeric limits for storm water and appropriate wet weather discharge criteria such as design storm, sampling methodology and compliance determinations are necessary for successful implementation of the TMDLs. The State Water Board expects that these issues will be addressed and TMDL implementation will appropriately incorporate State Water Board actions on these issues before numeric limits become enforceable." And as I had mentioned we had provided this in our suggested language in our written comments. In addition, I just have some additional comments and questions on the draft, the revised resolution. On Item No. 6 of the draft resolution, it mentions the fact that the State Board encourages local municipalities within the urban watersheds work with the South Coast AQMD as well as the Air Resources Board. Certainly, we support and agree with that. We would just suggest perhaps that you should include additional language or some clarification that there should be some type of stakeholder process involved in that. Certainly, we're looking at – we're going to looking at all of the sources that could be contributing to aerial deposition, so certainly you should open it up to a stakeholder type process rather than just being focused on certain individuals. And on No. 8, again maybe just a clarification. It talks about, let's see here, it does mention special studies and it wasn't clear whether you're talking about special studies that relates to aerial dep or is it the special studies that are all going to be done by the L.A. Board through their wet weather task force and specific to this TMDL. So what we just suggest on No. 8 is some clarification that it's not just the aerial dep that you're looking at, but also all of the other special studies that should be incorporated and completed before you move forward with the TMDL. And kind of our draft language kind of also addresses that, so maybe it's not an issue. The only other question I had, and maybe I just don't understand, I've looked at some of the other resolutions, but I noticed that Ballona Creek was stricken and I just wasn't sure why that was the case. Unless I'm mistaken, I thought they were pretty much the same.
Greg Frantz:	Excuse me. Greg Frantz again. We took Ballona Creek out of the wording for the L.A. River and the L.A. River out of the Ballona Creek language.
Secundy:	Well, when we originally drafted this language it was to apply to both and

Speaker	Comments
	regretfully it got incorporated into each one and Mr. Frantz is correct. You'll find if you look at No. 8 that you'll find its . . .
Arita:	Under the resolution for Ballona. Okay. And that concludes my comments. Again, we just urge that you would consider our suggested language for the resolution. Thank you.
Secundy:	Mr. Arita, while you were speaking Mr. Levy seems to be eager to speak. I will put it that way. And one of the things that I would ask him to do, or Mr. Sawyer, since I have been assured about 20 times that adoption of this TMDL does not mean that we are adopting numeric limits for storm water. And yet you have said that we are adopting numeric limits for storm water. Let's get a clarification on that. Mr. Levy?
Levy:	Yes. Thank you. In the first instance, in response to your question, the TMDL adopts a best management practices approach for storm water. If, however, there is inability to demonstrate that the best management practices are going to be effective, then the Regional Board is free to consider the implementation of numeric limits in storm water. Depending on what your blue ribbon panel comes up with, the Regional Board is free to go either way on that, again, to be in compliance with whatever the State recommends in that respect. But it does contemplate the use of best management practices on storm water. The language about there being certainty that they'll be effective, well we shouldn't , we're not really authorized to allow BMPs or use BMPs that we don't think are going to be effective in the first place. So really all the Regional Board is doing is requiring what should be required in any event. The two issues that I wanted to raise is we cannot unfortunately, accept Mr. Arita's suggestion.
Katz:	Before you leave the question that Mr. Secundy asked, correct me if I'm wrong, but I seem to remember that we had targets but that if the targets weren't met by BMPs, then the numeric limits were in place.
Levy:	Well, what it is, is they get --
Katz:	Which is fine with me by the way. All these guys think I'm making their point. It's fine with me.
Levy:	They're assigned a waste load allocation and they're free to come up with any means of meeting that waste load allocation they choose to including the use of BMPs and the ordinary iterative approach provided they demonstrate that the BMPs are likely to attain the waste load allocation.

Speaker	Comments
Katz:	So essentially, what you call a numeric limit or a performance standard, you know, how you get there is up to you but it's essentially the waste load allocation.
Levy:	Well, the distinction is that if a discharger or permittee establishes the BMPs are going to be effective to the satisfaction of the Regional Board, when the Regional Board adopts the permit there will not be a numeric requirement to meet the waste load allocation in the permit, only a requirement to implement the BMPs.
Katz:	But if it's not proven to be effective?
Levy:	Then the Regional Board is free to use numerical effluent limitations in the permit.
Katz:	So it's sort of, to an extent, it's the discharger's choice in that sense?
Levy:	Correct.
Katz:	Okay. Thanks.
Levy:	Okay. The other two issues were the requests that you add language saying that no waste load allocation changes will be put into the permit until the storm water blue ribbon panel has completed its work. Unfortunately, with the Basin Plan Amendment under 13246 of the California Water Code, all your authority is here to do is either approve or remand. You can't add language into a resolution that would actually change the terms of the Basin Plan Amendment. The second point is though, with the 5-year period, where the Regional Board in the Basin Plan Amendment has committed to reevaluating the TMDL and the waste load allocations, if they don't take action on that based upon or contemplating the results of the blue ribbon panel or anything else that you deem appropriate, you can take the matter up on your own motion and address it at that time and that's under 13320.
Secundy	Mr. Arita, and for the benefit of other members of the audience, also we did put in a sentence at the end clause 8 that says "The State Water Board intends to reassess the TMDL on its own motion if the L.A. Water Board does not do so on a timely basis." We intend to keep a very active hand in this. And Mr. Arita, in terms of putting in other stakeholders without amending language at this late date, I can assure you that we fully intend to have other stakeholders participate with the AQMD, with the ARB, with USEPA, and with anyone else. We will certainly welcome that is what it amounts to. We were simply trying to get those two agencies together as

Speaker	Comments
	quickly as possible.
Arita:	Okay. Thank you.
Chair:	Thank you. Actually, we do have another speaker. Our final speaker on this item is Ms. Sharon Green from the Sanitation District of L.A. County. And yes. That's it.
Secundy:	We're wearing out and we've got four more -- three more TMDLs to go. So no more cards.
Sharon Green:	I understand, and I apologize if there was confusion about my card. I did submit it when I arrived at 10 this morning. So, I apologize if it got lost in the shuffle or if I may have written the wrong agenda item number. So I apologize about that. Again, I'm Sharon Green with the Sanitation District of Los Angeles County. Gee, I've been actively listening and trying to integrate what's been discussed into what I'm going to raise and without repeating, but unfortunately I may be re-opening or re-touching on certain aspects of some of the issues. I guess I have to say that in the revised resolution in the new whereas Clause No. 8, the first part -- I guess the best way I can put it is it's very confusing to me as to what your intent is. It's the new language, the TMDL implementation provisions require no specific pollutant reductions to be implemented within the first 6 years during which . . . I'm really concerned about that first part of it, not the remainder of it. As I read the TMDL, it requires one of our facilities covered by this TMDL, which is covered under the general industrial storm water permit, to meet interim waste load allocations at the end of, you know, at year 5 and that will require pollutant reductions. As I further understood it from your legal counsel, this resolution does not change the TMDL or its implementation provisions. So I'm confused. What is, you know, it sounds like you do intend to have reductions happen so maybe you don't want to say that. That's not my hope obviously. I would rather have, you know, more clarity on, you know, have the studies completed and have better information to refine the TMDL and hopefully get the load reductions coming from the true sources as Mr. Secundy mentioned at the outset of this whole discussion. That seems like, you know, and I do agree with previous speakers that have pointed out that it seems like the impetus for doing this now and approving this today is a consent decree deadline. Yes, we all want to get to water quality improvements and we --
Chair:	We want to take you on on that statement.
Secundy:	I probably speak for the entire Board when I say this, if not, I'm certainly

Speaker	Comments
	speaking for myself. I have great respect for our judicial system. But the Consent Decree is not weighing heavy on my shoulders. If indeed we elect to approve this TMDL it's because we think it's the appropriate thing to do. Period. It has nothing to do with the Consent Decree.
Ms. Green:	Okay. Well, that's good news because it has been a concern of my agency's that an artificial deadline is driving these decisions rather than letting the science drive the decision. So, I'm glad to hear those comments that you're doing it because you think it's the right thing.
Secundy:	We think it's the right thing and you also have to look at our schedule. These are not the only TMDLs. We have a myriad number of TMDLs coming down the pike and we simply have to take them one by one. This one is up right now.
Ms. Green:	I understand that. So, I guess to conclude my first comment, that I would like to see some clarification. I would love to see that statement move down under the resolved clauses and that you're actually taking an action on it and not just having it as some kind of background finding. I'm not quite sure what the impact is of it having it in a whereas clause. A second comment I'd like to make is just with respect to your whereas clause number 7, I believe I touched on or I discussed this during my testimony at the workshop. I know you're talking here about municipalities and that the Water Board will work with municipalities and the County to encourage building designs and BMPs that will retain pollutants onsite. Obviously, in our context it's a landfill. We don't really want to retain those pollutants onsite or infiltrate that water into the ground and that's a problem for us. So you just -- I guess my point is that one size doesn't fit all. One approach doesn't work for all sources and there're such a myriad of different types of land uses and sources in the watershed that I don't think a blanket statement really is sufficient to capture that. And then lastly, I guess I want to go back to the discussion that occurred a little while ago about the need for waste load allocations and TMDLs for the "unlisted reaches," the ones that were highlighted, excuse me, in red on that one slide that was discussed. And as I understand it, the TMDL targets are based on the California Toxics Rule criteria which are concentration based. I guess I just don't fathom the reasoning of an upstream reach and sources that flow into it that meet those standards, in other words are unlisted, because they're not impaired, they are attaining standards flowing downstream to a reach and that they are somehow the cause of the downstream reach being impaired. That sort of, that doesn't add up to me. So I think that there's a big disconnect there and I don't think that in all cases you are required by the regulations to do that.

Speaker	Comments
?	[Inaudible]
Ms. Green:	I'm sorry.
?	[Inaudible]
Ms. Green:	Well, because if you look at it on a concentration basis, if a flow of water that meets a concentration base standard is flowing into a down stream reach below the standard or you know at the most up to the standard, it's not making that water body go above the standard. I suppose that's the simplest way I can explain it. It's not additive unless you're doing -- if you're doing everything on a mass basis that's different, but the mass load allocations I think have been derived from the concentration base numbers. So, that's anyway, that's my premise that I don't believe it's required. It's certainly not in all cases. Perhaps in those where you have an upstream listing as well and you can make a connection to the downstream reach impairment, but I don't think that in all cases that's been done and that table sort of graphically illustrated that but obviously you need to get back into the models and the calculations to determine that. Thank you very much.
Secundy:	Let's get an answer to just one of your questions which perhaps is one of the more important ones. I guess under clause 8, the bait and switch, which is you do have to do it, not you don't have to do it, you do have to do it, no you don't.
Bishop:	And I think there is some clarification that's needed and I would make a suggestion in a second after I explain what went on. Because we were addressing with item 8 the issue related to the MS4 and the Caltrans permittees and there is a requirement for general industrial permittees to meet interim limits which are the benchmark which they're already required to meet at a 5 year basis. So I would suggest that – or they're supposed to be meeting. Excuse me, I should be precise in my language. If we added in item 8 in the middle of that first sentence so that it says "No specific pollutant reductions from the MS4 and the Caltrans stormwater permits," if we add that in it takes care of that inconsistency which we inadvertently inserted with the language in 8. We did not mean it to apply to the interim limits for the benchmarks for the industrial general permits.
Secundy	Was that the answer you wanted?
	[Audience laughter]
Ms. Green:	No, but in his usual way Jon always clarifies things and makes them more precise. No, that's not the answer I wanted but yes it is more clear and at least people reading this later will understand what it was you meant.

Speaker	Comments
Baggett:	But is that language – now I'm unclear. That was an oral clarification. Is it written to say that precisely? It sounds like it's not.
Bishop:	No, it's not. I was suggesting that we add to the resolution.
Baggett:	Ok.
Chair:	Any other final comments from staff? Board members? Hear a motion?
Baggett:	I have a comment.
?	Inaudible.
Baggett:	I have comments.
Secundy:	I will make a motion to move for the adoption of the TMDL with the proviso that Mr. Bishop has just adopted for clause no. 8 by inserting the words "from MS4s and Caltrans." And Mr. Levy I will leave it up to you to put in that exact wording.
Levy:	Okay.
Katz:	Second.
Chair:	I hear a second from Member Katz. All in favor?
Art:	I have some challenges here. As you heard me last time – no, I didn't second it. I mean I agree with Jerry that I don't feel that we're being rushed by the Consent Decree although my comments are pretty clear on that last time. I have a real challenge here. I think this is the first of the aerial deposition TMDLs. It's truly and significantly a State Board policy. It's never been fully vetted or discussed by this Board except in a rushed fashion of 3 TMDLs. We've never had this policy discussion prior. I think the public's ill served by trying to make what I consider a major policy issue that's really of cutting edge significance, not just for California but for the country. It's typical we're always out on the front edges and this truly is a front edge issue. And I was just back in DC for three days meeting with the Division of Water and couple of folks at USEPA and we're not alone in this challenge as I think Alexis knows. But I think we have an opportunity to come up with some many more creative solutions as we've done with wetlands, as we've done with I think the mercury TMDL in San Francisco which was one I think most recognized. I wasn't real excited about extending for months and with all the lengthy discussions we had, but I did and I think it was fairly convincing once we started into those long public discussions on the mercury TMDL that there was an opportunity

Speaker	Comments
	there to look at offset programs, to look at the trading concepts, to recognize that the Bay Area dischargers weren't fully responsible for all the loading coming from the abandoned mines and the whole Good Samaritan issue and I think we did after a lot of debate and discussion actually put together a program I think ultimately will be cutting edge. It will be breaking some new ground for cleaning up water bodies in this state and even in the nation ultimately in terms of trading concepts. I think we have the same opportunity here. I feel we've rushed it. We haven't had the opportunity to truly look at how do we set up an air/water concept. It's unfortunate the agency responsible for multi-media interaction and the other agencies we deal with aren't even at that table I think as Mr. Katz pointed out. They should be. We've attempted to for a number of years to get them at the table. It hasn't happened. Here, we have a real opportunity to do that. So I can't support the TMDLs today. I feel that we're rushing to judgment and missing a major opportunity to do some really creative work that will really actually fix water bodies. Instead what we're doing is just delaying the game for 5 years, reopeners, we aren't in the end it reminds me of water rights a lot. We're taking 20, 30 years to get something, by the time we're done the fish are dead. And I think we have an opportunity to really solve it and this isn't going to do it.
Chair:	I certainly appreciate Mr. Baggett's comment regarding creative solutions and I think he was alluding to the mercury TMDL in the San Francisco Bay region which we did spend a lot of time working on and which we did remand to the Regional Water Board with the direction that they look at issues that we felt were neglected in the development of the TMDL including aerial deposition, including addressing the mine drainage issue. And so the difference for me between that TMDL and this one is that TMDL proposed measures that would attain water quality [END SIDE A] [START SIDE B] or look at other options. And so we remanded the TMDL with the direction that they look at these other factors. We did not require, and we obviously asked that they work with us and our staff to develop an offset program but there was certainly a recognition that not only these measures, the mine drainage, the aerial deposition, would be completed in the 6 or nine months that we asked the TMDL to be brought back to us. With respect to this particular TMDL, I believe the Regional Water Boards has taken a very thorough as best as we could. Obviously data is not complete, obviously it's not a perfect TMDL or perfect measures but it is – it shows progress and it shows a good foundation for moving ahead. So I'm in support of the TMDL.
Katz:	I was just going to add, I mean following up on the comments I made earlier, and I understand exactly what Art's saying but I do think it's important that we move forward. I also think that when you vote for this, you're voting to put in motion numeric effluent limits and I think that's an

Speaker	Comments
	important vote for all of us. I think it's important to go down that path and I hope you'll support that and I think this gets us there, or it begins to get us there.
Secundy	I'm not sure I agree with Mr. Katz's last statement, But aside from that, because I'm not there yet and I very much want to see what our panel of scientists comes back with in terms of the feasibility of implementing numeric limits for storm water. I'm very sympathetic to what Mr. Baggett is saying and that it is not an easy TMDL to vote for and I don't mean to give the appearance that I'm somewhat cavalier in saying I support this. I have agonized somewhat over this. I think the Regional Board has done an excellent job given the resources that they do have. But I think the TMDL will fail if indeed these joint studies do not take place. I'm very much counting on the ARB and the AQMD and the USEPA to get together with the Regional Board and work on this. And I guess if to paraphrase what I'm hearing from Mr. Baggett he would like to see some of those studies done beforehand and know what evidence we have before adopting this. I'm willing to take the chance of adopting this and then going in and having these studies and looking at the evidence. We have a long period of time to do that. But I intend to get started very quickly. You heard Ms. Cantu' say that at the latest we would start these meetings in February. I really hope it's nearer to January if not December. I would like to have a very quick time frame on these. Having said that, I would vote yes on this TMDL.
Baggett:	I don't want to drag it out, but I – well, I'll oppose it for the reasons I stated and I think while there have been other ones, I talked to the Tahoe folks about their aerial deposition TMDL which is bi-state in nature and it's not been effective. You've got to deal with the cars. You've got to deal with the air pollution. You've got to deal with the tailpipes. You've got to deal with the smokestacks. And until we do that, we're just taking a lot of staff time that could be doing something else that's I think more helpful for the environment and water quality and just looking like we're doing something.
Chair:	We had a motion from Mr. Secundy to adopt the resolution with the additional language proposed by Mr. Bishop. I believe we had a second from Mr. Katz?
?	Inaudible
Chair:	Uh, I think we won't go there. Alright, all in favor. Aye.
?	Aye.
Chair:	Oppose?
Male:	I'll oppose.

Speaker	Comments
Chair:	Thank you. We're now on to item no. 8.

End of Transcript

EXHIBIT "H"

Total Maximum Daily Loads (TMDL) QUESTIONS & ANSWERS

Q: What is a TMDL?

A: A TMDL is a written plan that describes how an impaired water body will meet water quality standards, it contains:
- a measurable feature to describe attainment of the water quality standard(s)
- a description of required actions to remove the impairment
- an allocation of responsibility among dischargers to act in the form of actions or water quality conditions for which each discharger is responsible.

Section 303(d) of the federal Clean Water Act requires states to develop TMDLs for impaired waterbodies.

Q: How does a TMDL differ from other pollution management efforts?

A: A TMDL requires that loads from all pollution sources within an impaired watershed be allocated. Other efforts focus on loads from a few, identifiable sources. TMDLs also generally require that a number of programs and agencies work together to achieve the desired level of pollution control. Other efforts are often limited to a single program or entity.

Q: What is the difference between point and nonpoint sources of pollution and how does this relate to TMDLs?

A: Point sources release pollutants from discrete conveyances, such as a discharge pipe from a factory and are defined in statute. Nonpoint sources release pollutants from landscape scale features and include such features as parking lot runoff, agricultural field runoff, and dust and air pollution from human activities (considered everything that is not covered under the point source definition). TMDLs must allocate loads for both point and nonpoint sources.

Q: What is an "impaired water body" and how many are there in California?

A: Informally, an impaired water body is any water that is not meeting the water quality standards that have been established for that water. Formally, an Impaired water body is one that is not attaining water quality standards after technology based discharge limits on point sources are implemented. Section 303(d) of the federal Clean Water Act requires each state to maintain a list of impaired waterbodies and revise the list from time to time (currently in even numbered years) California has 509 water bodies listed.

Q: What are the costs of preparing a TMDL?

A: Cost vary depending on the complexity of the TMDL. Estimates range to over $1 million for a complex TMDL that includes the implementation plan.

Q: How do you know which TMDL to do first?

A: The Clean Water Act requires the states to develop rankings for TMDLs. California, ranks TMDLs as high, medium or low priority based on a number of factors including the severity of the impairments and the importance of the specific beneficial uses. Regional Boards develop schedules that set the order for TMDL completion. These schedules are contained in the Regional Boards Watershed Management Initiative work plans.

Q: What steps are involved in producing a TMDL?

A: There are five steps in producing a TMDL:

1) *Stakeholder involvement: Stakeholders are people (e.g., general public, business interests, government entities, local agencies, citizens, etc.) concerned about a particular water body. They become involved in TMDL development through local groups working with Regional Water Quality Control Board staff. Their interests range from pursuing the science to support TMDLs to figuring out how to implement new management approaches.*

2) *Water body assessment: Pollution sources and loads are determined, and their overall effect on the water body is assessed.*

3) *Develop allocations: Based on the assessment, pollutant loads are allocated for each source. A TMDL may address a single pollutant or many pollutants. The allocations must be designed so that the water body will attain the applicable water quality standards.*

4) *Develop an implementation plan: The plan describes the approach and activities required to ensure that the allocations are met.*

5) *Amend the Basin Plan: Before a TMDL is enforceable it must be incorporated into the appropriate Basin Plan by amending the Basin Plan in accordance with state law. If TMDLs are not incorporated into Basin Plans, they have no legal standing under state law and cannot be enforced by Regional Boards. A Basin Plan amendment requires approval by the appropriate Regional Board, the State Water Resources Control Board (State Board), the Office of Administrative Law, and the U.S. Environmental Protection Agency Region 9. A public hearing process is used for the Regional Board and State Board steps in the process.*

Q: If TMDLs have been required since 1972, why don't all of California's impaired waterbodies have completed and approved TMDLs?

A: The federal Clean Water Act was established in 1972. In the early stages of implementing the Act, attention was placed on getting technology based controls in place. Technology controls are equipment and facilities that produce a minimum uniform level of pollution control. A great deal of attention was placed on getting sewage treatment plants built and operating at the minimum desired levels. Only after the technology controls were largely in place did attention begin to focus on other requirements of the Act, including TMDLs. Today, California maintains an extensive program to manage sewage treatment and other point sources and has begun to address the TMDL requirements.

P/F0121(APRIL 2001)

EXHIBIT "H"

"If you have questions concerning a specific waterbody, please visit our website "swrcb.ca.gov" or telephone the Regional Water Quality Control Board for your area (please see below) and ask to speak to the TMDL coordinator."

California Regional Quality Control Boards

North Coast Region (1)
5550 Skylane Blvd., Suite A
Santa Rosa, CA 95403
(707) 576-2220

San Francisco Bay Region (2)
1515 Clay Street, Suite 1400
Oakland, CA 94612
(510) 622-2300

Central Coast Region (3)
81 Higuera Street, Suite 200
San Luis Obispo, CA 93401-5427
(805) 549-3147

Los Angeles Region (4)
320 West 4th Street, Suite 200
Los Angeles, CA 90013
(213) 576-6600

Central Valley Region (5)
3443 Routier Road, Suite A
Sacramento, CA 95827-3098
(916) 255-3000

Fresno Branch Office (5)
3614 East Ashlan Avenue
Fresno, CA 93726
(559) 445-5116

Redding Branch Office (5)
415 Knollcrest Drive, Suite 100
Redding, CA 96002
(530) 224-4845

Lahontan Region (6)
2501 Lake Tahoe Blvd.
South Lake Tahoe, CA 96150
(530) 542-5400

Victorville Branch Office (6)
15428 Civic Drive, Suite 100
Victorville, CA 92392
(760) 241-6583

Colorado River Basin Region (7)
73-720 Fred Waring Drive, Suite 100
Palm Desert, CA 92260
(760) 346-7491

Santa Ana Region (8)
3737 Main Street, Suite 500
Riverside, CA 92501-3339
(909) 782-4130

San Diego Region (9)
9771 Clairemont Mesa Blvd., Suite A
San Diego, CA 92124-1324
(858) 467-2952

EXHIBIT "I"

Drinking Water/ Ground Water
Concentrated Animal Feeding Operations
State Revolving Fund
Total Maximum Daily Load / Impaired Waters
Water Quality Standards

Total Maximum Daily Load - Definitions

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The Act. The Clean Water Act, as amended, 33 U.S.C. 1251 et seq. The TMDL program deals with Subsection 303(d) which states:
(1)(A) Each State shall identify those waters within its boundaries for which the effluent limitations required by section 301(b)(1)(A) and section 301(b)(1)(B) of this Act are not stringent enough to implement any water quality standard applicable to such waters. The State shall establish a priority ranking for such waters, taking into account the severity of the pollution and the uses to be made of such waters.
(B) Each State shall identify those waters or parts thereof within its boundaries for which controls on thermal discharges under section 301 of this Act are not stringent enough to assure protection and propagation of a balanced indigenous population of shellfish, fish, and wildlife.
(C) Each State shall establish for the waters identified in paragraph (1)(A) of this subsection, and in accordance with the priority ranking, the total maximum daily load, for those pollutants which the Administrator identifies under section 304(a)(2) of this Act as suitable for such calculation. Such load shall be established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality.
(D) Each State shall estimate for the waters identified in paragraph (1)(D) of this subsection the total maximum daily thermal load required to assure protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife. Such estimates shall take into account the normal water temperatures, flow rates, seasonal variations, existing sources of heat input, and the dissipative capacity of the identified waters or parts thereof. Such estimates shall include a calculation of the maximum heat input that can be made into each such part and shall include a margin of safety which takes into account any lack of knowledge concerning the development of thermal water quality criteria for such protection and propagation in the identified waters or parts thereof.
(2) Each State shall submit to the Administrator from time to time, with the first such submission not later than one hundred and eighty days after the date of publication of the first identification of pollutants under section 304(a)(2)(D) of this Act, for his approval the waters identified and the loads established under paragraphs (1)(A), (1)(B), (1)(C), and (1)(D) of this subsection. The Administrator shall either approve or disapprove such identification and load not later than thirty days after the date of submission. If the Administrator approves such identification and load, such State shall incorporate them into its current plan under subsection (e) of this section. If the Administrator disapproves such identification and load, he shall not later than thirty days after the date of such disapproval identify such waters in such State and establish such loads for such waters as he determines necessary to implement the water quality standards applicable to such waters and upon such identification and establishment the State shall incorporate them into its current plan under subsection (e) of this section.
(3) For the specific purpose of developing information, each State shall identify all waters within its boundaries which it has not identified under paragraph (1)(A) and (1)(B) of this subsection and estimate for such waters the total maximum daily load with seasonal variations and margins of safety, for those pollutants which the

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Administrator identifies under section 304(a)(2) of this Act as suitable for such calculation and for thermal discharges, at a level that would assure protection and propagation of a balanced indigenous population of fish, shellfish, and wildlife.

Areawide agency. An agency designated under section 208 of the Act, which has responsibilities for Water Quality Management(WQM) planning within a specified area of a State.

Best Management Practice (BMP). Methods, measures or practices selected by an agency to meet its nonpoint source control needs. BMPs include but are not limited to structural and nonstructural controls and operation and maintenance procedures. BMPs can be applied before, during and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters.

Designated management agency (DMA). An agency identified by a WQM plan and designated by the Governor to implement specific control recommendations.

Indian Tribe. Any Indian Tribe, band, group, or community recognized by the Secretary of the Interior and exercising governmental authority over a Federal Indian reservation.

Load allocation (LA). The portion of a receiving water's loading capacity that is attributed either to one of its existing or future nonpoint sources of pollution or to natural background sources. Load allocations are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. Wherever possible, natural and nonpoint source loads should be distinguished.

Loading capacity. The greatest amount of loading that a water can receive without violating water quality standards.

Load or loading. An amount of matter or thermal energy that is introduced into a receiving water; to introduce matter or thermal energy into a receiving water. Loading of pollutants may be either man-caused or natural (natural background loading).

Pollution. The man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water.

Total maximum daily load (TMDL). The sum of the individual Wasteload Allocations(WLAs) for point sources and LAs for nonpoint sources and natural background. If a receiving water has only one point source discharger, the TMDL is the sum of that point source WLA plus the LAs for any nonpoint sources of pollution and natural background sources, tributaries, or adjacent segments. TMDLs can be expressed in terms or either mass per time, toxicity, or other appropriate measure. Best Management Practices or other nonpoint source pollution controls make more stringent load allocations practicable, then wasteload allocations can be made less stringent. Thus, the TMDL process provides for nonpoint source control tradeoffs.

Wasteload allocation (WLA). The portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality-based effluent limitation.

Water quality limited segment (WQLS). Any segment where it is known that water quality does not meet applicable water quality standards, and/or is not expected to meet applicable water quality standards, even after the application of the technology-based effluent limitations required by sections 301(b) and 306 of the

Act.

Water quality management (WQM) plan. A State or areawide waste treatment management plan developed and updated in accordance with the provisions of sections 205(j), 208 and 303 of the Act and this regulation.

Water Quality Standards (WQS). Provisions of State or Federal law which consist of a designated use or uses for the waters of the United States and water quality criteria for such waters based upon such uses. Water quality standards are to protect the public health or welfare, enhance the quality of water and serve the purposes of the Act.

The following definitions are from the Federal Water Pollution Control Act, Section 502.

Discharge of a pollutant. (A) Any addition of any pollutant to navigable waters from any point source. (B) Any addition of any pollutant to the waters of the contiguous zone or the ocean from any point source other than a vessel or other floating craft.

Effluent limitation. Any restriction established by a state or the administrator on quantities, rates, and concentrations of chemical, physical, biological, and other constituents which are discharged from point sources into navigable waters of the contiguous zone or the ocean including schedules of compliance.

Navigable waters. Waters of the United States, including territorial seas.

Point source. Any discernible confined and discrete conveyance including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft from which pollutants are or may be discharged, not including agricultural storm water discharges and return flows from irrigated agriculture.

Pollutant. Dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, celler dirt and industrial, municipal, and agricultural waste discharged into water.

Other Definitions

Allocation. A portion that has been designated for a specific purpose or to particular person or things.

FWPCA. The legal acronym for the Federal Water Pollution Control Act originally enacted in 1948 and amended on October 18, 1972, becoming known as the Clean Water Act.

Impaired waterbody. Any waterbody of the United States that does not attain water quality standards (as defined in 40 CFR part 131) due to an individual pollutant, multiple pollutants, pollution, or an unknown cause of impairment. Where a waterbody receives a thermal discharge from one or more point sources, impaired means that the waterbody does not have or maintain a balanced indigenous population of shellfish, fish, and wildlife.

List of Impaired Waterbodies or "List". The list of impaired waterbodies that States, Territories and authorized Tribes are required to submit to EPA pursuant to section 303(d) of the CWA. To view the State's 303(d) list visit the following links: Iowa, Kansas, Missouri, and Nebraska. EXIT Disclaimer

Non-point source. Any source from which pollution is discharged which is not identified as a point source, including, but not limited to urban, agricultural, or silvicultural runoff. Nonpoint source (NPS) pollution occurs when rainfall, snowmelt, or irrigation water runs over land, or through the ground, and picks up pollutants and deposits them into lakes, rivers and groundwater. Nonpoint pollutants and sources that threaten or impair designated uses in waterbodies include:

- Excess fertilizers (nutrients), herbicides, and insecticides from agricultural and residential and urban areas.

- Sediment (siltation, suspended solids), pesticides, pathogens (animal waste), from agricultural, and residential and urban areas.

- Oil, grease, and toxic chemicals from urban runoff and energy production;

- Sediment from improperly managed construction sites, crop and forest lands, and eroding streambanks;

- Bacteria and nutrients from livestock operations, pet wastes, and faulty septic systems.

- Atmospheric deposition, hydromodification, and habitat alteration are also sources of NPS pollution.

Reasonable assurance. Reasonable assurance means that you demonstrate that each wasteload allocation and load allocation in a TMDL will be implemented. For point sources regulated under section 402 of the Clean Water Act you must demonstrate reasonable assurance by procedures that ensure that enforceable National Pollutant Discharge Elimination System(NPDES) permits (including coverage to individual sources under a general NPDES permit) will be issued expeditiously to implement applicable wasteload allocations for point sources. For nonpoint sources you must demonstrate reasonable assurance by specific procedures and mechanisms that ensure load allocations for nonpoint sources will be implemented for that waterbody. Specific procedures and mechanisms for nonpoint sources must apply to the pollutant for which the TMDL is being established, must be implemented expeditiously and must be supported by adequate funding. Examples of specific procedures and mechanisms which may provide reasonable assurance for nonpoint sources include State, Territorial, and authorized Tribal regulations, local ordinances, performance bonds, contracts, cost-share agreements, memorandums of understanding, site-specific or watershed-specific voluntary actions, and compliance audits of best management practices.

Source. Any point of origin or beginning.

Threatened waterbody. Any waterbody of the United States that currently attains water quality standards, but for which existing and readily available data and information on adverse declining trends indicate that water quality standards will likely be exceeded by the time the next list of impaired or threatened waterbodies is required to be submitted to EPA. Where a waterbody is threatened by a thermal discharge, threatened means that the waterbody has a balanced indigenous population of shellfish, fish, and wildlife, but adverse declining trends indicate that a balanced indigenous population of shellfish, fish, and wildlife will not be maintained by the time the next list of impaired or threatened waterbodies is required to be

submitted to EPA.

Thermal discharge. The discharge of the pollutant heat from a point source.

Waterbody. A geographically defined portion of navigable waters, waters of the contiguous zone, and ocean waters under the jurisdiction of the United States, including segments of rivers, streams, lakes, wetlands, coastal waters and ocean waters.

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EXHIBIT "J"

tdc
environmental

Copper Sources in Urban Runoff and Shoreline Activities

Information Update

Prepared for the Clean Estuary Partnership

November 2004

EXHIBIT "J"

PREFACE

This is a report of research performed by TDC Environmental, LLC for the Clean Estuary Partnership. Views or information expressed in this report may not necessarily reflect those of the funding agencies. Because of the uncertainties inherent in research work, TDC Environmental, LLC does not make any warranty, expressed or implied, nor assume any legal liability or responsibility for any third party's use of the results or the consequences of use of any information, product, or process described in this report. Mention of trade names or commercial products, organizations, or suppliers does not constitute endorsement or recommendation for use.

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Much of the scientific literature used in this report is from the Brake Pad Partnership Technical Reference Library, a special collection in the U.S. EPA Region 9 library. Funding for development of this literature collection was provided by the U.S. Environmental Protection Agency, the San Francisco Estuary Project, and the Bay Area Stormwater Management Agencies Association.

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COPPER SOURCES IN URBAN RUNOFF AND SHORELINE ACTIVITIES

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COPPER SOURCES IN URBAN RUNOFF AND SHORELINE ACTIVITIES

EXECUTIVE SUMMARY

The purpose of this report is to summarize information on the sources of copper that is carried to San Francisco Bay in urban runoff and copper that is released directly into the Bay from shoreline activities. This report:

- Provides estimates of the amount of copper released to San Francisco Bay from each source;
- Estimates the relative degree of uncertainty in each copper release estimate and lists the sources of uncertainty for each estimate;
- Reviews available control measures for each copper source, providing control measure effectiveness information to the extent data are available;
- Identifies feasible control measures for copper sources in urban runoff and shoreline activities; and
- Identifies priorities for investigation of sources and control measures.

This report was prepared for the Clean Estuary Partnership to support Technical Task 4.11, Basin Planning Assistance for Cu/Ni North of the Dumbarton Bridge.

Tables S-1 and S-2 (on the next page) summarize urban runoff and shoreline activity copper source load estimates and the uncertainties in these estimates. Although the total of the urban runoff estimates (45,000 – 47,000 pounds per year) is somewhat less than the total estimated copper discharge in urban runoff (90,000 pounds per year), the report concludes that it is unlikely that a major copper source has not have been identified. Given the long history of investigation of copper sources in the Bay area, it is more likely that one or more of the copper load estimates understates actual copper releases.

Table S-3 (on page 3) summarizes the feasible control measures and priorities for investigation for each identified copper source.

Table S-1. Summary of Copper Sources in Urban Runoff (Pounds of Copper per Year Discharged to San Francisco Bay)

Copper Source	Load Estimate	Uncertainty[a]
Vehicle brake pads	>10,000	High
Estimate includes:		
Original equipment pads	*10,000*	
Replacement brake pads	*?*	
Brake pads on heavy-duty trucks, off-road vehicles, rail cars, and motorcycles	*?*	
Architectural copper	4,500	Moderate-High
Copper pesticides	<8,000 – <10,000	High
Estimate includes:		
Landscaping	*1,200 to 2,500*	
Wood preservatives	*1,400 to 2,800*	
Pool, spa, and fountain algaecides	*<5,000*	
Industrial copper use	3,300	Moderate
Deposition of copper air emissions	8,800[b]	Low to Moderate
Estimate includes:		
Diesel and gasoline fuel combustion	*3 – 60*	
Industrial facilities	*130*	
Residential wood burning and forest fires	*110*	
Unknown	*>8,000*	
Soil erosion	7,000	Moderate
Estimate includes:		
Construction	*2,600*	
Hydromodification	*<5,000*	
Copper in domestic water discharged to storm drains	3,000	Moderate-High
Vehicle fluid leaks and dumping	600	Moderate-High

[a]Uncertainty is defined as follows: Low indicates that the estimate has an error within 50%; Moderate indicates that the estimate has an error up to 2 fold; Moderate-high indicates that the estimate has an error up to 5 fold; High indicates an error up to 10 fold (see Section 1.4).
[b]May overlap with vehicle brake pad estimate.
Source: Section 3.

Table S-2. Summary of Shoreline Copper Sources (Pounds of Copper per Year Released to San Francisco Bay)

Copper Source	Load Estimate	Uncertainty
Marine antifouling coatings	20,000	Moderate-High
Copper algaecides applied surface waters	4,000	High

Source: Section 3.

Table S-3. Summary of Feasible Control Measures (Other than Public Outreach) and Priorities for Investigation for Copper Sources in Urban Runoff and Shoreline Activities

Copper Source	Feasible Control Measures	Priorities for Investigation
Vehicle brake pads	• Brake Pad Partnership (BPP)	• Improved load estimate (BPP)
Architectural copper	• Requirements for management of wastewater from cleaning and treatment • After completing the recommended investigation, consider limiting installation and/or requiring measures to prevent copper releases or to treat roof runoff	• Practicality and efficacy of control measures such as coatings and runoff treatment measures
Copper pesticides	• Consider developing best management practices for wood preservatives to minimize copper use where releases are most likely • Regulatory control measures for pool, spa, and fountain algaecides are feasible; use improved load estimate to determine if they are warranted	• Improved estimate of the copper load from algaecides (primarily pool, spa, and fountain algaecides); use estimate to determine whether regulatory measures are warranted • Evaluate alternative practices and pesticides for landscaping to determine if safe and effective alternatives exist
Industrial copper use	• Industrial stormwater permit program	None
Copper air emissions	• Not able to identify appropriate measures at this time • Additional controls on identified sources are not warranted	• Identify major air emissions sources • Determine overlap with brake pad wear debris (BPP studies will provide data)
Soil erosion	• Construction stormwater permit program • Hydromodification management plan requirement	None
Copper in domestic water discharged to storm drains	• None (other than public outreach)	None
Vehicle fluid leaks and dumping	• None necessary (other than public outreach)	None
Marine antifouling coatings	• Not able to identify appropriate measures at this time • Consider a non-toxic antifouling coatings pilot project	• Bay Area-specific load estimate • Participate in IACC Copper Antifouling Paint Sub-Workgroup investigation of copper problem and control measures
Copper algaecides applied to surface waters	• Aquatic pesticides permit program	None

Source: Section 3.

1.0 INTRODUCTION

1.1 Background

Copper has been a pollutant of concern in San Francisco Bay since the late 1980s. The 1989 designation of lower South San Francisco Bay as impaired by copper (listing under section 304(l) of the Clean Water Act) caused government agencies and businesses to make a significant investment in copper source identification and copper reduction measures. These activities created a wealth of information on copper releases to surface waters—and greatly expanded understanding of options to prevent or reduce copper releases to San Francisco Bay.

The most recent compilation of copper sources in urban runoff is in the lower South Bay *Copper Action Plan* (Tetra Tech *et al.*, 2000). The *Copper Action Plan*'s copper source list was based on copper source information from the mid-1990s such as the *Metals Control Measure Plan* (SCVURP, 1997), which in turn was based on a list of sources assembled in the South Bay Copper Reduction Dialogue (SBCRD, 1994).

Since the mid-1990s, activities in the San Francisco Bay Area (Bay Area) and scientific research from elsewhere have provided new information relevant to understanding copper sources and control measures. The purpose of this report is to update information on copper sources in Bay Area urban runoff. This report also explores shoreline copper sources that are not present in lower South San Francisco Bay, but that occur elsewhere in the Bay Area.

1.2 Scope of This Report

This report has been prepared for the Clean Estuary Partnership to support Technical Task 4.11, Basin Planning Assistance for Cu/Ni North of the Dumbarton Bridge. The report was originally intended to provide up to date information about copper sources in urban runoff to facilitate development of a prioritized list of potential urban runoff copper source control measures that would provide the greatest relative removals per effort expended. However, during the course of the review it became apparent that shoreline activities represent a potentially significant source of copper to San Francisco Bay that were not considered in previous evaluations of Bay copper sources. Therefore, the report was expanded to include shoreline copper sources, even though such sources are not components of urban runoff. This information will be used in any *San Francisco Bay Basin Plan* amendments that follow out of the impairment assessment. Because one of the necessary elements of a *Basin Plan* amendment package is a source analysis (which should be as quantitative as possible), this report provides quantitative load estimates to the extent possible with available information.

The focus of this report is copper sources in urban runoff to San Francisco Bay. Two types of non-runoff Bay shore copper releases not previously investigated are also included—marine antifouling paint and copper algaecides applied to shoreline lagoons. This report does not address discharges into or effluent from industrial or municipal wastewater treatment plants, nor does it address non-urban copper sources, like sediment erosion from open space, agricultural pesticide use, mine drainage, and reservoir releases.

The information in this report was assembled from available data sources. Only existing information was used; sampling and chemical analysis were not conducted.

1.3 Report Organization

Section 2 summarizes previous copper source identification studies and reviews the urban runoff copper control measures from the lower South Bay *Copper Action Plan*. Section 3 identifies the major copper sources, estimates the relative magnitude of each source and identifies the relative degree of uncertainty associated with these estimates, and reviews copper control measures, providing control measure effectiveness information to the extent it is available. Section 4 lists conclusions and recommendations and identifies priorities for follow-up activities to address critical data gaps and uncertainties relating to potentially significant copper sources.

1.4 Uncertainty

Available data do not support reliable quantitative estimates of copper releases from most copper sources. The estimates in this report are quite uncertain. While the scope of the report does not include a quantitative review of uncertainties underlying each estimate, the report identifies the sources of uncertainty and uses qualitative review of the uncertainties to categorize the level of uncertainty in each estimate according to the following definitions (Tsai *et al.*, 2001):

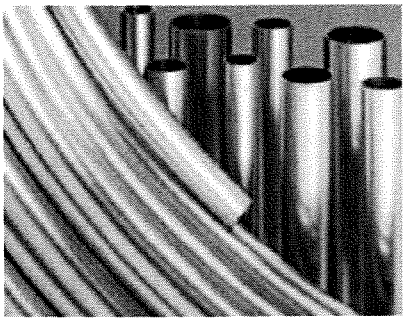
- *Low uncertainty* indicates that the estimate has an error within 50%;
- *Moderate uncertainty* indicates that the estimate has an error up to 2 fold;
- *Moderate-high uncertainty* indicates that the estimate has an error up to 5 fold;
- *High uncertainty* indicates an error up to 10 fold.

In each section, possible methods to reduce the uncertainty in the estimates are identified. In light of the potential magnitude of the copper sources, quality of the data underlying each estimate and the existing control measures for each source, the report recommends priorities for future investigations to improve the quality of the copper load estimates.

2.0 PREVIOUS COPPER SOURCE IDENTIFICATION STUDIES

2.1 Copper Uses

Most copper that is refined in the U.S. is used in copper wire and rod, products that have limited potential to release copper to surface waters. Other uses of copper and its compounds are highly varied, as shown in these examples compiled from the Copper Development Association and International Copper Association (CDA, 2002; CDA, 2003a: ICA, 2004):



- Plumbing pipe
- Heat exchangers, radiators
- Industrial catalysts and electrodes
- Jewelry and other decorations
- Utensils such as pots and pans
- Coins
- Fertilizer
- Firework ingredient
- Coating in cathode ray tubes
- Animal feed additive
- Dietary supplement
- Roofs, gutters, flashing, and other architectural elements
- Motor vehicle components like bearings, bushings, gears, and wiring
- Pesticide (algaecide, fungicide, wood preservative, bactericide)
- Batteries (as an electrolyte or contaminant; an ingredient in alkaline batteries)
- Blue coloring for consumer products
- Semiconductor manufacture

This report focuses on applications of copper metal, copper compounds, and copper alloys (*e.g.*, brass and bronze) that may be sources of copper releases to surface water.

2.2 Lower South San Francisco Bay Copper Source Studies

For more than a decade, San Francisco Bay Area wastewater treatment plants and urban runoff management programs have investigated the many uses of copper to identify potentially significant sources of copper releases to surface waters. The 1992 Santa Clara Valley Nonpoint Source Pollution Control Program *Source Identification and Control Report* was the region's first compilation of copper source information—and its first comprehensive plan to reduce copper levels in urban runoff (SCVNPSPCP, 1992). The South Bay Copper Reduction Dialogue assembled a comprehensive compilation of copper sources, which is summarized in Table 1 (South Bay Copper Reduction Dialogue, 1994). Additional investigation has identified that many of the listed copper "sources" actually conveyed copper from one or more uses of copper into San Francisco Bay. Table 1 (on the next page) identifies which of the listed "sources" convey copper from elsewhere and lists the primary copper sources.

In 1997, the Santa Clara Valley Urban Runoff Pollution Prevention Program was the first stormwater program in the Bay Area—and probably the first in the nation—to attempt to quantify the specific sources of copper in urban runoff. Since 1997, the report documenting this effort—the *Metals Control Measure Plan*—has provided the only available basis for prioritizing efforts to manage copper in urban runoff in the Bay Area (SCVURP, 1997). Table 2 (on page 8) presents the copper sources summary from the *Metals Control Measure Plan*.

Table 1. Copper Sources Listed by the South Bay Copper Reduction Dialogue

Copper "Source"	Primary Copper Source
Air deposition	Conveys copper from many sources
Automobile dismantlers (runoff)	Vehicle parts
Brake pads	Brake pads
Commercial and residential land uses (runoff)	Conveys copper from many sources
Construction activities—copper in sand blasting slag and copper surface finishes	Copper in waste materials used for sandblasting, copper architectural materials
Copper algaecides (swimming pools, spas, fountains, and ornamental pools)	Copper algaecides
Copper algaecides in water supply systems and reservoirs	Copper algaecides
Copper fungicides and herbicides	Copper-containing pesticides
Copper in imported water supply	Copper in source water, copper algaecides
Erosion of native soils	Soil
Gas Stations	Brake pads, other vehicle sources
Highway runoff	Conveys copper from many sources
Illicit connections	Copper in wastewater (conveys copper from many sources)
Industrial land use	Conveys copper from many sources
Landfills	Conveys copper from many sources disposed in solid waste
Open space	Soil
Parking lots and maintenance yards (runoff)	Conveys copper from many sources
Spills and illegal dumping (copper contamination in motor oil, copper-containing pesticides)	Many copper sources
Street runoff	Conveys copper from many sources
Tap water	Copper pipes, copper in source water, copper algaecides
Vehicle Fuels (Exhaust)	Vehicle fuels
Wastewater treatment plants	Copper in wastewater (conveys copper from many sources)

Source: South Bay Copper Reduction Dialogue, 1994 and analysis by TDC Environmental.

2.3 Other Copper Source Studies

A literature review identified three studies estimating contributions of various copper uses to copper levels in urban runoff. The findings of each study are briefly summarized below.

2.3.1 Stockholm

A Swedish study investigated sources of metals in runoff and sewage in a portion of Stockholm, Sweden (Sorme and Lagerkvist, 2002). The urban runoff contributions from copper roofs, brake pads, tires, and asphalt were estimated. Other sources were

Table 2. Copper Sources Summary from *Metals Control Measure Plan*

Copper Source	Estimated Load at Source (lbs/yr)	Adjusted Load to Bay (lbs/yr)[a]	% of Total Load to Bay
Point Sources (Wastewater Treatment Plants)	*2,461*	*2,461*	*28*
Nonpoint Load Estimate for Lower South San Francisco Bay	*6,400*	*6,400*	*72*
Urban Nonpoint	9,611	4,685	53
Brake Pads	7,700	3,753	42
Coolant Leaks	112	55	1
Coolant Illegal Dumping	116	57	
Oil Illegal Dumping	7	3	0
Industrial runoff	693	338	4
Tailpipe Emissions	116	57	1
Construction Erosion	93	45	1
Pesticide Application[b]	74	36	0
Water Supply/Corrosion	700	341	4
Other Nonpoint (Natural Erosion and Reservoir Spills)	3,519	1,715	19
Total		**8,861**	**100**

[a]Nonpoint Source estimates were adjusted to be consistent with the nonpoint load estimated on the basis of creek monitoring data.
[b]Agricultural and landscape maintenance applications only. Although the original table attributed this load to both fertilizers and pesticides, the calculations not appear to address copper from fertilizers.
Source: *Metals Control Measure Plan* (SCVURP, 1997).

assumed to be negligible, an assumption validated by the acceptable mass balance (sources estimated as 109-113% of measured load). Table 3 presents the load estimates. It should be noted that copper roofs are relatively common in Stockholm—study authors estimated a total copper roof area of 623,000 square meters in an area with a population of 630,100.

Table 3. Copper Sources in Stormwater Entering Henriksdal Treatment Plant, 1999

Copper Source	Estimated Copper Load (kg/yr)
Copper roofs	700-920
Brake pads	280
Tires	0.2
Asphalt	11-17
Total (Stormwater Only)	**991-1217**

Source: Sorme and Lagerkvist, 2002

2.3.2 Maryland

A University of Maryland group explored sources of copper in urban residential and commercial runoff (Davis *et al.*, 2001). While this study confused "sources" and conveyances of copper and makes some unverified assumptions, it nevertheless sheds light on the presence of copper in urban environments. The study involved washing various urban surfaces and measuring the amount of metal washed off. This technique cannot separate copper from the "source" and copper conveyed to the sources from elsewhere (*e.g.*, from air deposition). The exterior surfaces examined did not contain copper so they are unlikely to be the primary source of the measured copper (copper roofs were not examined). The study also assumes that the material collected on vehicle wheels is entirely (and exclusively) brake pad wear debris, rather than a mixture of debris from road and vehicle sources. Table 4 summarizes study results.

Table 4. Copper "Sources" in Maryland Urban Stormwater

Copper Source	Estimated Contribution to Residential Stormwater	Estimated Contribution to Commercial Stormwater
Roofs (non-copper)	9-10%	75%
Material washed from building siding	9-22%	7%
Brake pads	47-55%	15%
Tires	1%	0%
Oil	0%	0%
Wet deposition	7-8%	1%
Dry deposition	14-17%	2%

Source: Davis *et al.*, 2001.

2.3.3 Copper Development Association

The industry association for copper manufacturers has compiled information about environmental copper releases into a report (CDA, 2003b). This report some of the relevant literature on copper releases and provides estimates of release rates from certain sources. These release rate estimates are summarized in Table 5.

Table 5. Estimated Copper Release Rates from Environmental Copper Sources

Copper Source	Estimated Copper Release Rate (g/m^2 material per year)
Copper roofs	0.5 – 3.0
Copper gutters	3.5 (old gutters) 7.8 (new gutters)
Composite roof shingles with copper mildewcide	0.17
Copper-based marine antifouling paint	$0.7 – 10 \times 10^{13}$ (all boats) $6 – 8 \times 10^{13}$ (well-maintained boats)

Source: CDA, 2003b.

2.4 Lower South San Francisco Bay Copper Control Measures

The lower South Bay *Copper Action Plan* lays out measures to control copper in wastewater and stormwater (Tetra Tech *et al.*, 2000). These measures are divided into three phases: Baseline actions and Phase I and Phase II contingency plans. This section considers only the implemented (baseline) activities. Table 6 reproduces the list of *Copper Action Plan* Baseline actions. Appendix A contains lists of Baseline, Phase I and Phase II actions and the copper source addressed by each action.

Table 6. Lower South Bay *Copper Action Plan* Baseline Actions*

Action	Description
B-1	Vehicle washing consistency in level of implementation
B-2	Continue to track copper sulfate use by water suppliers (includes State & Federal water project)
B-3	Complete Industrial-2: investigations (based on MCMP), identify and implement reasonable controls in conjunction with industry (older printed circuit board manufacturers with copper plating) to reduce elevated levels in runoff from targeted industry including development/implementation of education and outreach plan Clarify linkage with POTW Pretreatment program
B-4	1-Provide appropriate level of local support for agreed upon quantification studies to: 2-Investigate and/or track quantification studies for a wide range of existing copper control/pollution prevention measures and sources loadings (update copper pie charts contained in MCM based on data from B-6 and B-16) 3-Collect data and prepare annual reports on the following potential indicators Copper content in new auto brake pads • Total population in basin • Auto/truck vehicle traveled in basin • Copper sulfate (*e.g.*, algaecide, pesticide, industrials; chemicals) sales in basin (aggregate basis-scaled to basin level estimate) • Copper content in macoma tissue at Sand Point (Palo Alto • Reproductivity index for macoma at Sand Point • Benthic community assemblages at Sand Point 4-Prepare issue paper on feasibility of potential field investigation to monitor long-term trends between copper from brake pads and concentration in water
B-5	Provide appropriate level of local support for agreed upon BPP activities consistent with MCM 1-Review/assess/provide input on BMC/BPP brake pad wear debris research & brake pad content data 2-Ensure that other local state and Federal players are involved appropriately on brake pads issue as it is a widespread urban concern 3-Assist in making research data that are in the public domain accessible
B-6	Review appropriateness of transportation control measures, prioritize reasonable measures and identify potential efforts for further development as part of Phase I and implementation as part of Phase II
B-7	Establish transportation/impervious surface "forum" • Consider results of VMT and imperviousness load estimates and control effectiveness evaluation; identify potential control efforts for further development as part of Phase I and implementation as part of Phase II
B-8	Continue to implement watershed classification and assessment efforts of SCBWMI and improve institutional arrangements for watershed protection (review Vol. II Chapter 5/CCMP/CONCUR findings for relevance and possible gaps as part of C-31)

*Transcribed directly from source.

Table 6. Lower South Bay *Copper Action Plan* Baseline Actions (continued)

Action	Description
B-9	Continue current efforts and track corrosion control opportunities: • Continue educational outreach, within the City of Palo Alto, to plumbers and designers to reduce corrosion of copper pipes via better design and installation • Track developments in (1) alternatives to copper piping (b) corrosion inhibitors, and (c) other methods of reducing copper corrosion
B-10	Utilize results of SEIDP indicator #5 (Sediment Characteristics and Contamination) to investigate development of an environmental indicator and investigate the linkage with SFEI sources and loading work effort
B-11	Consider need for Continuous Improvement of street sweeping controls and storm water system operation & maintenance controls (key emphasis is to develop SOP for disposal of collected materials)
B-12	Maintain existing education and outreach program for pools and spas
B-13	Track POTW Pretreatment Program efforts and POTW loadings
B-14	Track and encourage water recycling efforts
B-15	Utilize results of SEIDP to evaluate effective ness of related SCVURPPP Performance Standards and identify cost-effective modifications
B-16	Establish Information Clearinghouse (Track & disseminate new scientific research on copper toxicity, loadings, fate and transport, and impairment of aquatic ecosystems for use in CAP update; provide stakeholder resource)
B-17	Track and encourage investigation of several important topics that influence uncertainty with Lower South Bay Impairment Decision • Phytoplankton toxicity and movement (IAR Section 5.3.1) • Sediment cycling • Loading uncertainty. Encourage incorporation of appropriate bioassessment tools into ongoing monitoring programs to track presence of copper-sensitive taxa in LSB Prepare issue paper on feasibility and cost of addressing phytoplankton toxicity questions
B-18	Track and encourage investigation of important factors that influence copper and fate (potential reduction in uncertainty is moderate to high) • Investigate flushing time estimates for different wet weather conditions • Investigate location of northern boundary condition • Determine Cu-L1 and L2 complex concentrations • Investigate algal uptake/toxicity with competing metals
B-19	Continue to promote industrial water use and reuse efficiency. These programs may include workshops, outreach, incentives, or audits.
B-20	Revise copper conceptual model report findings and produce status report (revise conceptual model uncertainty table, Appendix based on available information)
B-21	1-SCVURPPP & Co-permittees evaluate feasibility of discouraging architectural use of copper & explore feasibility of related policy 2-Promote Green Building principles and identify measures to investigate as part of Phase I

Source: *Copper Action Plan* Table 4-1 (Tetra Tech *et al.*, 2000).

The *Copper Action Plan* included a wide variety of measures, such as studies relevant to one or more copper sources, tracking activities of other entities that were addressing copper sources, general measures that relate to many copper sources, and implementation of control programs for specific copper sources. For purposes of this report, those measures involving investigation or implementation of control measures for specific copper sources to urban runoff are of interest. These items are listed in Table 7. The lower South Bay experience with these actions is reflected in the control measures discussions in Section 3 of this report (SCVURPPP, 2004).

Table 7. *Copper Action Plan* Investigation and Implementation Actions and Copper Sources Addressed

Action	Description	Copper Source
B-3	Complete Industrial-2 investigations (based on MCMP), identify and implement reasonable controls in conjunction with industry (older printed circuit board manufacturers with copper plating) to reduce elevated levels in runoff from targeted industry including development/implementation of education and outreach plan	Industrial copper use
B-5	Provide appropriate level of local support for agreed upon BPP activities consistent with MCM 1-Review/assess/provide input on BMC/BPP brake pad wear debris research & brake pad content data 2-Ensure that other local state and Federal players are involved appropriately on brake pads issue as it is a widespread urban concern 3-Assist in making research data that are in the public domain accessible	Brake pads
B-6	Review appropriateness of transportation control measures, prioritize reasonable measures and identify potential efforts for further development as part of Phase I and implementation as part of Phase II	Brake pads and other vehicle sources
B-12	Maintain existing education and outreach program for pools and spas	Copper algaecides
B-21	1-SCVURPPP & Co-permittees evaluate feasibility of discouraging architectural use of copper & explore feasibility of related policy 2-Promote Green Building principles and identify measures to investigate as part of Phase I	Architectural copper

Source: *Copper Action Pla*n Table 4-1 (Tetra Tech *et al.*, 2000).

3.0 REVIEW OF COPPER SOURCES AND CONTROL MEASURES

3.1 Copper Sources Selected for Evaluation

On the basis of the *Metals Control Measure Plan*, other urban runoff copper source identification studies described in Section 2 and a review of recent literature, nine categories of copper sources were found to have the potential to make a significant contribution to copper levels in San Francisco Bay Area in urban runoff and in releases from shoreline activities. Table 8 lists these copper sources. Each copper source is considered in the subsection listed in Table 8.

Table 8. Potentially Significant San Francisco Bay Area Urban Runoff and Shoreline Activity Copper Sources

Copper Source	Section
Marine antifouling coatings	3.2
Vehicle brake pads	3.3
Architectural copper	3.4
Copper pesticides (including shoreline algaecides)	3.5
Industrial copper use	3.6
Copper air emissions	3.7
Soil erosion	3.8
Copper in domestic water discharged to storm drains	3.9
Vehicle fluid leaks and dumping	3.10

Source: TDC Environmental.

3.2 Marine Antifouling Coatings

Paints applied to boats and ships to control unwanted "fouling" growth[1] on their hulls often contain copper-based biocides. Historically, the biocide tributyltin was commonly used in marine coatings. Its use on recreational boats was phased out in the late 1980s, when U.S. EPA restricted use of tributyltin-based antifoulants to ships longer than 25 meters. Copper-based biocides—long used on recreational boats—became the primary antifouling coating option for recreational boats.

Because of the lack of marinas in the lower South San Francisco Bay,[2] marine antifouling paint was not evaluated as a copper source in the *Metals Control Measure Plan*. In the Bay north of the Dumbarton Bridge, there are major ports, industrial piers, and dozens of marinas. Thousands of boats are berthed in the Bay; recreational boaters put thousands of additional boats into the Bay for short-term use. Larger vessels include about 2,000 shipping vessels that dock in Bay ports each year (BCDC and MTC, 2003), hundreds of commercial ships involved in trade and tourism, and hundreds of government-owned vessels to manage aquatic safety and resources. Boats and ships coated with copper-containing biocides may release copper directly into the Bay during storage, operation, and in-water maintenance. On-shore maintenance activities have the potential to release copper into urban runoff.

In the process of developing a Total Maximum Daily Load (TMDL) for the Shelter Island Yacht Basin, the San Diego Regional Water Quality Control Board (San Diego RWQCB)

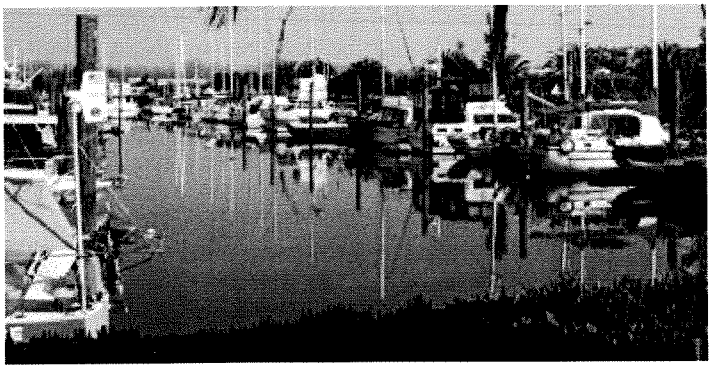
[1] Growth of seaweed, barnacles and other organisms. The presence of such growth on the hull reduces boat speeds and increases motor boat fuel consumption.

[2] The one small marina in Alviso indefinitely closed on October 22, 2003 due to encroachment of wetland vegetation (Santa Clara County Parks, 2004).

has explored the potential importance of copper-based antifouling paint as a source of copper in California surface waters. In a draft TMDL report, the San Diego RWQCB estimated that 98% of the approximately 2,000 pounds of copper released into the Yacht Basin each year comes from marine antifouling paints on the 2,400 boats berthed in the marina (Dobalian and Arias, 2003). Of the approximately 1.8 pounds of copper estimated released per boat per year, about 95% is believed to leach from the paint while boats are moored at the dock; the remaining 5% is believed to be released during monthly underwater hull cleaning activities.

The data that forms the basis of these estimates may not directly apply to San Francisco Bay. Water body specific factors (such as temperature, pH, salinity, and fouling rates) determine both release rates of biocides in antifouling coatings and coating maintenance and replacement requirements. The draft Shelter Island Yacht Basin TMDL report considered only dissolved copper releases and dissolved copper levels (Dobalian and Arias, 2003); it did not consider copper releases from marina sediments, which are known to contain copper released in particulate form from marine antifouling paint.

San Francisco Estuary Project's (SFEP's) Boater Education Program has worked with boaters and marinas since the early 1990s to develop and implement an education and outreach program to protect Bay water quality. The program has focused on marine waste management, encouraging boaters to use pump out and dump stations rather than discharging directly into San Francisco Bay and the Delta. SFEP is currently completing a comprehensive survey of Bay Area marinas that will provide data about boat sizes and marina occupancy levels (Patton and McDowell, 2004).



Pete's Harbor, Redwood City

The San Francisco Bay Conservation and Development Commission (BCDC) completed a pilot San Francisco Bay marina water quality study to explore the water quality impacts of marinas. To guide the monitoring study, BCDC established a multi-stakeholder task force and a technical advisory committee, each comprised of federal, state, and local agencies; environmental groups; and marina and boating organizations. The study, which includes both a literature review and sediment monitoring in four Bay Area marinas,[3] was published in August 2004 (Pap, 2004b). BCDC intends to work with the stakeholder task force to develop management strategies for any water quality problems identified by the pilot study (Pap, 2004a).

3.2.1 Background

Marine antifouling coatings rely on slow release of a biocide impregnated in the coating to prevent fouling growth on the hull. Two formulation types are common:

- Ordinary "hard" copper-containing antifouling paints must be cleaned often enough to remove early stages of fouling growth before it becomes established on the boat's

[3] Copper levels were measured in sediment samples, but not in water column samples.

hull. Cleaning frequencies and methods vary by boat owner and location. In Shelter Island Yacht Basin, boat hulls are typically cleaned by a diver about once a month.

- An alternative formulation, known as "ablative" or "soft" paint, wears away as it ages. This eliminates the need for cleaning. In San Diego, ablative paint is less common than hard paint, apparently because few ablative paint formulations meet applicable air pollutant emissions requirements (Johnson and Miller, 2002).

Marine antifouling paints are technically pesticides because they contain biocides. As such, antifouling paints are subject to the authorities of the California Department of Pesticide Regulation (DPR). DPR maintains public databases containing detailed information about pesticide formulations, sales, and use (DPR, 2004a; DPR, 2003a; DPR, 2003b). The discussion below is based on these data.

3.2.1.1 Coating Formulations

DPR product registration data show that the following copper-based biocides are used in marine antifouling coatings:[4]

- *Cuprous oxide* (copper (I) oxide)—The most popular marine antifouling paint biocide, cuprous oxide has been formulated by 11 manufacturers into 157 marine antifouling coating products that are registered for sale in California. Cuprous oxide concentrations in marine antifouling paints range from 26 to 76%; most paints are in the 40-70% range. Since cuprous oxide is 89% copper by weight, typical cuprous oxide marine antifouling paints are 36 to 62% copper by weight.
- *Cuprous thiocyanate* (copper thiocyanate)—This unusual marine biocide is formulated into 12 marine antifouling paints from one manufacturer. Cuprous thiocyanate is 52% copper by weight At concentrations of 9-23% by weight, the copper content of these paints is about 5 to 12%.
- *Copper hydroxide*—Two cuprous oxide-containing products made by one manufacturer also contain copper hydroxide. Both products are 8% copper hydroxide by weight. (Since copper hydroxide is 65% copper, this translates into about 5% copper from copper hydroxide by weight.) Since this formulation is unusual and the copper contribution in these paints is small relative to the copper in the same paints from cuprous oxide, its contribution is assumed to be negligible.

3.2.1.2 Sales

DPR compiles statewide pesticide sales data based on proceeds of DPR's funding source, the "mill tax." County-specific sales data are not available. Public data are only available for pesticides for which more than 3 companies ("registrants") had registered products during the calendar year for which sales are reported. In 2002 (the most recent year for which data are available), 1,146,625 pounds of cuprous oxide products were sold in California (DPR, 2003a). Because there is only one manufacturer of cuprous thiocyanate-containing products, it sales volume is not public.

3.2.1.3 Reported Use

Certain pesticide uses (primarily agricultural and urban applications by licensed pest control operators) must be reported to DPR. DPR compiles these reports by October of the year following application into reports organized by pesticide and by application site

[4] Two copper naphthenate-containing wood preservatives (neither of which are labeled as antifouling paints) are also allowed by the state to be used for marine antifouling applications. While it is possible that these products may occasionally be used for boat antifouling coatings, the high solubility of copper naphthenate makes this use impractical.

(DPR, 2003b). Unfortunately, because marine antifouling coatings are paints, applying them to boats is not typically considered to be a pesticide application. For this reason, most marine antifouling paint use is not reported to the state.[5] In 2002 (the most recent year for which data are available), DPR records show that 15,184 pounds of biocides were reported applied to boats and piers—almost all of this (15,032 pounds) was copper oxide. Two other copper-containing biocides were also reported: 25 pounds of copper bronze powder (a marine antifouling paint that is no longer registered) and 52 pounds of cuprous thiocyanate.[6]

The product registration and use reporting data summarized above suggest that the cuprous thiocyanate products are not likely to comprise a significant fraction of the copper used in marine antifouling paints. For this reason—and because sales data are not available—it is not considered further in this analysis.

3.2.2 Copper Loads

Copper releases from marine antifouling coatings to surface water relate to the amount of copper applied to boats, the number of boats, the storage locations of those boats, boat use frequency, and maintenance practices.

3.2.2.1 Copper Use in Marine Antifouling Coatings

Almost all copper-containing marine antifouling coatings use cuprous oxide as the biocide—and almost all cuprous oxide products are marine antifouling paints. Copper use in marine antifouling paint can be estimating by estimating cuprous oxide use. Because regional sales data are not available, this analysis starts with a look at statewide copper-based antifouling paint use.

Of the 195 cuprous oxide biocides registered in California, 157 registered specifically as marine antifouling paints. Most of the remaining products have a broader "wood coating" registration, but are sold commercially as marine antifouling paints. Only four of the 195 products—from 2 manufacturers—have uses other than coating wood, and these other uses are almost exclusively agricultural. Since all agricultural pesticide uses must be reported, it is reasonable to assume that almost all non-reported use of cuprous oxide represents marine antifouling paint applications. In 2002, 214,000 pounds of cuprous oxide was reported used for applications other than marine antifouling paint (remaining reported use was almost exclusively agricultural, as expected). Assuming that all cuprous oxide sold was also used in 2002, non-reported use of cuprous oxide was about 917,000 pounds. Since there are few non-reportable uses of cuprous oxide other than use in marine antifouling paint, this means that as much as 932,000 pounds of cuprous oxide (as much as 830,000 pounds of copper) could have been applied to California boats in 2002.

3.2.2.2 Boat Population

California Department of Motor Vehicles (DMV) records show that 963,379 marine vessels were registered in the state as of December 31, 2003 (DMV, 2004). California registration data do not include sailboats less than 8 feet in length or commercial vessels larger than 5 net tons or 30 feet. These must be registered ("documented") by the U.S. Coast Guard, which does not have a readily available compilation of registrations by water body. California registration data are apparently compiled on the basis of the

[5] It should be noted that this treatment of marine antifouling paint is not unusual—other types of paint commonly applied by homeowners and professional painters contain biocides (*e.g.*, bathroom paint, deck paint); use of these paints is sim ilarly not reported.

[6] About 75 pounds of tributyltin was also applied. Tributyltin may legally be applied to ships longer than 25 meters.

owner's address, rather than the boat storage location. Registrations include boats used in California lakes and rivers as well as those used in bays and coastal waters.

Vessel registration data are broken down by county—in 2003, 176,483 vessels were registered in the nine Bay Area counties (Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, Sonoma) (DMV, 2004). Most of these are pleasure craft; the remainder (a few hundred vessels) are government and commercial boats. About 20,000 are personal water craft (jet skis) (DMV, 2003).[7] Other breakdowns of boat types (sail boat, motor boat), sizes, and storage location (*e.g.*, in-water or on-shore) are not provided in the registration data summary. These data probably include some vessels used only in the ocean or other water bodies that do not drain to San Francisco Bay.

3.2.2.3 Antifouling Paint Use

Boats may be stored in the water, or on shore. On-shore storage ("dry storage") is less expensive and requires substantially less maintenance than wet storage, so most boats are stored dry, often at one of the region's many storage yards. Dry-stored boats, which only enter the water for short periods, normally are not treated with antifouling paint, which is not necessary and may be damaged during travel on a boat trailer. Only wet-stored boats typically have antifouling coatings. These boats, perhaps 10 to 15% of registered boats, typically are larger and thus more difficult to transport and to move in and out of the water than smaller boats.

The San Francisco Bay Area has about 60 yacht harbors, with about 15,000 berths (Bay and Delta Yachtsman, 2004). Not all of these berths are occupied; colloquial information from industry professionals suggests that about 10,000 to 12,000 boats are berthed in San Francisco Bay.

3.2.2.4 Annual Copper Load

Not all of the copper applied to boats has the potential to be released to California surface waters. Copper releases from marine antifouling paint may occur several ways.

- *Passive leaching and in-water hull cleaning*. Because San Francisco Bay marinas probably have cooler temperatures than San Diego Bay marinas, available copper leaching data is likely to overestimate both passive and cleaning-related copper releases. Colloquial information from boaters and boat maintenance facilities suggests that underwater hull cleaning is not common in San Francisco Bay, and frequent only among special groups (*i.e.*, competitive sailors). In the absence of data relevant to San Francisco Bay, the release rate estimates from San Diego Bay can be used as a starting point to understand the potential magnitude of releases. Assuming that the copper release rates estimated for San Diego Bay (about 1.8 pounds per 12.2 meter boat per year) apply to boats in San Francisco Bay, and that boat sizes are similar (averaging 12.2 meters), the 10 to 12,000 boats wet stored in San Francisco Bay could release as much as 20,000 pounds of copper per year. It is not known what fraction of this copper remains in marinas and what fraction moves into the main part of the Bay.
- *Boat use*. Available studies of copper antifouling paint do not estimate copper releases while boats are in motion; however, data suggest that release rates are likely to be higher than releases from stationary boats because motion removes biofilms that reduce copper releases. In the absence of data, it is assumed that

[7] In 2002, 21,416 of the registered vessels in the 9 Bay Area counties were personal watercraft; 2003 data are not available.

releases from watercraft in motion are the same as in-dock passive leaching rates and thus included in the above estimate. Because dry-stored boats normally are not treated with antifouling paint, their use is assumed not to release copper.

- *On-shore maintenance*. Boat maintenance—such as on-shore hull cleaning and painting—has the potential to release copper to the environment, if the maintenance discharges are not controlled. Discharges from boat maintenance facilities in the Bay Area are regulated by stormwater management agencies and wastewater treatment plants. While some unregulated maintenance activities may occur at marinas, for purposes of this report, discharges are assumed to be negligible because they should be managed with best management practices and/or directed to wastewater treatment plants.

3.2.3 Control Measures

Currently there are no specific control measures in place to limit copper releases from marine antifouling paint in the San Francisco Bay Area. In response to concerns raised in San Diego, DPR and the State Water Resources Control Board are working together to explore the relationship between marine antifouling paints and copper levels in surface waters. To facilitate exploration of this issue, the Interagency Coordinating Committee (IACC), an existing working group composed of 28 State agencies involved in implementing California's Nonpoint Source Pollution Control Program, has created the Copper Antifouling Paint Sub-Workgroup of its Marina and Recreational Boating Workgroup. The purpose of the subgroup is to assess the degree and geographical distribution of copper pollution caused by copper antifouling paints in California's aquatic environments. The subgroup, which held its first meeting in March, has not yet established a workplan or schedule. One of the goals of the committee's work is to facilitate the evaluation of control measures by DPR and Regional Water Quality Control Boards.

Alternative marine antifouling coatings. Other marine antifouling coatings exist. In recent years, coatings designed to prevent adhesion of fouling growth to boat hulls have entered the market. The University of California has evaluated these epoxy and silicone coatings (Carson *et al.*, 2002) and has published an education piece for boaters about non-toxic antifouling strategies for boats (Johnson and Miller, 2002). To date, non-toxic alternatives have not been widely accepted in the boating industry, due to concerns about practicality and cost. If adopted, these alternatives would eliminate copper loads from marine antifouling paint.

Hull cleaning best management practices. Although modifying underwater hull cleaning practices to minimize copper release is possible, data from San Diego suggest that even with relatively frequently underwater cleanings, modified procedures are likely have little impact on copper loads (Schiff *et al.*, 2003; Carson *et al.*, 2002).

Prohibiting use of copper antifouling coatings. To date, no California agency has prohibited use of copper marine antifouling coatings. A San Diego RWQCB proposal that would effectively phase out their use in Shelter Island Yacht Harbor has met with stiff resistance (San Diego RWQCB, 2003). DPR has the authority to restrict their use, but has determined that further investigation of the need for restrictions through the IACC Copper Antifouling Paint Sub-Workgroup should be completed prior to consideration of possible restrictions (which would need to be based on data identifying the contribution of copper marine antifouling paints to surface water quality impairment).

3.2.4 Uncertainty

Due to the lack of San Francisco Bay-specific information (such as the specific number and types of marine craft moored in the Bay, which marine antifouling paints are most common, copper release rates in Bay water, hull cleaning frequencies, and recoating frequencies) this estimate has moderate-high uncertainty. Sources of uncertainty in the current estimate include (but are not limited to):

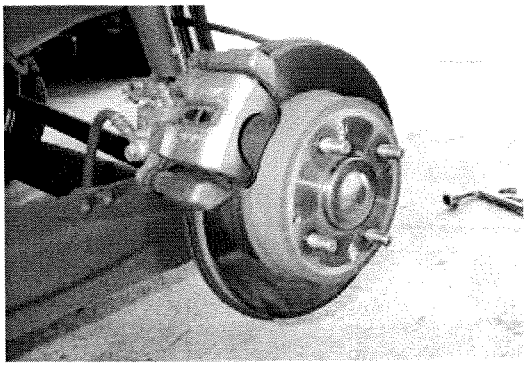
- *Marine craft information*. Information about the number and sizes of boats, commercial ships, and government vessels wet-stored in San Francisco Bay is needed. Data needs include boat and ship numbers, typical sizes, cleaning frequency, common antifouling paint types, length of time in Bay waters, and recoating frequency.
- *Marina information*. Most copper releases from antifouling paints probably occur into water and sediments in marinas. Both the Regional Water Quality Control Board and BCDC have marina sediment copper data. While the BCDC data shows copper enrichment, the Water Board data do not (it is not clear whether this data represents the active layer) (Pap, 2004b; RWQCB, 2004b). The extent to which this copper is transferred to the water column and sediments in the Bay is unknown.
- *No total copper measurements*. Studies prepared for the Shelter Island Yacht Harbor TMDL evaluated release of dissolved copper. Total copper releases were not measured. These studies note that paint particles are released upon hull cleaning. These paint particles, which probably contain copper (since such a high fraction of copper-based antifouling paint is copper), are assumed to deposit into marina sediments and become stabilized in a manner that prevents future contribution to dissolved copper levels. San Francisco Bay research has demonstrated that fluxes from copper bound in Bay sediments contribute to dissolved copper levels in the water column (URS and Tetra Tech, 1998).
- *Local environmental different than San Diego Bay*. The release rates of biocides in antifouling coatings are influenced by temperature, pH, salinity, and fouling rates; these factors may be water body specific.
- *Boat usage increases copper release rates*. The above copper release measurements were necessarily made in static conditions. Increased copper release rates have been measured from coatings after periods of motion (Valkirs *et al.*, 2003). The increased copper release was attributed to the motion-induced loss of the biofilm that forms on antifouling paints (Valkirs *et al.*, 2003).
- *Paint types unknown*. Ablative paints may have somewhat higher copper release rates than hard paints, but received little attention in the San Diego studies because colloquial information suggested that they are little used due to region-specific air pollutant compliance requirements.
- *Other biocides*. Contribution of biocides other than cuprous oxide are omitted (*e.g.*, cuprous thiocyanate).
- *Applications to materials other than boats*. No available data suggests that copper-based antifouling paint is commonly applied to marine structures other than boats and ships; however, most marine antifouling paints are registered for use on other structures.

3.2.5 Next Steps

- *Load Estimate*. Given the potential magnitude of copper releases from marine antifouling paint, a region-specific investigation of the copper load and related issues is a priority. An estimate would most efficiently be prepared in coordination with the two entities currently working with Bay Area marinas (SFEP and BCDC) and with the IACC Copper Antifouling Paint Sub-Workgroup.
- *Control Measures*. The IACC Copper Antifouling Paint Sub-Workgroup plans to facilitate evaluation of control measures, assuming its investigations identify the need to reduce copper releases from marine antifouling paint. Among the possible control measures that could arise from the subgroup are potentially costly measures like education programs and cost-effective measures like state agency restrictions on copper antifouling paint use.[8] Given the lack of acceptance of non-toxic alternatives to copper antifouling paint, a non-toxic antifouling coatings pilot project would be an appropriate precursor to future control programs.

3.3 Vehicle Brake Pads

San Francisco Bay Area drivers use their brakes millions of times a day, each time releasing small amounts of brake wear debris to the environment. In 1993, the Santa Clara Valley Nonpoint Source Pollution Control Program retained Woodward-Clyde to investigate the potential that vehicle brake wear debris contained water pollutants. The resulting report (Woodward-Clyde, 1994a) identified vehicle brake pads as a potentially significant source of copper in urban runoff, sparking Santa Clara Valley water quality agencies' interest in vehicle brake pads, and eventually leading to the formation of a partnership with the brake pad industry and other interested stakeholders to explore the issue.



Behind the wheel: vehicle disc brake pads and rotor

The *Metals Control Measure Plan* relied on the 1994 Woodward-Clyde report to estimate the copper load from vehicle brake pads. Substantial errors in these estimates, which were identified through the Brake Pad Partnership, are probably part of the reason that the copper load estimate in the *Metals Control Measure Plan* was about double the measured copper release from urban runoff into lower South San Francisco Bay.[9]

The Brake Pad Partnership is currently conducting investigations that will lead to a reliable estimate of the contribution of vehicle brake pads to copper levels in San Francisco Bay. The approach of the Brake Pad Partnership is to characterize brake wear debris and to conduct environmental transport and fate modeling to predict how copper released from brake pads enters the Bay and affects both the short-term and long-term concentrations of copper in the Bay. Results of these studies, which involve air, watershed, and Bay modeling, are anticipated in 2006.

[8] In considering such restrictions, DPR usually relies on other agencies to develop region-specific data identifying the contribution of the pesticide to surface water quality impairment.

[9] Estimated copper loads from urban runoff and other non-point sources were divided by a factor of 2 to match creek copper load estimates.

3.3.1 Background

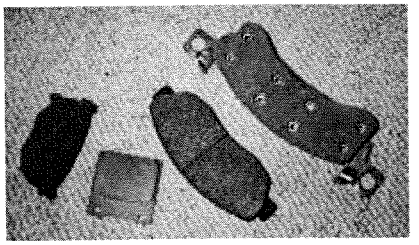
Currently, the Bay Area Air Quality Management District (BAAQMD) estimates that vehicles drive an average of 167.2 million miles per day in the San Francisco Bay Area (BAAQMD, 2004). More than 5 million vehicles are registered to Bay Area residents and businesses (MTC, 2004a). All of these vehicles rely on the friction between their brake pads ("brake linings") and a rotor or drum to stop.

While drum brakes are still common, most new vehicles have disc brakes that are open to the environment. With a disc brake, each vehicle stop wears off a tiny amount of the brake pad material ("friction material"), which may be deposited on the road, on the vehicle, or elsewhere in the urban area.

Vehicle brake pads are manufactured by automobile parts companies that supply vehicle manufacturers—not by vehicle manufacturers themselves. Brake pad manufacturers use a wide variety of ingredients—including copper—in formulating brake pads. Manufacturers consider formulations, customer identity, and pad sales data to be trade secrets. Since brake pad composition is not regulated by any government agency, there is no independent central data source for information about vehicle brake pads.

3.3.2 Copper Loads

Estimating copper releases from vehicle brake pads into urban runoff involves two steps: estimating copper releases in the watershed, and then estimating the fraction of copper released that is washed off in runoff. The Brake Pad Partnership is currently exploring both of these questions. The estimate in this section is intended to serve as a placeholder until such time as the Brake Pad Partnership's cooperative investigations are complete.



Disc brake pads

The discussion in this section is based primarily on preliminary information obtained from the Brake Pad Partnership.[10] The estimate of copper releases to Bay Area watersheds involves use of the best available data and assumptions that the Brake Pad Partnership believes are as accurate as currently possible given the available data. Because the Brake Pad Partnership has not yet addressed the potential for wash-off of copper in vehicle brake wear debris, the estimate of the fraction of copper that is washed off in urban runoff does not involve input from the Brake Pad Partnership; it is based on preliminary results of U.S. EPA modeling of copper runoff in Castro Valley.

3.3.2.1 Copper Release to Bay Area Watersheds

The annual copper release from vehicle brake pads can be represented by the following equation:

$$\text{Cu Release} = N_{vehicles} \times \%_{wear} \times Cu_{vehicle}$$

Where:

Cu Release—Annual quantity of copper released (Lb Cu/yr)
$N_{vehicles}$—Number of vehicles
$\%_{wear}$—Percent of brake pad (friction material) worn off each year
$Cu_{vehicle}$—Average brake pad copper content per vehicle (Lb Cu/vehicle)

[10] Please note that this discussion represents the analysis of the report preparer; it does not represent the views of the Brake Pad Partnership.

Ideally, this equation would be used to calculate the total annual copper contribution from vehicles driven in the San Francisco Bay Area. Unfortunately, since the copper content of vehicle brake pads is considered proprietary by manufacturers, the data to perform vehicle-specific calculations are not available. Limited aggregate data are available; these can be used with the above equation to generate a preliminary aggregate estimate of copper releases, as described below.

Copper content per vehicle. The best available data on brake pad copper content is from the Brake Pad Partnership. As part of the Brake Pad Partnership, U.S. brake pad manufacturers have developed a procedure for reporting on the amount of copper used in brake pads on new vehicles each year. Reporting began in 1998; data are currently available through vehicle model year 2002 (see Table 9) (Brake Pad Partnership, 2004). The annual report provides the average quantity of copper per vehicle for vehicles in the reported model year. Although these data are not intended for use in copper load calculations, they are the most comprehensive and reliable data available regarding the copper content of automotive brake pads.

Table 9. Copper Use in Brake Pads on the 20 Best Selling Domestic Light Duty Vehicles, Model Years 1998-2002

Model Year	1998	1999	2000	2001	2002
Copper per vehicle (kg)	0.0402	0.0517	0.0564	0.0561	0.0766
Copper per vehicle (lb)	0.0886	0.114	0.124	0.124	0.169

Source: Brake Pad Partnership, 2004

These data are for "original equipment" brake pads used in cars and light trucks. According to brake pad industry representatives these vehicles are most likely to have copper-containing brake pads. The data do not include "aftermarket" (replacement) brake pads or brake pads used on heavy-duty trucks, rail cars, off-road vehicles, or motorcycles.[11] Brake manufacturers indicate that the copper content of aftermarket brake pads is small, but no public data are available to confirm that statement. Colloquial information from brake manufacturers also suggests that copper use in trucks and off-road vehicle brake pads is limited and that motorcycle brake pads, while often containing copper, are so physically small that they comprise only a small fraction of on-road brake pad material.

The available data provide the basis for an estimate of the amount of copper released from "original equipment" brake pads used in cars and light trucks. At this time, it is not possible to estimate the contributions from other types of brake pads.

Annual brake pad wear. Generally, automobile owners replace disc brake pads before the pad material has worn off (this is done as preventative maintenance and avoids damage to the rotor). Normally, all pads are replaced at once, leaving some pad material permanently unused. In early Brake Pad Partnership discussions of wear debris calculation methods, manufacturers provided colloquial information that on average, about 60% of brake pad material is worn off prior to replacement. This assumption has not been verified.

Since brake pads are not replaced annually, the brake pad material wears off over the course of several years. According to brake pad manufacturers, original equipment brake pads are replaced, on average, after about 3 years of service. This estimate has not been verified, but it is consistent with typical automobile maintenance schedules.

[11] Manufacturers of these other friction material types are not currently participating in the Brake Pad Partnership.

The actual lifetime of individual pads is highly variable, and pad lifetime on individual vehicles may differ significantly from the estimated three-year average.

Due to the variability of pad lifetimes, it would be relatively complicated to develop the data needed to estimate the portion of brake pad wear that occurs from each vehicle with original equipment pads each year. However, since about the same fraction of material is worn off of all pads prior to replacement—and a similar mix of new vehicles enters the San Francisco Bay region every year, the overall wear rate for original equipment brake pads in the San Francisco Bay Area is relatively constant. Assuming that vehicle sales and the Bay Area fleet mix are relatively constant, the calculation can be simplified with the assumption that the amount of original equipment brake pad wear each year is equal to 60% of the amount of brake pad material sold on new vehicles each year.

Number of vehicles in use. To account for variation in vehicle sales, three years worth of data were averaged (this is consistent with the assumed typical 3-year lifetime of original equipment brake pads). In the San Francisco Bay Area, there are 5,432,514 registered cars and trucks (MTC, 2004a). While annual vehicle sales data for the San Francisco Bay Area are not readily available,[12] California DMV data show that 33.63% of non-commercial registered vehicles are less than 3 years old (DMV, 2002), reflecting a recent average of about 609,000 vehicles sold each year.

Copper release estimate. To account for variation in brake pad copper content, original equipment brake pad copper content data for the most recent three model years were averaged (0.139 lb/vehicle) (this is consistent with the assumed typical 3-year lifetime of original equipment brake pads). Putting this value and the above estimates into the equation yields an estimate of about 51,000 pounds of copper released to San Francisco Bay Area watersheds annually from wear of original equipment brake pads on passenger cars and light duty trucks. This estimate does not include contributions from replacement brake pads nor brake pads used on heavy-duty trucks, rail cars, off-road vehicles, or motorcycles.

3.3.2.2 Copper Washoff into Urban Runoff

Available information suggests that brake pad wear debris is deposited not only on roads, but also is widely dispersed in urban areas. Brake pad wear debris is comprised of very small particles (less than 10 microns in diameter), making air emissions a significant release method and a likely important transport pathway for brake pad wear debris (BMC/PEC, 2001; Garg, 2000; Sanders, 2002). Information from the literature shows that elevated copper concentrations appear at soil surfaces within about 20 meters of roads (Heath *et al.*, 1999; Sutherland and Tolosa, 2001), suggesting that a significant amount of brake pad wear debris is deposited near roads. Since most vehicle use occurs on roads in urbanized portions of Bay Area watersheds, this analysis assumes that most deposition occurs in the urbanized portion of Bay Area watersheds.

Potential for wash-off. The City of Palo Alto and the Bay Area Stormwater Management Agencies Association (BASMAA) funded Clemson University to characterize brake wear debris from one brake pad provided by the Brake Manufacturers Council Product Environmental Committee (BMC/PEC). Clemson conducted copper leaching tests, using standard extraction test methods and some modified methods with environmentally relevant reagents to measure the ability of copper in brake pad wear debris to leach out in the environment. Test results show that a substantial fraction of copper in the tested brake wear debris can be mobilized in the environment

[12] These data may be purchased for a fee from automotive industry sources.

(Schlautman, 2002; Schlautman, 2003a; Schlautman, 2003b; Hur *et al.*, 2003; Hur *et al.*, in press). The copper solubility in the tested brake wear debris is probably due to the high surface area of brake wear debris[13] and the chemical form of the copper in the wear debris.

If these data from one brake pad are typical of all copper containing brake pads,[14] the results would mean that in the long term, most of the copper can probably be mobilized from brake wear debris that remains exposed to water flows. This analysis assumes that the behavior of copper in vehicle brake wear debris has wash-off behavior similar to other anthropogenic urban copper sources.

Preliminary wash-off estimate. No specific estimates of brake pad wear debris copper wash-off are currently available. A rough estimate of wash-off can be made from preliminary watershed modeling information in combination with simplifying assumptions. On behalf of the Brake Pad Partnership, U.S. EPA staff has set up a model of copper runoff from the Castro Valley watershed. This preliminary model has not yet been incorporated into the Brake Pad Partnership's investigations. In preliminary runs of this model based on currently available data (no data specific to vehicle brake pads), between 31 and 48% of anthropogenic copper annually deposited on impervious surfaces was estimated to be transported to San Francisco Bay in urban runoff (Carleton, 2004).[15]

In the modeled watershed (Castro Valley), the impervious surface area is about 50% of the total surface area. Assuming that all vehicle brake wear debris is deposited in urbanized portions of Bay Area watersheds and that Castro Valley's impervious surface fraction is typical for the urbanized portion of Bay Area watersheds, this suggest that 15 to 24% of copper in brake pad wear debris may be transported to San Francisco Bay in urban runoff.

3.3.2.3 Annual Copper Load

Combining the two above estimates (about 50,000 pounds per year of copper released from original equipment brake pads, of which 15 to 24% may be transported to the Bay in urban runoff) yields a copper load estimate of about 7,600 to 12,000 pounds per year (or with one significant figure, about 10,000 pounds per year). This estimate is highly uncertain (see below).

3.3.3 Control Measures

The Brake Pad Partnership has served as the primary control measure for copper in vehicle brake wear debris. Initiated by Santa Clara Valley Urban Runoff Pollution Prevention Program members in the mid-1990s, the Brake Pad Partnership is a cooperative effort of government regulators, brake pad manufacturers, stormwater management agencies, and environmentalists aimed at identifying and preventing impacts on surface water quality that may arise from the use of automotive brake pads. Together, the partners are investigating the issue of copper from vehicle brake pads in urban runoff. The Brake Pad Partnership anticipates completing its investigations in 2006. As part of their participation in the Partnership, brake pad manufacturers have committed to voluntarily introducing reduced copper products within five years if the

[13] Clemson's data show that brake wear debris has a much higher specific surface area (31 m^2/g) than the standard copper-containing minerals tested (< 1.5 m^2/g).

[14] In 2004, the Brake Pad Partnership plans to repeat the extractions on a representative sample of brake wear debris to answer this question.

[15] Because this modeling effort involved matching washoff estimates and creek monitoring data, it accounts for copper removal via control measures like street sweeping and runoff treatment systems.

Brake Pad Partnership determines that copper from brake pads is a significant cause of water quality impairment. While the Partnership's investigations proceed, brake pad manufacturers are conducting research to develop low copper or copper-free pad formulations that meet safety standards.

Other control measures involve collecting copper after it is released to the environment or reducing vehicle use. The major options are:

- *Street sweeping*—collects particles from streets and highways. Municipalities already sweep most Bay Area streets. Because street sweepers are relatively inefficient in collecting fine particles (Woodward-Clyde Consultants, 1994b; Brown and Caldwell, 1997), and wear debris probably deposits on many urban impervious surfaces not subject to street sweeping, street sweeping is not a very effective control measure for copper in vehicle brake wear debris. Available data are insufficient to determine if increasing street sweeping frequencies or adding more rural streets to the sweeping program would increase copper removal significantly (Claytor, undated).

- *Treating urban runoff*—Runoff treatment devices vary in their ability to remove copper from urban runoff, with typical efficiencies in the 40-60% removal range (Winer, 2000). Removal efficiencies for dissolved copper are typically lower than those for total copper (Winer, 2000). Many devices are designed to remove trash and sediments from stormwater in watersheds; these devices are not designed to remove very fine particles like brake wear debris. Such devices are not very effective at copper removal (Woodward Clyde, 1996).[16] Vegetation-based treatment methods—like grassy swales—and infiltration methods generally have the highest removal efficiency for copper (Winer, 2000).

  Urban runoff agency permits will soon require treatment of runoff from much of new urban development in the Bay Area. This requirement will require substantial financial investment for installation and maintenance of the treatment facilities. Treating runoff from existing development, while theoretically possible, would involve an enormous infrastructure investment (much greater than for new development, where installation can be paid for by developers)—plus significant annual maintenance costs. Treatment facility costs vary greatly—a BASMAA survey listed costs from $160 to $122,000 per acre (not including land costs) (Minton, 2003). While vegetation based systems are generally at the lower end of the cost range (hundreds to thousands of dollars per acre), Bay Area land costs—assuming land is even available—would likely make retrofitting such measures on a widespread basis cost-prohibitive.

- *Reducing vehicle miles traveled*. Reducing vehicle use would reduce release of vehicle brake wear debris. In response to Federal and California Clean Air Act requirements, the California Air Resources Board, the Bay Area Air Quality Management District, and Bay Area municipal congestion management and transportation agencies have worked for the last several decades to reduce vehicle use. Due to population increases and land use patterns, these efforts have been unsuccessful—the number of vehicle miles traveled in the Bay Area increases each year and is anticipated to increase for the foreseeable future (MTC, 2004b).

[16] As it flows through watersheds, copper transfers to larger particles, generally after hours of contact time (Sansalone and Buchberger, 1997). In typical Bay Area urban watersheds, this transfer occurs in creeks, which have flows that are much too high for typical urban runoff treatment devices.

3.3.4 Uncertainty

Given the many assumptions and omissions in the estimation of the vehicle brake pad copper load, this estimate should be treated as highly uncertain. Most of the data gaps will be filled by the much more complete and reliable estimate anticipated from the Brake Pad Partnership.

Sources of uncertainty in the current estimate include (but are not limited to):

- *Most brake pads are not included in the estimate*. Because limited copper use data is available for replacement brake pads or brake pads used on heavy-duty trucks, off-road vehicles, rail cars, or motorcycles, the copper contribution from these pads was not estimated.
- *Estimates assume that the behavior of copper in vehicle brake wear debris has wash-off behavior similar to other anthropogenic urban copper sources*. This assumption is based on data from only one copper-containing brake pad. There are several different chemical forms of copper used in brake pad formulations.
- *Copper use data are not designed for mass load calculations*. The Brake Pad Partnership's copper use reporting program does not document total copper use; instead, it assumes that copper usage in disc brake pads for the top 20 models of domestically-manufactured light vehicles (accounting for approximately 40% of vehicle sales) serves as a valid indicator of the industry's overall copper use.
- *Vehicle fleet mixes vary*. Within a region or watershed, variations in fleet mix and vehicle use patterns also contribute to differences in copper content and amounts of wear debris released to the environment.

3.3.5 Next Steps

- *Load Estimate*. The Brake Pad Partnership is currently conducting investigations that will lead to a reliable estimate of the contribution of vehicle brake pads to copper levels in San Francisco Bay.
- *Control Measures*. Continue participation in the Brake Pad Partnership, which serves as the primary control measure for copper in vehicle brake wear debris.

3.4 Architectural Copper

Architects and building occupants enjoy the beauty and longevity of copper architectural features like roofs, gutters, and flashing. Nationally, architectural use of copper has increased in recent years (CDA, 2003b). Copper roofs and gutters cost far more than ordinary materials, limiting their use to a relatively small number of structures in the San Francisco Bay area.

Copper roof, Redwood Shores California

Perhaps due to the relative rarity of copper roofs, the *Metals Control Measure Plan* did not estimate copper releases from architectural copper features. Since the late 1990s, a series of papers in the literature have revealed relatively high concentrations of copper in copper roof and gutter runoff (Barron, 2001;

Wallinder and Leygraf, 1997; Zobrist *et al.*, 2000; Wallinder and Leygraf, 2001; Leuenberger-Minger *et al.*, 2002). In some studies, copper concentrations in roof runoff exceeded 1,000 µg/l (Barron, 2001). Concerned about these findings and an upward trend in the use of copper roofs and gutters in new construction, Palo Alto commissioned a study to estimate copper releases from copper architectural features (Barron, 2001). The Palo Alto study estimated that architectural copper runoff comprises about 20% of the copper load in Palo Alto creeks.

3.4.1 Background

While all copper pieces start with a shiny metal appearance, if left untreated, the copper will develop a patina, oxidizing to shades of green and brown as it ages. Oxidation forms compounds that are soluble in water. Factory or field treatments immediately give the copper a desired patina, by oxidizing the surface to create a complete coating of oxides. Occasionally, architectural materials may be clear coated to maintain a desired hue (typically a penny-colored brown).

Some composite roofing shingles are treated with copper granules to retard moss and mildew growth. Like the copper in pure copper roofs, the copper granules will age, become covered with an oxide patina, and be subject to runoff when it rains.

3.4.2 Copper Loads

3.4.2.1 Copper Release to Bay Area Watersheds

The amount of copper washed off architectural copper features is proportional to the area of those features and the copper release rate. Both of these can be estimated using information compiled by Palo Alto (Barron, 2001). The major types of architectural copper features (roofs, gutters, and copper-treated composite shingles) are included in this estimate; the contribution from other materials (flashing, ornamentation) is assumed to be relatively small.

Copper roof section, prior to installation

Presence of copper architectural features. No quantitative data is available about the presence of architectural copper or the installation rate of new copper roofs and gutters (Barron, 2001). The Palo Alto estimate relied on colloquial information obtained from a survey of contractors, building departments and similar entities and a visual inspection of buildings in Palo Alto to create a very rough estimate that copper roofs are installed on 0.05% of residences, 0.3% of industrial commercial buildings, and 1.5% of other structures. The "other structures" category was region-specific,[17] to reflect the relatively high frequency of copper use in the institutional structures in that region (Barron, 2004). The Palo Alto study estimated that 0.03% of residential roofs use composite roofing shingles with copper biocides, and that these shingles had negligible use on structures in other land uses. Roof coverage was assumed to be 30% for residential land and 50% for other developed land.

[17] The region includes East Palo Alto, Los Altos, Los Altos Hills, Mountain View, Palo Alto, and Stanford.

Using these estimates, the copper roof area can be estimated as follows:

$$\text{Copper roof area}_{LU} = \text{Acres}_{LU} \times \text{Roof Coverage}_{LU} \times \text{Copper Roof Fraction}_{LU}$$

Using land use data from the Association of Bay Area Governments (ABAG, 2003) the copper roof area in the San Francisco Bay Area is estimated to be about 466 acres and the composite shingle with copper biocide roof area is estimated to be about 39 acres (see Table 10).

For copper gutters, the method was very similar (Barron, 2004)—except 0.06% of residential buildings were assumed to have copper gutters (to reflect the presence of copper gutters on some buildings without copper roofs). The surface area of building gutters was assumed to be about 3.25% of the roof surface area. Using these figures, the estimated copper gutter area in the San Francisco Bay area is 15.5 acres (2.5 acres residential; 13 acres commercial/industrial/institutional).

Table 10. Copper Roof Area Estimate

Land Use	Land use area (Acres)	Total Roof Coverage	Copper Roof Fraction	Copper Roof Area (Acres)	Copper Biocide Roof Fraction	Copper Biocide Roof Area (Acres)
Residential	428,660	30%	0.05%	64	0.03%	39
Commercial/Industrial/ Institutional	267,630	50%	0.3%	402	--	--

*Local streets and some highways are included within land use estimates (ABAG, 2003).
Source: TDC Environmental calculations based on data from ABAG, 2003 and Barron, 2001.

Copper release rates. Published literature and limited measurements conducted by Palo Alto provide the estimates of copper releases from copper architectural features listed in Table 11 (on the next page) (Barron, 2004). Note that the copper release rates are within the range of the release rate estimates provided by the Copper Development Association (see Table 5 on page 9).

3.4.2.2 Copper Washoff into Urban Runoff

Since the copper release rates for architectural copper are based on copper concentrations in runoff, no additional adjustment for wash-off fraction is necessary. Since discharge configurations vary—and often involve direct discharge to storm drains—this analysis assumes that the net copper load is essentially the same as the quantity of copper in runoff from architectural copper features. This approach does not account for losses of copper between the release point (*i.e.*, downspout) and surface waters. While there is a potential for significant reduction in copper levels in roof runoff if the runoff flows through vegetation or passes through a treatment device, the variation in discharge locations for copper roofs provides no rational basis for assuming a certain fraction removal of the copper.

3.4.2.3 Annual Copper Load

Multiplying the architectural copper roof area estimate by the estimated copper release rates gives the copper load estimates in Table 11 (on the next page), a total of about 4,500 pounds per year of copper releases.

Table 11. Architectural Copper Release Estimate

Architectural Material	Estimated Area (Acres)	Estimated Release Rate (g/m^2 material per year)	Estimated Copper Release (lb Cu/year)
Copper Roofs	466	1	4,200
Composite Roofs with Copper Biocide	39	0.17	59
Copper Gutters	15.5	2	280
Total			**4,500**

Source: TDC Environmental calculations based on data above.

3.4.3 Control Measures

Many control measures to reduce architectural copper releases are possible—measures could include public education to reduce copper use, coating copper to reduce releases, treating runoff to collect released copper, and restricting copper use. In the San Francisco Bay Area, a few municipalities have used education to limit use of copper architectural features; one municipality (Palo Alto) has prohibited most architectural copper use.

Public education. Education of architects, planners, and the public has the potential to reduce copper use in buildings. SCVURPPP has encouraged South Bay municipalities to incorporate avoiding copper architectural features into municipal green building programs. Ordinarily, green building programs do not address copper architectural features. The general effectiveness of such educational programs is unknown, although colloquial information suggests that education can limit copper use.

Treating copper or runoff. In theory, architectural copper features could be coated in a manner that would maintain the copper's appearance, but would prevent release of copper to the environment. In practice, the efficacy and maintenance requirements for such coatings have not been demonstrated. As described in Section 3.3.3, treatment of runoff for copper removal is also possible. Treatment systems have significant technical downsides—they require management and maintenance and have incomplete copper removal. Costs for treatment would include building owner costs for installation and maintenance, and municipal costs to ensure that treatment systems meet performance standards.

Collecting copper wastewater. Cleaning and treating copper architectural features (particularly patina treatments) involves corrosive solutions that may contain relatively high concentrations of copper. These solutions could be collected, tested to determine their waste classification, and managed according to accepted best management practices for wastewater from building surface cleaning activities (BASMAA, 2000).

Prohibiting architectural copper use. Local governments have the authority to regulate the use of building materials. Many attractive alternative roofing materials do not contain copper (Barron, 2001). In August 2002, the City of Palo Alto adopted an ordinance prohibiting the use of copper for new roofs. Prohibitions include copper metal roofing, asphalt shingles containing copper granules, and copper gutters. Copper flashing and ornaments are exempted. The ordinance, which became effective on January 1, 2003, includes provisions to protect historic buildings.

3.4.4 Uncertainty

The major source of uncertainty in this estimate is the uncertainty in the surface area of copper architectural features in the Bay Area. This, combined with the uncertainty in copper release rates, suggests a moderate-high uncertainty for this estimate. Sources of uncertainty in the current estimate include (but are not limited to):

- *Surface area*. Estimates of the area of copper architectural features are based on colloquial information and are highly uncertain. No method to improve the estimates has been identified, though field surveys or photographic analysis may be practical for small watersheds.
- *Release rates*. Copper release rate estimates relate to weather conditions, air quality, distance from salt water and other region-specific factors. This analysis assumes that the copper release rate selected on the basis of the literature is representative of San Francisco Bay Area release rates.
- *Patina treatments and cleaning solutions*. Load from runoff of field treatments to create a patina and cleaning solutions is not estimated. Since field treatments involve corrosive solutions, spent treatment solution and rinsate could have elevated copper levels. While construction stormwater regulations should prevent discharge of such solutions, improper discharges of such solutions could comprise a meaningful copper load.
- *Copper removal from runoff*. Some fraction of the copper released from architectural features may be removed from runoff if the discharge flows over landscaping or across other materials to which copper may bind. Depending on the drainage configuration, copper removal from runoff from some architectural copper features may be significant.

3.4.5 Next Steps

- *Load Estimate*. Although the load estimate is uncertain, the cost involved in preparing a more accurate load estimate—particularly the cost to inventory copper roofs in the entire region—is probably not justified. Community-specific load estimates may be necessary to support local decisions regarding restrictions on use of architectural copper features.
- *Control Measures*. Measures to control runoff from cleaning and treatments (*e.g.*, patina treatments) of copper architectural features should be considered. Questions remain regarding the practicality and efficacy of measures to prevent copper releases (*e.g.*, coatings) or to treat roof runoff. If such measures are practical and sufficiently reduce copper discharges, they offer a technically more complicated—but perhaps politically less difficult alternative to prohibiting architectural copper use (which is technically feasible). Architectural copper use limitations are feasible; these could be structured to allow installation with appropriate treatment measures, if such measures are found to be practical and effective.

3.5 Copper Pesticides

Since the inception of copper control programs in the San Francisco Bay area, municipalities have sought to reduce use of copper-based pesticides. Pesticide use may release copper to urban runoff, to Bay area shorelines, to Bay area surface waters, or to wastewater treatment plants.

In response to a request from the Regional Water Quality Control Board in the early 1990s, some water suppliers have limited their use of copper-based algaecides. Wastewater treatment plants worked with the state legislature and the Department of Pesticide Regulation (DPR) to secure a 1995 prohibition on the sale and use of copper-based root control products in the San Francisco Bay Area (Palo Alto, 1999). Many municipalities have conducted public outreach efforts to reduce copper algaecide use in swimming pools, spas, and fountains.

Retail pesticide display

Copper-based pesticides are among the most commonly used pesticides in surface water bodies. In response to a 2001 Federal court decision, the State Water Resources Control Board (SWRCB) initiated a program to regulate applications of pesticides to surface waters (SWRCB, 2004a). Concurrently, the SWRCB commissioned a study of the environmental effects of aquatic pesticide applications. The study, conducted by the San Francisco Estuary Institute (SFEI) found that dissolved copper from aquatic pesticide applications caused lethal and sublethal toxicity in juvenile trout for at least 24 hours after application, toxicity in *ceriodaphnia dubia* (water flea) for at least a week after application, and may relate to increased sediment copper concentrations (though results on sediment toxicity were inconclusive) (Siemering, 2004).

The presence of the permit requirements has increased incentives for applicators (who are primarily public agencies) to reduce use of aquatic pesticides. The SWRCB permit has planning, monitoring, and reporting requirements on the use of copper-based aquatic pesticides (SWRCB, 2004a), increasing the incentives for applicators to transition to alternative pesticides or to non-pesticide control methods for aquatic weeds and algae.

While the *Metals Control Measure Plan* included an estimate of copper releases from pesticides, the estimate was based only on use of copper sulfate-containing pesticides by professional pest control operators. Recognizing that use of any of the more than a dozen copper-containing pesticide active ingredients, for the last several years Palo Alto's annual *Copper Action Plan Report* has compiled information about all copper containing pesticides and their use in Santa Clara Valley (Palo Alto, 2003).

3.5.1 Background

Copper-containing pesticides are widely used to control fungi, mildew, algae, and roots. Common applications include controlling fungi on plants; controlling roots and other plant growth in sewers; controlling algae in swimming pools, ponds and lakes; controlling aquatic plant growth on boat hulls; serving as biocides in commercial products; and preventing rot and mildew on wood, roofing, and other outdoor surfaces.

As of February, 2004, there were 19 copper-containing pesticide active ingredients in products registered for sale in California. Primary uses are as algaecides, marine antifouling paint biocides, root killers, and wood preservatives, agricultural and garden fungicides. Table 12 (on the next page) summarizes the registered copper-containing pesticide active ingredients and their urban uses.

Table 12. Copper-Containing Pesticides Active Ingredients and their Urban Uses

Pesticide Active Ingredient Name	Number of products	Algaecide	Marine Paints	Root Killer	Wood Preservative	Garden Fungicide
Copper	49	X			X	X
Copper 8-quinolinoleate	8				X	
Copper Ammonia Complex	5					X
Copper Ammonium Carbonate	4				X	
Copper Carbonate	8	X			X	
Copper Ethanolamine Complexes, Mixed	11	X			X	
Copper Ethylenediamine Complex	1	X				
Copper Hydroxide	45		X			X
Copper Naphthenate	27				X	
Copper Oxide (Cuprous)	212		X			
Cupric Oxide	12				X	
Copper Oxychloride	13					X
Copper Oxychloride Sulfate	6					
Copper Resinate	3					
Copper Soap (Copper Octanoate)	4					X
Copper Sulfate (Basic)	25					X
Copper Sulfate (Pentahydrate)	61	X		X	X	X
Copper Thiocyanate	16		X			
Copper Triethanolamine Complex	8	X				

Source: DPR Product database (DPR, 2004a)

3.5.2 Copper Loads

Using DPR data, it is possible to develop a gross estimate of copper containing pesticide use in the San Francisco Bay Area. The estimate uses pesticide sales data, reported pesticide use data, and a calculation of unreported use as described below. To ensure consistent use of pesticide data, DPR provides its reports in units of pounds of pesticide "active ingredient" (A.I.). With a simple calculation based on the copper mass fraction of each copper-based pesticide, this can be converted to pounds of copper.

Pesticide Sales Data. DPR compiles statewide pesticide sales data based on proceeds of DPR's funding source, the "mill tax." County-specific sales data are not available. Public data are only available for pesticides for which more than three companies ("registrants") had registered products during the calendar year for which sales are reported.

Reported Pesticide Use. Certain pesticide applications are required to be reported to the County Agricultural Commissioner, who, in turn, reports the data to DPR.[18] In general, the pesticide uses that require reporting are agricultural uses or urban applications done by licensed pest control operator. DPR compiles pesticide use reports annually into a document that identifies pesticide application locations by broad categories that are sufficiently defined to allow differentiation of urban uses from other uses, but not to evaluate the details of urban uses.

Unreported Pesticide Use. Assuming all pesticides sold are used within a particular year, unreported pesticide use is (approximately) equal to the difference between pesticide sales and reported pesticide use. The primary exceptions to the use reporting requirements are urban uses: home and garden use and most industrial and institutional uses. (Pesticides used in consumer products are also often unreported.) Additional analysis of the uses of particular active ingredients can improve this assumption somewhat, but it is a highly uncertain estimate.

Table 13 (on the next page) presents an estimate of the copper content in copper-containing pesticides used in the San Francisco Bay Area (see Appendix B for additional details). The estimate is based on an estimate of statewide urban use of copper-based pesticides, which is a sum of reported urban pesticide use and unreported pesticide use. Assuming that urban copper pesticide use per capita is the same in the San Francisco Bay Area as it is statewide, the statewide urban copper estimate was adjusted on the basis of population to create a Bay Area estimate.

The next step in the analysis is to evaluate how the copper-containing pesticides are used and the potential for each to be released to surface waters. To simplify the analysis, the seven pesticides with estimated Bay area use less than10 pounds are not considered further. The remaining pesticides are divided into the following groups (recognize that some pesticides have multiple uses and therefore fall into multiple groups):

- Landscaping fungicides—copper, copper ammonia complex, copper hydroxide, copper oxychloride, copper sulfate (basic);
- Wood preservatives—copper, copper carbonate, copper ethanolamine complexes (mixed), copper naphthenate, cupric oxide, copper sulfate (pentahydrate);
- Algaecides—copper, copper carbonate, copper ethanolamine complexes (mixed), copper ethylenediamine complex, copper sulfate (pentahydrate), copper triethanolamine complex (the copper content of potable water discharged to storm drains is discussed in Section 3.9);[19]

Marine antifouling paint (copper oxide [cuprous], copper thiocyanate, and negligible quantities of copper hydroxide)—primarily a shoreline copper source, not an urban runoff source—is discussed in Section 3.2. Root control products (copper sulfate) are assumed not to be used, in compliance with the state prohibition on their sale and use (Palo Alto, 1999).

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[18] Pesticide uses for the production of any agricultural commodity, except livestock; for the treatment of post-harvest agricultural commodities; for landscape maintenance in parks, golf courses, and cemeteries; for roadside and railroad rights-of-way; for poultry and fish production; any application of a restricted material; any application of a pesticide designated by DPR has having the potential to pollute ground water when used outdoors in industrial and institutional settings; and any application by a licensed pest control operator must be reported the County Agricultural Commissioner, who, in turn, reports the data to DPR.

[19] The copper content of reservoir releases is not an urban stormwater copper discharge and thus is not included in this report.

Table 13. Bay Area Copper-Containing Pesticide Use Estimate, 2002

Pesticide	2002 Statewide Sales (lb A.I.)	2002 Statewide Reported Use (lb A.I.)	Estimated Statewide Urban Use (lb A.I.)	Copper in Statewide Estimated Use (lb Cu/yr)	Estimated Bay Area Copper Use[a] (lb Cu/yr)
Copper	326,000	45,857	286,805	286,805	56,501
Copper 8-quinolinoleate	--[b]	10	10	2	0
Copper Ammonia Complex	14,277	5,543	9,697	9,697	1,910
Copper Ammonium Carbonate	--	42	12	4	1
Copper Bronze Powder	--	25	0	0	0
Copper Carbonate	14,274	7,878	6,228	3,550	699
Copper Ethanolamine Complexes, Mixed	171,230	17,721	166,318	166,318	32,765
Copper Ethylenediamine Complex	--	2,557	1,456	1,456	287
Copper Hydroxide	3,940,156	2,592,460	1,355,936	881,358	173,628
Copper Naphthenate	380,620	84,476	380,605	38,061	7,498
Copper Oxide (Cupric)	--	127,523	126,210	100,968	19,891
Copper Oxide (Cuprous)	1,146,625	229,214	918,075	817,087	160,966
Copper Oxychloride	84,997	58,934	26,489	15,364	3,027
Copper Oxychloride Sulfate	--	174,700	0	0	0
Copper Resinate	--	18,612	35	3	1
Copper Soap (Copper Octanoate)	250	0.007	250	45	9
Copper Sulfate (Basic)	1,455,054	876,722	579,200	306,976	60,474
Copper Sulfate (Pentahydrate)	5,646,324	2,916,477	2,649,632	675,656	133,104
Copper Thiocyanate	--	61	9	5	1
Copper Triethanolamine Complex	256	2	256	256	50
TOTAL				**3,303,610**	**650,811**

[a] 19.7% of statewide estimate, based on a California' population of 35,591,000 and a San Francisco Bay Area population of 6,994,500 as of January 1, 2003 (DOF, 2003).
[b] Data not made public by DPR because there are 3 or fewer registrants.
Source: TDC Environmental calculations with data from DPR (DPR, 2004a; DPR 2003a; DPR, 2003b).

3.5.2.1 Landscaping

Copper Release to Bay Area Watersheds. Most urban uses of copper ammonia complex, copper hydroxide, copper oxychloride, and copper sulfate (basic) are as lawn and garden fungicides. Although there are other miscellaneous uses (*e.g.*, copper hydroxide is incorporated into soil to prevent root growth into structures), this analysis assumes that all estimated Bay Area urban use of these products is on urban landscaping. Almost all products with copper metal as the active ingredient are

algaecides; however, there are 2 professional turf products that use copper metal. Since professional pesticide applications should be reported, the outdoor garden use of copper metal is assumed to equal to the extrapolated Bay Area fraction of its statewide reported landscaping use, 672 pounds. Similarly, use of the one copper sulfate product registered for landscape use (which is assumed to be a professional product as it was not observed in a recent retail shelf survey) is assumed to equal to the extrapolated Bay Area fraction of its statewide reported landscaping use, 6,800 pounds. Using these assumptions, Table 14 presents the total San Francisco Bay area use of copper in copper-containing landscaping pesticides.

Table 14. Bay Area Copper-Containing Landscaping Pesticide Use Estimate, 2002

Pesticide	Estimated Bay Area Copper Use (lb Cu/yr)
Copper	672
Copper Ammonia Complex	1,910
Copper Hydroxide	173,628
Copper Oxychloride	3,027
Copper Sulfate (Basic)	60,474
Copper Sulfate (Pentahydrate)	6,800
TOTAL	**250,000**

Source: Table 13; s ee text.

Copper Washoff into Urban Runoff. Only a small fraction the copper applied to landscaping is washed off in storm water runoff, as copper tends to bind to soil and vegetation. A study of copper runoff from tomatoes treated with copper fungicides found that about 1% of applied copper was washed off of a tomato cultivation study area (Dietrich and Gallagher, 2002). This study involved the use of plastic mulch for the tomatoes, which is known to increase pesticide wash-off rates (Rice *et al.*, 2001). The runoff fraction is consistent with known washoff rates of many other pesticides, which are typically less than 0.5% of the amount applied (Wauchope, 1978).

Annual Copper Load. Assuming the runoff fraction is 0.5 - 1%, the copper release to San Francisco Bay Area urban runoff from landscaping pesticide use would be about 1,200 to 2,500 pounds.

3.5.2.2 Wood Preservatives

Copper Release to Bay Area Watersheds. The primary uses of copper carbonate, copper naphthenate, and cupric oxide are for wood treatment. These may be used individually or combined with other ingredients to produce well-known wood preservatives like chromated copper arsenate (CCA). Most or all of the estimated Bay Area use of these three pesticides (about 28,000 pounds of copper) is assumed to be for wood protection. While three other pesticides (copper, copper ethanolamine complexes [mixed], copper sulfate [pentahydrate]) may be formulated into wood preservative products, these are believed to be minor uses of these pesticides based on the relatively small number of products.

Copper Washoff into Urban Runoff. Copper is known to leach out of wood treated with copper-based wood preservatives. The amount of copper leaching, particularly after the first few months, is not well understood (CDA, 2003b). A recent U.S. Geological Survey (USGS) study of a 580-acre watershed with a 27 acre lake suggests that even in a

watershed with relatively extensive use of copper-treated wood, the wood preservatives are a relatively minor source of copper releases to surface water (Rice *et al.*, 2002). In the USGS study watershed, CCA-treated wood is used for bank stabilization along about 75% of the lake shoreline. In addition, the watershed contained copper-treated decks and docks. Nevertheless, copper leaching from preserved wood was estimated to represent only about 4% of the annual copper load in the small watershed; the main source (comprising about 90% of the copper) was road runoff. Since copper-treated wood use in the San Francisco Bay area is far less dense than in study watershed studied by the USGS, it is reasonable to conclude that copper-based wood preservatives release only a relatively small amount of copper to San Francisco Bay.

In the USGS study, the authors note that most of the copper in treated wood is removed when the wood is removed from service, typically after 10 to 20 years of use. Since they estimated that it would take about 180 years to leach all the copper from treated wood posts and pilings submerged in water, a conservative assumption would be that about 8% of copper used to treat wood (15 years divided by 180 years) is released while it is used. In the San Francisco Bay area, the main uses of copper wood preservatives are not along shorelines, but in fences, decks, and other outdoor landscaping. It is therefore reasonable to assume that wood preservative copper releases would be attenuated by runoff across soil surfaces in a manner similar to runoff losses of other urban copper releases, and therefore that the runoff fraction would be similar to the runoff fraction for other copper pesticides used in landscaping (see above).

Annual Copper Load. To simplify the estimate, it is assumed that all copper that will be released from a year's worth of wood preservative use occurs in the first year—in other words, it is assumed that all the copper released from annual sales of 28,000 pounds of copper wood preservatives occurs in the year the wood is sold. If the runoff fraction is 0.5 - 1%, the copper release to San Francisco Bay Area urban runoff from wood preservative use would be about 1,400 to 2,800 pounds.

3.5.2.3 Algaecides

Copper Release to Bay Area Watersheds. Most urban uses of copper ethanolamine complexes (mixed), copper ethylenediamine complex, and copper triethanolamine complex are as algaecides, so this analysis assumes that other uses of these three pesticides are negligible. Since most copper carbonate products are wood preservatives, algaecide use is assumed to be minor. Separating out algaecide uses of copper metal and copper sulfate (pentahydrate) is quite difficult. Of 61 copper sulfate (pentahydrate) products, 16 are root control products; 3 are wood treatments; one product is for landscaping, 9 are agricultural products; 27 are swimming pool algaecides, and the remainder are specialize algaecides (*e.g.*, for aquaria, industrial water). The mix of products containing copper metal is similarly confusing. With this mix of products and the limitations of available data, it is not possible to estimate quantitatively all algaecide uses, though it is likely that use exceeds 50,000 pounds per year. Table 15 (on the next page) summarizes available information about San Francisco Bay Area copper algaecide use.

Table 15. Bay Area Copper-Containing Algaecide Use Estimate, 2002

Pesticide	Estimated Bay Area Copper Use (lb Cu/yr)	Number of Swimming Pool Products	Notes
Copper[a]	Unknown (<55,829)	24 of 49	Unclear what fraction is used as an algaecide.
Copper Ethanolamine Complexes, Mixed	32,765	4 of 11	
Copper Ethylenediamine Complex	287	0	
Copper Sulfate (Pentahydrate) [b]	Unknown (<126,304)	27 of 61	Unclear what fraction is used as an algaecide
Copper Triethanolamine Complex	50	7 of 8	

[a]Total reduced by 672 pounds to reflect reported use of professional landscaping products.
[b]Total reduced by 6,800 pounds to reflect reported use of professional landscaping product.
Source: Table 13 and DPR product information (DPR, 2004a); see text.

Copper Washoff into Urban Runoff. Copper-based algaecides are applied to many different types of water, with very different potential to release copper to urban runoff or San Francisco Bay. The primary uses are considered below:

- *Surface water applications to non-drinking water bodies*—While some non-drinking water surface waters may be treated with copper algaecides, the majority of such treatments in the San Francisco Bay Area are treatments by municipalities made to lagoons and sloughs bordering San Francisco Bay (RWQCB, 2004a). Since lagoons and sloughs generally release water directly to San Francisco Bay, this analysis assumes that all copper applied to non-drinking water bodies is released to the Bay and is therefore a shoreline copper source, rather than an urban runoff copper source (actual releases are somewhat lower due to copper deposition in the treated water body).
- *Reservoirs and water supply conveyance channels*—These common applications to prevent unpleasant taste and odor from algae growth and to ensure smooth operation of potable water systems are part of the copper considered in Section 3.9.
- *Industrial applications*—Copper has many industrial algae control applications, often in systems that do not regularly discharge to either the sewer or storm drain systems (*e.g.*, irrigation ponds, recirculated cooling water). Stormwater discharges from industrial facilities are considered in Section 3.6.
- *Swimming pools, spas, and fountains*—much of the applied copper is collected by a pool's filtering system, or bound to pool, spa, or fountain walls and fixtures, but an unknown fraction remains in the water. When emptied (not a common event), pools, spas, and fountains may be discharged to sewers or to storm drains (under municipal stormwater permits, dechlorinated swimming pool water is an exempted discharge). No estimate of the fraction discharged to storm drains is available; however, based on copper's efficient binding to solids like pool, spa, and fountain surfaces and materials in pool filtration systems, it is reasonable to assume that less than 5% of pool, spa, and fountain algaecide copper is discharged to storm drains.

Annual Copper Load. Of the above algaecide uses, all must be reported to DPR except homeowner applications to swimming pools, spas and fountains. DPR has a database tool that allows reported pesticide uses to be obtained for specific California counties. This tool was used to obtain reported non-industrial copper-containing pesticide applications to surface water bodies in the nine San Francisco Bay Area counties (a region larger than the area discharging urban runoff to the Bay) Reported applications were 3,700 pounds in 2002 (DPR, 2004b).

This report may not very accurately reflect actual copper algaecide use in Bay Area surface waters. Aquatic pesticide application permit records for 2002 (RWQCB, 2004a) provided numerous examples of copper algaecide applications to surface waters that do not appear in the DPR database results, suggesting that the database does not include accurately classification of use reports (or possibly that some uses reported to the Water Board were not reported to DPR). It should be noted that this report includes applications to reservoirs and water supply conveyance channels, which are not shoreline copper sources.

Of the remaining application types listed above, copper algaecide use in pools, spas, and fountains is most likely to have a potential to release meaningful quantities of copper into runoff. A rough estimate of this algaecide use can be made by assuming that the swimming pool, spa, and fountain use of copper pesticides with multiple uses is proportional to the fraction of products labeled for pool, spa, and fountain applications. This assumption gives a rough estimate of <95,000 pounds. Assuming that less than 5% of this copper is discharged to storm drains, a rough load estimate would be <5,000 pounds.

3.5.3 Control Measures

Control measures are available for all types of copper pesticide uses. In the San Francisco Bay Area, control measures have focused on copper algaecide uses.

Algaecides for pools, spas, and fountains. Currently, the primary control measure to prevent copper releases from pools, spas, and fountains to San Francisco Bay is public outreach. Outreach discourages uses of copper (copper-free alternatives, such as hypochlorite-containing shock treatments, are available), and encourages discharge of copper-containing pool, spa, and fountain water to the sewer, not the storm drain. SCVURPPP developed model source control measures for pools, spas and fountains. These model measures provide (1) that there be no direct discharge of pools to storm drains or sanitary sewer manholes; (2) pools should be drained to the sanitary sewer via a clean-out (with POTW permission); and (3) for new pools, local codes should require installing a clean-out in accessible area near the pool. In the lower South San Francisco Bay, outreach about copper-containing algaecide use and pool water discharge started in the mid-1990s. Outreach programs target both residential pool owners and pool maintenance professionals. SCVURPPP has concluded that effectiveness of these programs cannot be measured at this time (instead, performance evaluation is based on the quantity of outreach materials distributed) (SCVURPPP, 2004).

Other algaecides applied to surface waters. The primary control measure for copper-based pesticide applications to surface waters is the Aquatic Pesticide General Permit program, managed by the State and Regional Water Quality Control Boards. (Certain municipal stormwater permits also include provisions requiring development of performance standards for aquatic pesticide applications.) The aquatic pesticide general permit requires an Aquatic Pesticides Application Plan describing best management practices to mitigate effects to water quality resulting from pesticide application, monitoring, and reporting of pesticide applications and monitoring results to the Regional

Water Quality Control Board (SWRCB, 2004a). In response to permit requirements, copper algaecide use in lagoons and sloughs discharging to San Francisco Bay has declined significantly (RWQCB, 2004a).

Alternative algae control methods. In addition to applying registered pesticides, aquatic pests can be controlled with biological, physical, and mechanical control methods, non-conventional chemical control methods, and/or preventive measures. Some alternative control measures have the potential to impact water quality and aquatic habitats adversely, though a study by SFEI showed that many alternatives had lesser impacts than aquatic pesticides (Greenfield, 2004). Appropriate alternatives methods need to be identified on a site-specific basis, which means that testing is a necessary step in transitioning to a non-copper control measure. The relative cost-effectiveness of conventional pesticides versus alternative methods varies among different management scenarios (Mann and Wittmann, 2003).

Copper landscaping pesticides. Currently there are few control measures in place specifically addressing copper-based pesticides used in landscaping. Some municipal integrated pest management policies include measures to limit use of copper-based pesticides. Little or no public outreach regarding use of copper pesticides has occurred. The transition to integrated pest management (IPM) by municipalities and efforts to promote IPM to communities are likely to reduce use of copper-based pesticides, but the reduction is unknown. Because copper-based landscaping pesticides are often less toxic to humans than alternative pesticides, any transition away from copper landscaping pesticides needs to be managed with caution.

Copper wood preservatives. The U.S. EPA phase-out of chromated copper arsenate (CCA) has stimulated a transition to other copper-based wood preservatives. Colloquial information suggests that the most commonly available alternatives are also copper-based (but do not contain chromium or arsenic), such as copper naphthenate and ammoniacal copper quat. Borates are also commonly available, but are intended primarily for indoor (dry) applications. Based on an evaluation of wood preservative alternatives, San Francisco is considering adoption of a policy to minimize use of copper wood preservatives for structures built in or over water or where significant runoff would contact the treated wood (Dickey, 2003). Non-wood alternative materials, rather than wood treated with a different wood preservative, are likely to be environmentally preferable—but some alternative materials have potential adverse environmental effects (Dickey, 2003).

Regional copper-based pesticide sales or use restrictions. Another possible option is to ask DPR to consider regulating copper-containing pesticides. Given the relative magnitude of the potential copper load and the cost of alternative control measures, regulation would be most cost-effective for controlling copper-based pool, spa, and fountain algaecides. This option has not been explored to date. DPR generally requires quantitative information about the water quality and/or permit compliance problems associated with a pesticide (including quantification of the pesticide's relative contribution to the problem) before it will consider restricting a pesticide's sales and use.

3.5.4 Uncertainty

Given the major data gaps, the estimated release from copper pesticides is highly uncertain. Sources of uncertainty in the current estimate include (but are not limited to):

- *Sales data*. Extrapolation of statewide pesticide sales data to the San Francisco Bay Area creates highly uncertain pesticide sales estimates. The lack of sales data

for 8 of the 19 copper-containing pesticides on the market only increases the uncertainty of the estimates made in this analysis.

- *Region-specific factors*. Estimates do not account for climate, lot size, regional pest problems or other reasons that pesticide use per person might vary across the state.
- *Simplifying assumptions*. The analysis relies on many simplifying assumptions (primarily regarding the relative importance of various uses of each copper-containing pesticide active ingredient), each of which is noted in the text above.
- *Washoff rates*. Pesticide wash-off rates are based on very limited data.
- *Inaccuracies in DPR databases*. In general, DPR quality assurance programs ensure that DPR databases provide data with low uncertainty; however, review of records of surface water applications of copper-containing pesticides identified discrepancies between DPR records and reports filed with the Regional Water Quality Control Board, suggesting that the database does not include accurately classification of use reports (or possibly that some uses reported to the Water Board were not reported to DPR).
- *Assumptions about pool, spa, and fountain algaecides*. The load estimate relies on two assumptions that cannot be verified—(1) the assumption that the swimming pool, spa, and fountain use of copper pesticides with multiple uses is proportional to the fraction of products labeled for pool, spa, and fountain applications and (2) the assumption that less than 5% of this copper is discharged to storm drains.

3.4.5 Next Steps

- *Load Estimate*. Given the potential magnitude of copper releases from algaecides, an improved estimate of the copper load from algaecides (primarily pool, spa, and fountain algaecides) is a priority. Such a load estimate could determine whether voluntary programs are sufficient or regulatory programs (*e.g.*, sale and use restrictions and/or more stringent controls on pool, spa, and fountain water management) are warranted.
- *Control Measures*. Evaluate alternative practices and pesticides for landscaping to determine if safe and effective alternatives exist. Consider developing best management practices for wood preservatives to minimize use of copper wood preservatives where releases are most likely to occur. Since the Aquatic Pesticides General Permit regulates surface water algaecide applications, additional controls should not be needed (unless the permit does not continue to create a disincentive for copper use). Appropriate control measures for pool, spa, and fountain algaecides should be determined on the basis of a better load estimate.

3.6 Industrial Copper Use

Industry has long been a focus of environmental regulatory programs, including both wastewater pretreatment and stormwater permit programs. Any industrial facility in one of 10 broad categories of industrial activities must participate in the State Water Resources Control Board's industrial stormwater permit program. About 1,400 industrial facilities in the San Francisco Bay Area are currently active participants in the program.

The *Metals Control Measure Plan* used a specialized estimate based on industrial stormwater runoff monitoring data compiled from the industrial stormwater permit program (Grotte, 1996; SCVURP, 1997). That analysis involved special categorization of industry to separate out metal-using industry categories and to focus particularly on

three types of companies with relatively high copper levels in their reported monitoring data (electroplaters, metals finishers, and semiconductor manufacturers) (Grotte, 1996).

Subsequently, three Santa Clara Valley studies looked at elements of the *Metals Control Measure Plan* industrial copper load estimate. A detailed analysis of facilities in Palo Alto and Mountain View found that the previous estimates were imperfect, but the variations in subsequent monitoring data suggested that the imperfections reflect, in part, real variation in industrial monitoring data (Cooke and Bodine, 1997). Similarly, two subsequent studies of Santa Clara Valley electroplaters, metals finishers, and semiconductor manufacturers concluded that results were similar to previous estimates, given the inherent variability of the data (SCVURPPP, 1998; SCVURPPP, 2003b).

3.6.1 Background

Although quite a few industrial activities involve use of copper-containing materials, many of these activities occur indoors, where most copper releases would not have the potential to be released to runoff. Certain processes—like heated plating tanks—could potentially release droplets of copper-containing solutions into building air exhaust system and out onto building roofs and the surrounding area (SCVURPPP, 1998).[20]

3.6.2 Copper Loads

The specific analysis conducted for the *Metals Control Measure Plan* cannot be repeated with available information. While a similar analysis of region wide industrial stormwater monitoring data would be useful, such a significant effort was not possible within this project's scope and budget.

Since no recent or region-wide analysis of industrial stormwater monitoring data has been identified, the estimate used in the *Metals Control Measure Plan* was assumed to be sufficiently representative of current industrial stormwater discharges to be extrapolated to a Bay-wide estimate. The extrapolation on the basis of the number of acres of industrial facilities in the San Francisco Bay Area (89,266), as determined from the State Water Resources Control Board Industrial Stormwater Database for the San Francisco Bay Area (SWRCB, 2004b). Since previous total industrial acreage was not available, the number of acres of industrial facilities in Santa Clara County (18,835) was assumed to have remained constant since 1997. The extrapolated copper load is 3,300 pounds per year.

3.6.3 Control Measures

The primary control measure for industrial runoff is the Industrial Storm Water General Permit program, managed by the State and Regional Water Quality Control Boards. The industrial stormwater permit requires the implementation of management measures that will achieve the performance standards of "best available technology economically achievable" and "best conventional pollutant control technology." Facilities covered by the permit must prepare and implement Storm Water Pollution Prevention Plans and monitoring plans. The state regulatory program is supplemented by the required commercial/industrial element of municipal stormwater programs.

Individual municipalities have explored a variety of methods to enhance the effectiveness of their industrial stormwater programs. For example:

[20] Copper that is emitted to the air is considered in Section 3.7.

- Many municipalities combine industrial stormwater inspections with other routine inspections of the same facilities (*e.g.*, by wastewater pretreatment programs or certified unified program agencies).
- On the basis of its investigations of copper in industrial runoff, the Santa Clara Valley Urban Runoff Pollution Prevention Program initiated a unique pilot outreach campaign designed to increase compliance with industrial stormwater permit requirements. The effort includes a partnership with industry to increase familiarity with practical best management practices to reduce pollutant levels in runoff. The effectiveness of this pilot project has not yet been evaluated (SCVURPPP, 2003b).

No data are currently available to estimate the effectiveness of these regulatory and education programs in reducing copper discharges.

3.6.4 Uncertainty

Although the estimate involves significant extrapolations, since it was based on actual industrial runoff monitoring data, the industrial copper load estimate is moderately uncertain. Sources of uncertainty in the current estimate include (but are not limited to):

- *Monitoring data*. The estimate assumes that previous monitoring data is representative of current industrial stormwater discharges (regulatory efforts have probably reduced the industrial copper load.)
- *Extrapolation*. The estimate assumes that the previous estimate is representative of the industrial contribution to runoff from all industrial facilities.
- *Industrial facility area*. The estimate assumes that the number of acres of industrial facilities in Santa Clara County have remained constant since 1997 (substantial growth followed by a substantial economic downturn have occurred since that time.)

3.6.5 Next Steps

- *Load Estimate*. Although the load estimate is uncertain, given that the control measures are unlikely to change, a more accurate load estimate is not necessary at this time. Using industrial stormwater permit data to compare previous and current pollutant loads could, however, be generally helpful in understanding the efficacy of stormwater permits as a control measure.
- *Control Measures*. Since the Industrial Storm Water General Permit already regulates industrial runoff, additional controls are not needed.

3.7 Copper Air Emissions

Air deposition conveys copper from copper air emissions sources into San Francisco Bay and onto surfaces subject to urban runoff. The actual emissions sources of the copper deposited onto the Bay and Bay watersheds are not fully known at this time. Sources include vehicle fuel combustion, fires, industrial air emissions, vehicle components, soils, and industrial air emissions.

The *Metals Control Measure Plan* estimated copper emissions from motor vehicle fuel combustion, but not from other copper air emissions sources. The basis of the *Metals Control Measure Plan* estimates was the California Air Resources Board model BURDEN7F. The metals data in this model are not recent—in fact they represented emissions from leaded gasoline, which was phased out in 1992. Although the copper emissions estimates were not noteworthy, the emissions estimates for several metals were high enough to merit follow-up investigation to obtain a more accurate—and

region-specific—load estimate. BASMAA coordinated with the California Air Resources Board and the University of California Santa Cruz to measure metals concentrations in San Francisco Bay Area gasoline and diesel fuel (Brosseau, 2004).

In 2001, the San Francisco Estuary Institute (SFEI) published results of a pilot study to measure wet and dry deposition of copper and other metals in the San Francisco Bay area (Tsai *et al.*, 2001). The report included an estimate of the quantity of copper deposited from the air into Bay Area watersheds and—based on a general estimate of the wash-off fraction—the estimated copper load to San Francisco Bay from air-deposited copper. Samples were collected at locations somewhat away from human activity with the intent of obtaining a regional background load estimate not influenced by specific sources (like roads or industrial facilities). While this report did not identify the copper emissions sources, it provided a relatively reliable estimate of the contribution of copper deposited from the air to the quantity of copper in urban runoff.

3.7.1 Background

Air emissions may result from ordinary industrial or residential activities, like combustion of industrial fuels and firewood containing trace amounts of copper. Although copper emissions have not been a focus of air quality agencies, air pollutant emissions from industrial facilities and from vehicles are closely regulated by California air quality agencies.

In the San Francisco Bay Area, vehicle fuel combustion has proven of interest to water quality agencies due to the relatively large volume of fuel used in the Bay Area. Each day, almost 9 million gallons of gasoline and more than one million gallons of diesel fuel provide the power for San Francisco Bay Area vehicles to travel 167.2 million miles (BAAQMD, 2004). Given these fuel volumes, there exists the potential that even trace impurities in fuels could result in environmentally meaningful releases of water pollutants. Unlike lead, copper is not intentionally added to motor vehicle fuels. Copper is an impurity that comes from the crude oil or from equipment in the refining process. Because fuel transportation is expensive, motor vehicle fuels are typically distributed regionally. Most of the San Francisco Bay Area's supplies come from the region's own oil refineries. The characteristics of fuel in a region are defined by the oil source, and to a lesser extent the specific refinery processes used to create the fuel from crude oil.

3.7.2 Copper Loads

3.7.2.1 Copper Release to Bay Area Watersheds

Although some fraction of copper emissions travel outside the Bay Area, because deposition patterns are source specific and unknown, all release estimates below assume that all emitted copper is deposited in Bay Area watersheds.

Vehicle Fuels. Pre-publication data provided by BASMAA (Brosseau, 2004) was used to estimate the copper releases from motor vehicle fuel combustion. Eighteen diesel fuel samples and 19 gasoline samples (five premium, one mid-range, 13 regular) were tested for copper concentrations. Copper was not detected in most samples; it was detected in one diesel and one premium gasoline sample. Assuming that these detects represent normal variation in copper concentrations, an average copper concentration range of 0.6 – 8 parts per billion (ppb) was calculated for the diesel samples (low value assumes non-detected values were 0; high value assumes that non-detected concentrations equaled the detection limit). The concentrations were similarly averaged to estimate a copper concentration range of 0.7 – 8 ppb for gasoline, assuming that the sample mix was adequately representative of the sales fraction of the three gasoline grades. Fuel

densities were assumed to be equal to the density of octane (gasoline) and cetane (diesel) (Lide, 1998).

Fuel use estimates were obtained as follows:

- *Gasoline*. BAAQMD estimates 2003 San Francisco Bay Area gasoline use was 8.8 million gallons per day (BAAQMD, 2004).
- *Diesel*. Since BAAQMD did not provide a diesel fuel use estimate, diesel use was estimated on the basis of statewide fuel use data from the California Department of Finance (DOF, 2002b). Assuming the fraction of the state's diesel used in the San Francisco Bay Area is the same as the fraction of the state's gasoline used in the Bay Area (21%), about 1.6 million gallons of diesel are used daily in the San Francisco Bay Area.

On the basis of this data, the copper released to Bay Area watersheds is estimated to be in the range of 10-200 pounds.

Industrial Air Emissions. The Bay Area Air Quality Management District (BAAQMD) prepares an annual inventory of air toxics emissions in the San Francisco Bay Area, based on reports from facilities with air pollutant emissions permits (BAAQMD, 2003). Although copper emissions are not required to be reported by any facility emitting less than 463 pounds per year, 53 industrial facilities reported a total of 410 pounds of copper air emissions in 2001 (BAAQMD, 2003).

Fires. The Copper Development Association (CDA) estimated statewide copper releases from residential wood burning and forest fires (CDA, 2003b). Bay Area emissions can be roughly estimated on the basis of these statewide estimates.

- *Residential wood burning*. CDA estimated annual copper emissions of 1371 pounds statewide (CDA, 2003b). Assuming wood burning is proportional to population, Bay Area emissions would be 19.7% of statewide emissions (based on a California population of 35,591,000 and a San Francisco Bay Area population of 6,994,500 as of January 1, 2003 [DOF, 2003]), or 270 pounds.
- *Forest fires*. CDA estimated annual copper emissions of 1720 pounds statewide (CDA, 2003b). Assuming forest fire emissions are proportional to land area, Bay Area emissions would be 4.0% of statewide emissions (based on the Bay Area Air Basin area of 6,619 square miles [BAAQMD, 2004] and California land area of 163,696 square miles [DOF, 2002b]), or 69 pounds.

Together, these emissions total 340 pounds. These estimates do not include emissions from structural fires, which could release copper from wood and other copper-containing building components.

3.7.2.2 Copper Washoff into Urban Runoff

Copper deposited on Bay Area watersheds from both wet and dry deposition may run off to San Francisco Bay. SFEI estimated that 32% of copper in both wet and dry deposition is washed into San Francisco Bay (Tsai *et al.*, 2001). In the absence of source-specific washoff information, this analysis assumes that the SFEI estimate is applicable to all air deposition sources.

3.7.2.3 Annual Copper Load

Using the above copper release and wash-off fraction estimates, the loads from identified copper air emissions sources can be estimated as follows:

- *Vehicle Fuels*. If 32% of the 10 to 200 pounds of copper emitted from fuel combustion is washed into the Bay, the copper load would be 3 to 64 pounds per year.
- *Industrial air emissions*. If 32% of the 410 pounds of reported industrial copper emissions are washed into the Bay, the copper load would be 130 pounds per year.
- *Fires*. If 32% of the estimated release of 340 pounds is washed off, the copper load would be 110 pounds per year.

The total of the above copper loads (240 to 300 pounds per year) is substantially less than SFEI's total estimate of copper load to San Francisco Bay from copper air deposition in Bay Area urban watersheds, 8,800 pounds per year (Tsai *et al.*, 2001).

3.7.3 Control Measures

No control measures specific to copper air emissions have been identified. The BAAQMD regulates industrial air emissions to reduce releases of various air pollutants, including toxic air pollutants. It also conducts education programs that address all pollutant sources, including residential fireplaces. Many measures that reduce air pollution would also reduce copper emissions. Because the BAAQMD has not identified copper-containing compounds as a source of air quality problems, it has not specifically addressed copper emissions other than through the reporting requirements of its air toxics program.

The California Air Resources Board regulates air emissions from vehicles. While regulations technically address all air emissions, they focus on tailpipe emissions, which are significant contributors to major air quality problems in California. Vehicle emissions control devices probably remove some of the copper prior to emission from a vehicle's tailpipe. This amount is unknown.

Measures to reduce vehicle miles traveled would reduce copper air emissions from diesel and gasoline fuel combustion. (See Section 3.3.3 for a discussion of these measures).

3.7.4 Uncertainty

The total air deposition quantity is based on actual measurements of copper deposition in the Bay area. After reviewing the data behind the estimate, its uncertainty was determined by SFEI to be low to moderate (Tsai *et al.*, 2001). Sources of uncertainty in the estimates in this report include (but are not limited to):

- The *industrial air emissions* estimate may significantly understate copper air emissions, because BAAQMD does not require reporting of copper emissions less than 463 pounds per year. All reporting facilities emitted less than the reporting threshold. The high threshold may mean that many emitters are not reporting emissions.
- The *vehicle fuel* estimate does not reflect any potential vehicular emissions from metals worn from engine parts that come in contact with the fuel, nor any metals losses within a vehicle engine or exhaust system.
- The *fire* estimate does not include emissions from structural fires.
- *Vehicle brake pads* are known to release copper to the air but are not included in this estimate because they are considered in Section 3.3. The extent to which air deposition measurements reflect copper from vehicle brake pads is currently not known. Investigations underway by the Brake Pad Partnership will estimate the

transport distance of vehicle brake wear debris. Using this information and information about the SFEI air deposition monitoring sampling locations, it will be possible to estimate the contribution of vehicle brake pads to the air deposition load estimated by SFEI.

- The contribution of *other copper air emissions sources*, such as wind and vehicle suspension of soils, is unknown.

3.7.5 Next Steps

- *Load Estimate*. Identification of the copper emissions that are the sources of measured air deposition is a priority. Since copper from vehicle brake pad wear may contribute to the measured deposition, the most cost-effective approach would be to wait to initiate the source investigation until after the Brake Pad Partnership completes its air deposition modeling (anticipated in spring, 2005).
- *Control Measures*. Additional controls on identified sources are not warranted. Feasibility of control measures for other copper air emissions sources should be explored once those sources are identified.

3.8 Soil Erosion

Each year, hundreds of construction sites cover thousands of acres of San Francisco Bay Area land, digging up the soil to build new homes, businesses, industries, and infrastructure. In order to prevent releases of soil and other pollutants into stormwater runoff, the State Water Resources Control Board requires all construction sites larger than 1 acre to participate in the construction stormwater permit program. There were about 700 active construction sites in the San Francisco Bay Area in 2003 (SWRCB, 2004b).

Construction of new impervious surfaces in Bay Area watersheds also changes the quantity and timing of runoff flows in urban creeks. These changes can accelerate erosion of stream banks—potentially contributing significantly to sediment loads in runoff. Recent new development related amendments to urban runoff agency permits require development of hydromodification management plans to protect beneficial uses in Bay Area creeks.

The copper load estimate in the *Metals Control Measure Plan* used construction stormwater permit data and a rough estimate of erosion to estimate construction copper loads. Since that time, expansion of the permit system to include sites as small as 1 acre has probably reduced construction site soil erosion and thus copper loads. The *Metals Control Measure Plan* assumed that remaining sediments in urban creeks were from natural erosion. Any contribution from changes in creek flows or other urban activities (*e.g.*, landscaping) was not identified or estimated.

In runoff, eroded soils become "suspended solids" because they are entrained in water flows before they deposit in creeks or the Bay. The San Francisco Estuary Institute (SFEI) estimated the total quantity of suspended solids in urban runoff in the report *Contaminant Loads From Stormwater to Coastal Waters in the San Francisco Bay Region* (Davis *et al.*, 2000). The study estimated that about half (51%) of the solids in Bay Area stormwater come from agricultural land uses. Open space (22%) and urban areas (residential, commercial, and industrial land uses, 27%) each comprised about a quarter of the solids load.

3.8.1 Background

San Francisco Bay area soils—like soils from elsewhere in the nation—contain trace levels of copper naturally. When soil washes off urban areas, it carries copper with it to San Francisco Bay. While a certain amount of soil erosion is normal, human activities in Bay Area watersheds have accelerated soil erosion. Watershed modifications like dams and flood control projects also change the flow of sediments to San Francisco Bay.

3.8.2 Copper Loads

3.8.2.1 Construction Sites

The estimation method from the *Metals Control Measure Plan* was used to estimate the regional copper releases to urban runoff from copper in construction site soils, starting with data from the State Water Resources Control Board Construction Stormwater Database for the San Francisco Bay Area (SWRCB, 2004b). The methodology involves the following estimates:

- *Area under construction*. Using the information in the database, the average number of acres under construction during the rainy season (November-April) in 2003 was estimated to be 9,067 acres.
- *Erosion rate and soil copper concentrations*. The *Metals Control Measure Plan* values (7,500 pounds per acre and 38.57 mg/kg, respectively) were used.

Using the above values, the copper load from construction sites is estimated to be about 2,600 pounds per year.

3.8.2.2 Development-Related Hydromodification

No basis exists to prepare a specific quantitative estimate of the copper load from hydromodification of Bay Area urban creeks. The way creeks are affected by changes in flows are highly variable, depending on the characteristics of the watershed and the new development. Preparing an estimate would require an assessment of each Bay Area watershed affected by hydromodification. The load can, however, be bracketed by the copper load estimated from total urban suspended solids loads (below).

3.8.2.3 Annual Copper Load—All Soil Erosion Sources

Using SFEI's best estimate of suspended solids discharges in stormwater runoff and the *Metals Control Measure Plan* soil copper concentration estimate, the annual copper load in urban runoff from soil erosion can be estimated. SFEI estimates that 27% of the best estimate of 680,000,000 pounds of suspended solids in all Bay Area runoff is from urban areas—a total of 180,000,000 pounds of solids. These solids contain about 7,000 pounds of copper attributed to urban soil erosion.

3.8.3 Control Measures

Control measures are already in place for both construction and hydromodification-related soil erosion.

Construction. The primary control measure for construction site stormwater is the Construction Storm Water General Permit program, managed by the State and Regional Water Quality Control Boards. Facilities covered by the permit must prepare and implement Storm Water Pollution Prevention Plans and monitoring plans. The state regulatory program is supplemented by the required new development and construction controls element of municipal stormwater programs.

Individual municipalities have explored a variety of methods to enhance the effectiveness of their construction stormwater programs. For example, many municipalities combine construction stormwater inspections with other routine inspections of the same sites (*e.g.*, by building code enforcement). Construction stormwater best management practices information is routinely distributed by municipal building departments. As municipalities incorporate new requirements for post-construction stormwater treatment measures, they are changing their relationships with construction sites, which may modify the level of oversight occurring during the construction phase.

No data are currently available to estimate the effectiveness of the regulatory and education programs in reducing copper discharges.

Hydromodification. The primary control measure for soil erosion from creek hydromodification due to urban development is the hydromodification management requirement within the new development requirements incorporated in Bay Area stormwater agency permits. This requirement addresses new development; it does not require retrofitting to manage erosion increases from past development, which may continue to occur for many years after the development is in place. Municipalities are just beginning to implement the required planning actions, so no data are available regarding their effectiveness in reducing soil erosion.

3.8.4 Uncertainty

On the basis of the uncertainty in SFEI's total sediments load estimate Davis *et al.*, 2000), the soil erosion copper load estimate is moderately uncertain. Sources of uncertainty in the current estimate include (but are not limited to):

- *Hydromodification-related sediment loads*. Although site-specific studies have included sediment load estimates, no regional assessment of hydromodification-related sediment loads has been prepared. Site-specific studies (*e.g.*, SCVURPPP, 2003a) suggest that hydromodification related sediment loads—and thus copper loads—have the potential to be significantly higher than the <5,000 pounds suggested by the regional total sediment load estimate minus the construction load estimate.
- *Construction site sediment releases*. The primary source of uncertainty in the construction estimate is that the sediment release estimate, which is based on colloquial information and does not account for the soil erosion reductions achieved by the use of construction site best management practices required by construction stormwater permits. Metals concentrations used in the estimate (data from the Calabazas Creek watershed in Santa Clara Valley) may not be representative of copper concentrations in soils elsewhere in the Bay Area.
- *Omission of small construction sites*. Since the Construction Stormwater Database does not includes sites smaller than 1 acre, small sites are not included. While small sites may contribute additional copper loads, this error is expected to be less important than other sources of uncertainty.
- *Omission of soil erosion from non-construction urban activities*. Accelerated soil erosion due to ordinary residential and business activities other than construction (such as landscaping) are not included in the load estimate.

3.8.5 Next Steps

- *Load Estimate*. Given that the control measures are unlikely to change, a more accurate load estimate is not necessary at this time. Using the construction stormwater permit data to compare previous and current sediment loads could, however, be generally helpful in understanding the efficacy of stormwater permits as a control measure.
- *Control Measures*. Since the Construction Storm Water General Permit already regulates construction stormwater runoff, and the new development hydromodification planning requirement will control hydromodification-related soil erosion, additional controls are not needed.

3.9 Copper in Domestic Water Discharged to Storm Drains

Most of the San Francisco Bay Area's drinking water supply flows into homes and businesses, where it is used indoors and discharged to the sewer—or piped outdoors to irrigate landscaping. A small fraction of drinking water flows into gutters and storm drains from activities like hydrant flushing, water main cleaning, outdoor water-based cleaning activities, and irrigation overflows. This water carries the traces of copper it contains into creeks and San Francisco Bay.

The *Metals Control Measure Plan* used detailed South Bay-specific information to estimate copper levels in the drinking water supply. This information was combined with a somewhat generic estimate of the fraction of drinking water that flows to storm drains (10% of the volume of drinking water not discharged to sewers). The estimate assumed that all drinking water flows through copper pipes. Most of the estimated copper load was from corrosion of copper pipe.

3.9.1 Background

Copper in the drinking water supply comes from the following sources:

- *Trace copper in the raw water supply*. This copper comes from natural minerals, or (in river water supplies) from upstream stormwater and wastewater discharges to the water source.
- *Algaecides*. To control nuisance algae—and prevent the unpleasant taste and odor associate with it—some water supply agencies apply copper-containing algaecides to reservoirs.
- *Corrosion of copper pipes in buildings*. Although copper pipe is long-lasting, it slowly wears down during use, through a combination of chemical corrosion and physical erosion of the pipe surface. Corrosion rates—and therefore drinking water copper content—vary by water supply, depending on factors like pH and trace ionic composition.

Most—but not all—drinking water receives some type of purification treatment prior to distribution to homes and businesses. Water purification treatments typically remove a portion of the copper in the source water. Subsequent to purification, disinfectants (*e.g.*, chlorine or chloramines) and additives to modify the water supply's corrosivity and fluoride levels are added. Because additives are high purity chemicals, they are not believed to add significant amounts of copper to the water supply.

3.9.2 Copper Loads

No additional information was identified to improve the load estimation method used in the *Metals Control Measure Plan*. Since water use is generally proportional to

population, the previous copper load estimate (700 pounds/year) was adjusted on the basis of the ratio of the San Francisco Bay Area population–6,994,500 (DOF, 2003) to the 1995 Santa Clara County population—1,568,200 (DOF, 2002a),[21] to estimate that copper releases from urban storm drains discharge of drinking water is 3,000 pounds per year.

3.9.3 Control Measures

Both reducing discharge of drinking water to storm drains and reducing the copper level in drinking water can reduce copper loads from domestic water discharged to storm drains.

Reducing storm drain discharges. Most San Francisco Bay Area water suppliers have water conservation programs; some municipalities also have their own programs. These programs work in tandem with public outreach from municipal stormwater programs. However, most such programs emphasize messages other than reducing drinking water discharges to storm drains. Two water conservation pilot programs by the Irvine Ranch Water District (IRWD) have recognized and evaluated storm drain discharge reductions as a benefit of improved irrigation water management (IRWD, 2004).

- Installation of evapotranspiration irrigation controllers and generally improving irrigation water management in a test neighborhood reduced dry weather storm drain discharges by about 20% (IRWD, 2003).
- Wick irrigation of lawns is being tested in lawns; this method has the potential to almost eliminate lawn irrigation-related storm drain discharges.

Although IRWD materials do not specify the costs of these measures, costs are not insignificant, as these systems required physical installation of new irrigation controllers and/or new irrigation water distribution systems, in addition to outreach and education.

Reducing copper levels in drinking water. Water suppliers and wastewater treatment plants have explored options to reduce copper levels in drinking water. These options have been explored on a voluntary basis, because only the California Department of Health Services regulates drinking water supply quality. Many water suppliers have reduced copper-based algaecide use (see Section 3.5). Water supply modifications to reduce corrosivity have proven more challenging. The potential for copper reduction is very water supply specific, thus specific measures need to be developed and tested just to determine if reductions are feasible. Water suppliers vary in their willingness to consider modifying water supply corrosivity; they must grapple with customer acceptance, regulatory, cost, and management issues.

3.9.4 Uncertainty

Because of the many region-specific data used in the estimate extrapolated to the Bay Area, this estimate has moderate-high uncertainty. Sources of uncertainty in the current estimate include (but are not limited to):

- *Contact with copper pipe*. Most of the estimated copper load comes from the assumption that all discharged water flows through copper pipes. Since exterior copper pipes are relatively rare, this is approximately the same as assuming that discharged water flows through buildings. Much of the water discharged to storm drains never enters buildings. For example, water for hydrant flushing, water main cleaning, water supply system leaks, and some irrigation water—particularly for

[21] The *Metals Control Measure Plan* water supply use estimate was based on 1995 data.

common irrigation overflow locations like median strips and large landscaped areas—never enters copper pipe.

- *Fraction of drinking water discharged to storm drains*. The estimate of the amount of drinking water discharged to storm drains is based on limited data from Santa Clara Valley water purveyors and wastewater treatment plants, and the assumption that storm drain discharges comprise 10% of the volume of drinking water not discharged to sewers. This estimate may not reflect conditions elsewhere in the Bay Area, and may not accurately reflect discharge volumes.
- *Representativeness of Santa Clara Valley water supply copper data*. The copper concentrations in water supplies in other portions of the Bay Area differ from those in Santa Clara Valley. It is uncertain whether this might bias the estimate high or low.

3.9.5 Next Steps

- *Load Estimate*. Developing a more accurate estimate would be costly, and would be unlikely to modify the ability to control the discharge.
- *Control Measures*. Since the available control measures are already being pursued by other agencies and have shown only limited efficacy, additional controls are not warranted.

3.10 Vehicle Fluid Leaks and Dumping

Photos of motor oil in water bodies—and the negative public reaction to this visible water pollution—was one of the motivations for initiation of Federal programs to regulate urban stormwater runoff. Oil spots in streets, parking lots, and driveways remain a visual reminder of this ubiquitous source of water pollution.

Since their inception, municipal urban runoff programs have targeted illegal dumping and other improper discharges of pollutant-containing materials. Although little quantitative data are available to characterize improper discharges, increasing public awareness that storm drains carry water directly to creeks, San Francisco Bay, and the Pacific Ocean without treatment suggests that urban runoff programs have reduced improper discharges. Regulation of industrial and certain commercial discharges has terminated thousands of improper discharges in the San Francisco Bay area, eliminating many potential copper sources. Since municipalities focused on eliminating—rather than measuring—improper discharges, little or no quantitative data exists on such copper releases.

The *Metals Control Measure Plan* used colloquial and limited quantitative information to estimate copper releases from leaks and illegal dumping of vehicle fluids (motor oil and coolant). A recent study also estimated the potential contribution from vehicle fluids to copper in urban runoff, finding a negligible contribution (Davis *et al.*, 2001). Measurements of copper concentrations in motor oil for that study found a typical concentration similar to that used in the *Metals Control Measure Plan* estimate. While other copper-containing improper discharges certainly occur, it is likely that urban runoff education and regulatory programs have directed the most copper-laden of these discharges (*e.g.*, cooling water, vehicle service facility discharges, commercial vehicle wash water) away from storm drains.

3.10.1 Background

Neither motor oil nor coolants typically contain meaningful concentrations of copper. While inside vehicles, both fluids pick up copper from copper and brass vehicle parts. Spent solutions may be enriched in copper and other metals.

3.10.2 Copper Loads

Previous estimates from the Metals Control Measure Plan were adjusted as follows:

- *Activity factor adjustment*. Adjustments were made on the basis of the activity factor used in the *Metals Control Measure Plan* (MCM Plan)—see Table 16. The number of registered cars and trucks (5,432,514 in 2002) was obtained from the Metropolitan Transportation Commission (MTC, 2004a). The annual vehicle miles value (167.2 million miles per day or 6.1×10^{10} miles per year in 2003) was obtained from the Bay Area Air Quality Management District (BAAQMD) (BAAQMD, 2004).
- *Do-it-yourself vehicle maintenance survey data adjustment*. Two assumptions were adjusted on the basis of a statewide do-it-yourself vehicle maintenance survey by the California Integrated Waste Management Board (CIWMB, 2002). The estimated fraction of do-it-yourself fluid changes was reduced from 50% to 19% and the estimated improper disposal fraction was reduced from 50% to 19%.

Table 16. Motor Vehicle Fluid Improper Discharge Estimates

Improper Discharge	Previous Estimate (lb Cu/yr)	Previous Activity Factor	Current Regional Activity Factor	Regional Estimate (lb Cu/yr)
Coolant leaks	112	1,130,000 vehicles	5,432,514 vehicles	500
Coolant dumping	116	1.2×10^{10} miles driven per year	6.1×10^{10} miles driven per year	90
Oil leaks	<1	1,130,000 vehicles	5,432,514 vehicles	<1
Oil dumping	7	1,130,000 vehicles	5,432,514 vehicles	4
Total				**600**

Source: TDC Environmental calculations based on data sources and assumptions above.

3.10.3 Control Measures

All municipal urban runoff programs include commercial/industrial, illicit discharge, and public information programs as core program elements. Together these program elements address all types of improper discharges. Other than the survey information used in developing the load estimate (which implies a reduction in illegal dumping), no quantitative data are currently available to estimate the effectiveness of these regulatory and education programs in reducing improper discharges of vehicle fluids.

3.10.4 Uncertainty

Given the paucity of data characterizing improper discharges, the estimate is moderately-highly uncertain. Sources of uncertainty in the current estimate include (but are not limited to):

- *Copper concentrations in waste oil and coolant are from rather elderly sources*. Current copper levels in waste fluids may differ, particularly because manufacturer-recommended fluid replacement frequencies are lower, so fluids spend more time in contact with copper-containing vehicle parts.
- *Manufacturer-recommended fluid change frequencies have decreased*.
- *Leakage and dumping estimates were based on colloquial information*. Data gaps include quantity, frequency, and copper content of improper discharges. In the

absence of authoritative data on leakage and dumping rates, the *Metals Control Measure Plan* relied on colloquial information and professional judgment. Given the effectiveness of education programs and improved vehicle designs in the last decade, both leak and dumping rates are likely to have declined.

- *Estimates assume that all released copper flows to San Francisco Bay*. Some or all of the copper in leaked fluids is likely to build up and wash off in a manner similar to other anthropogenic copper deposited on impervious surfaces, suggesting less than complete wash-off to San Francisco Bay (Carleton, 2004).

3.10.5 Next Steps

- *Load estimate*. Although the load estimate is uncertain, it is small enough that additional study of this source is not warranted.
- *Control measures*. Control measures already in place have addressed this source. Given the relatively small load estimate, additional controls are not warranted.

3.11 Sources Not Evaluated

In theory, there are thousands of potential sources for copper in urban runoff and shoreline activities. Since the purpose of this report was to identify major sources, it does not include a comprehensive review of other possible copper sources. This subsection provides a brief description of the reasons for omission of some of the copper sources mentioned in previous studies or in the literature.

The following "sources" convey copper from primary copper sources into urban runoff:

- Runoff from residential, commercial, industrial, and institutional land uses
- Car washing
- Streets
- Parking Lots

The following are copper sources, but are not significant sources to urban runoff or from shoreline activities:

- Wastewater treatment plants and all discharge sources to the sewer system
- Mines
- Local reservoir releases, including algaecides directly discharged
- Non-urban soil erosion
- Agricultural pesticide and fertilizer use
- Landfills

The following sources are anticipated to be relatively small sources of copper release in urban runoff:

- *Tires*. Other stormwater source identification studies have not found tires to be a significant copper source (Sorme and Lagerkvist, 2002; Davis *et al.*, 2001; CDA, 2003b). Although tires wear off on roads during use, the copper content of tires (about 2 parts per million) is relatively low (less than 10% of the copper concentration in Bay Area soils).
- *Illicit connections and improper discharges*. Illicit connections and improper discharges have been among the major focuses of urban runoff programs, which have sought to eliminate all identified improper discharges. Around the San Francisco Bay area, it is likely that thousands of discharge sources have been eliminated or redirected to the sewer system. Although copper-containing discharges (like cooling water from industry or debris from waste materials used in

sandblasting) may have occurred in the past, municipal, industrial, and construction stormwater permit requirements have ensured that regulators from Bay Area agencies and staff from local businesses and institutions have worked diligently to eliminate such discharges. It is unlikely that significant numbers of illicit connections remain after about 10 years of urban runoff regulation.

- *Building paint*. According to the Copper Development Association (CDA), copper pigments and biocides are commonly present in exterior paint. The CDA cites only one investigation of paint copper content, which found a medial concentration of 21 parts per million (CDA, 2003b). Since this concentration is relatively low (lower than the copper concentration in Bay Area soils) if the data are representative, paint is probably a negligible source.
- *Exposed electrical wires*. Most electrical wires are made of copper. The only identified exposed electrical wires in the Bay Area are those associated with San Francisco MUNI's electric bus and streetcar operations. The copper in these wires may wear off as streetcar electrical connections pass by them. These lines occur primarily (if not exclusively) in areas where the stormwater runoff flows to wastewater treatment plants, and thus are unlikely to contribute significantly to copper levels in San Francisco Bay area urban runoff.
- *Asphalt*. In an area with accelerated asphalt pavement wear due to use of studded snow tires, asphalt's contribution to urban runoff copper levels was estimated to be relatively small (Sorme and Lagerkvist, 2002).

While no previous copper source identification study has found the following sources to be significant, available information does not provide sufficient evidence to evaluate their significance:

- *Airplane brakes*. While airplane brakes are known to contain copper, the exact copper content is not known. The primary point of potential copper release is on airport runways. At larger airports runways are cleaned (frequency unknown). At most airports the runoff is subject to some type of treatment. At Bay Area airports without runoff management systems, the runoff flows through vegetated areas prior to entering a drainage system or a surface water body. Airport stormwater monitoring data would likely be able to shed light on whether airport runoff is elevated in copper as compared to other urban runoff.
- *Electrical motors*. Most electrical equipment is used indoors or in relatively weatherproof outdoor locations, as water and moisture-related corrosion may damage it. Electrical motors and generators contain parts that may wear off, potentially releasing copper-containing particles. Some older design motors ("brush DC") incorporate brushes that usually contain copper. If electrical motors are commonly placed in manners that do not contain wear debris—and if wear rates for copper-containing parts are significant—they could meaningfully contribute to copper levels in urban runoff.
- *Fertilizers*. CDA reports that about 54 million tons of commercial fertilizers were used in the U.S. in 1996 (CDA, 2003b). Many fertilizers contain copper, according to the CDA at concentrations from 0 to 39,900 parts per million (CDA, 2003b) The average copper concentration of fertilizers is not available. Since plants use the copper as a micronutrient, it is unclear how much copper enrichment of soil surfaces occurs as a result of fertilizer application. The fraction of this copper that may wash off is not known, though it would be reasonable to assume that wash-off fractions are

similar to those for copper-containing pesticides applied to soils and therefore are probably small.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

Conclusion 1. The significant sources of copper in urban runoff flowing to San Francisco Bay Area are vehicle brake pads, copper air emissions, architectural copper, industrial copper use, domestic water discharged to storm drains, soil erosion, and copper pesticides. Table 17 summarizes the copper load estimates and their uncertainties.

Table 17. Summary of Copper Sources in Urban Runoff (Pounds of Copper per Year Discharged to San Francisco Bay)

Copper Source	Load Estimate	Uncertainty[a]
Vehicle brake pads	>10,000	High
Estimate includes:		
Original equipment pads	*10,000*	
Replacement brake pads	*?*	
Brake pads on heavy-duty trucks, off-road vehicles, rail cars, and motorcycles	*?*	
Architectural copper	4,500	Moderate-High
Copper pesticides	<8,000 – <10,000	High
Estimate includes:		
Landscaping	*1,200 to 2,500*	
Wood preservatives	*1,400 to 2,800*	
Pool, spa, and fountain algaecides	*<5,000*	
Industrial copper use	3,300	Moderate
Deposition of copper air emissions	8,800[b]	Low to Moderate
Estimate includes:		
Diesel and gasoline fuel combustion	*3 – 60*	
Industrial facilities	*130*	
Residential wood burning and forest fires	*110*	
Unknown	*>8,000*	
Soil erosion	7,000	Moderate
Estimate includes:		
Construction	*2,600*	
Hydromodification	*<5,000*	
Copper in domestic water discharged to storm drains	3,000	Moderate-High
Vehicle fluid leaks and dumping	600	Moderate-High

[a]Uncertainty is defined as follows: Low indicates that the estimate has an error within 50%; Moderate indicates that the estimate has an error up to 2 fold; Moderate-high indicates that the estimate has an error up to 5 fold; High indicates an error up to 10 fold (see Section 1.4).
[b]May overlap with vehicle brake pad estimate.
Source: Section 3.

Conclusion 2. Shoreline copper sources have the potential to contribute significantly to copper levels in San Francisco Bay. Table 18 summarizes shoreline copper load estimates and their uncertainties.

Table 18. Summary of Shoreline Copper Sources (Pounds of Copper per Year Released to San Francisco Bay)

Copper Source	Load Estimate	Uncertainty
Marine antifouling coatings	20,000	Moderate-High
Copper algaecides applied surface waters	4,000	High

Source: Section 3.

Conclusion 3. The total of all estimated urban runoff copper loads (45,000 – 47,000 pounds per year, assuming air deposition does not overlap with other identified sources) is less than the total estimated stormwater copper load to San Francisco Bay (90,000 pounds per year, see Table 19). (Marine antifouling coatings and copper algaecides applied to non-industrial surface waters are assumed not contribute to urban runoff copper loads). Since many source estimates are highly uncertain, it is entirely possible that one or more estimates understates actual copper releases. While it is also possible that a significant copper source has not been identified, given the extensive investigations of copper sources for nearly 15 years in the San Francisco Bay Area, it is unlikely that a major source would not have been identified.

Table 19. Copper Load Estimates for San Francisco Bay

Sources	Copper Load (lb/yr)*
All sources (excluding contribution from Delta)	160,000
Stormwater runoff from all land uses	150,000
Urban portion of total stormwater copper load (Residential, commercial, and industrial land uses)	90,000

*"Best estimate"
Source: *Contaminant Loads From Stormwater to Coastal Waters in the San Francisco Bay Region* (Davis *et al.*, 2000)

4.2 Recommendations

Recommendation 1. Control measures are warranted for vehicle brake pads, copper air emissions, architectural copper, industrial copper use, domestic water discharged to storm drains, soil erosion, and copper pesticides. Control measures are already in place for most of these sources. Table 20 (on the next page) summarizes identified feasible control measures (many of which are already being implemented by one or more San Francisco Bay Area agencies) and recommended priorities for investigation. In addition to the listed control measures, public outreach is feasible for all copper sources.

Recommendation 2. Control measures are warranted for marine antifouling coating copper shoreline releases. No control measures are currently in place for this source. Prior to implementing control measures, additional investigation is recommended and a pilot project should be considered (see Table 20).

Recommendation 3. Improved load estimates for copper pool, spa, and fountain algaecides are needed to determine the appropriate types of control measures.

Recommendation 4. Investigation is needed to determine appropriate control strategies for copper marine antifouling coatings and copper air emissions sources.

Recommendation 5. Because measures to reduce landscaping copper pesticide use could adversely impact human health or the environment, potential measures and their impacts should be evaluated for safety and effectiveness prior to implementation.

Table 20. Summary of Feasible Control Measures (Other than Public Outreach) and Priorities for Investigation for Copper Sources in Urban Runoff and Shoreline Activities

Copper Source	Feasible Control Measures	Priorities for Investigation
Vehicle brake pads	• Brake Pad Partnership (BPP)	• Improved load estimate (BPP)
Architectural copper	• Requirements for management of wastewater from cleaning and treatment • After completing the recommended investigation, consider limiting installation and/or requiring measures to prevent copper releases or to treat roof runoff	• Practicality and efficacy of control measures such as coatings and runoff treatment measures
Copper pesticides	• Consider developing best management practices for wood preservatives to minimize copper use where releases are most likely • Regulatory control measures for pool, spa, and fountain algaecides are feasible; use improved load estimate to determine if they are warranted	• Improved estimate of the copper load from algaecides (primarily pool, spa, and fountain algaecides); use estimate to determine whether regulatory measures are warranted • Evaluate alternative practices and pesticides for landscaping to determine if safe and effective alternatives exist
Industrial copper use	• Industrial stormwater permit program	None
Copper air emissions	• Not able to identify appropriate measures at this time • Additional controls on identified sources are not warranted	• Identify major air emissions sources • Determine overlap with brake pad wear debris (BPP studies will provide data)
Soil erosion	• Construction stormwater permit program • Hydromodification management plan requirement	None
Copper in domestic water discharged to storm drains	• None (other than public outreach)	None
Vehicle fluid leaks and dumping	• None necessary (other than public outreach)	None
Marine antifouling coatings	• Not able to identify appropriate measures at this time • Consider a non-toxic antifouling coatings pilot project	• Bay Area-specific load estimate • Participate in IACC Copper Antifouling Paint Sub-Workgroup investigation of copper problem and control measures
Copper algaecides applied to surface waters	• Aquatic pesticides permit program	None

Source: Section 3.

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APPENDIX A. Lower South San Francisco Bay *Copper Action Plan* Actions

Information in this appendix:

Table A-1. *Copper Action Plan* Baseline (Table 4-1) Actions

Table A-2. *Copper Action Plan* Phase I (Table 4-2) Actions

Table A-3. *Copper Action Plan* Phase II (Table 4-3) Actions

Table A-1. *Copper Action Plan* Baseline (Table 4-1) Actions

Action	Description	Copper Source
B-1	Vehicle washing consistency in level of implementation	Vehicle washing, including mobile cleaners (conveys copper from brake pads, other vehicle sources, and soil)
B-2	Continue to track copper sulfate use by water suppliers (includes State & Federal water project)	Copper algaecides
B-3	Complete Industrial-2: investigations (based on MCMP), identify and implement reasonable controls in conjunction with industry (older printed circuit board manufacturers with copper plating) to reduce elevated levels in runoff from targeted industry including development/implementation of education and outreach plan Clarify linkage with POTW Pretreatment program	Industrial copper uses
B-4	1-Provide appropriate level of local support for agreed upon quantification studies to: 2-Investigate and/or track quantification studies for a wide range of existing copper control/pollution prevention measures and sources loadings (update copper pie charts contained in MCM based on data from B-6 and B-16) 3-Collect data and prepare annual reports on the following potential indicators Copper content in new auto brake pads • Total population in basin • Auto/truck vehicle traveled in basin • Copper sulfate (*e.g.*, algaecide, pesticide, industrials; chemicals) sales in basin (aggregate basis-scaled to basin level estimate) • Copper content in macoma tissue at Sand Point (Palo Alto • Reproductivity index for macoma at Sand Point • Benthic community assemblages at Sand Point 4-Prepare issue paper on feasibility of potential field investigation to monitor long-term trends between copper from brake pads and concentration in water	All sources

Table A-1. *Copper Action Plan* Baseline (Table 4-1) Actions (Continued)

Action	Description	Copper Source
B-5	Provide appropriate level of local support for agreed upon BPP activities consistent with MCM 1-Review/assess/provide input on BMC/BPP brake pad wear debris research & brake pad content data 2-Ensure that other local state and Federal players are involved appropriately on brake pads issue as it is a widespread urban concern 3-Assist in making research data that are in the public domain accessible	Brake pads
B-6	Review appropriateness of transportation control measures, prioritize reasonable measures and identify potential efforts for further development as part of Phase I and implementation as part of Phase II	Brake pads and other vehicle sources
B-7	Establish transportation/impervious surface "forum" • Consider results of VMT and imperviousness load estimates and control effectiveness evaluation; identify potential control efforts for further development as part of Phase I and implementation as part of Phase II	Brake pads and other vehicle sources
B-8	Continue to implement watershed classification and assessment efforts of SCBWMI and improve institutional arrangements for watershed protection (review Vol. II Chapter 5/CCMP/CONCUR findings for relevance and possible gaps as part of C-31)	n/a
B-9	Continue current efforts and track corrosion control opportunities: • Continue educational outreach, within the City of Palo Alto, to plumbers and designers to reduce corrosion of copper pipes via better design and installation • Track developments in (1) alternatives to copper piping (b) corrosion inhibitors, and (c) other methods of reducing copper corrosion	Copper pipes
B-10	Utilize results of SEIDP indicator #5 (Sediment Characteristics and Contamination) to investigate development of an environmental indicator and investigate the linkage with SFEI sources and loading work effort	n/a
B-11	Consider need for Continuous Improvement of street sweeping controls and storm water system operation & maintenance controls (key emphasis is to develop SOP for disposal of collected materials)	Brake pads, other vehicle sources, and soil
B-12	Maintain existing education and outreach program for pools and spas	Copper algaecides

Table A-1. *Copper Action Plan* Baseline (Table 4-1) Actions (Continued)

Action	Description	Copper Source
B-13	Track POTW Pretreatment Program efforts and POTW loadings	Wastewater (conveys copper from many sources)
B-14	Track and encourage water recycling efforts	Wastewater (conveys copper from many sources)
B-15	Utilize results of SEIDP to evaluate effective ness of related SCVURPPP Performance Standards and identify cost-effective modifications	n/a
B-16	Establish Information Clearinghouse (Track & disseminate new scientific research on copper toxicity, loadings, fate and transport, and impairment of aquatic ecosystems for use in CAP update; provide stakeholder resource)	n/a
B-17	Track and encourage investigation of several important topics that influence uncertainty with Lower South Bay Impairment Decision • Phytoplankton toxicity and movement (IAR Section 5.3.1) • Sediment cycling • Loading uncertainty. Encourage incorporation of appropriate bioassessment tools into ongoing monitoring programs to track presence of copper-sensitive taxa in LSB Prepare issue paper on feasibility and cost of addressing phytoplankton toxicity questions	n/a
B-18	Track and encourage investigation of important factors that influence copper and fate (potential reduction in uncertainty is moderate to high) • Investigate flushing time estimates for different wet weather conditions • Investigate location of northern boundary condition • Determine Cu-L1 and L2 complex concentrations • Investigate algal uptake/toxicity with competing metals	n/a
B-19	Continue to promote industrial water use and reuse efficiency. These programs may include workshops, outreach, incentives, or audits (see Appendix 4-1 #35)	Industrial copper use (and other water supply sources)
B-20	Revise copper conceptual model report findings and produce status report (revise conceptual model uncertainty table, appendix __ based on available information)	n/a
B-21	1-SCVURPPP & Co-permittees evaluate feasibility of discouraging architectural use of copper & explore feasibility of related policy 2-Promote Green Building principles and identify measures to investigate as part of Phase I	Architectural copper

Table A-2. *Copper Action Plan* Phase I (Table 4-2) Actions

Action	Description	Cu Source
I-1	Update findings and recommendations of BPP efforts and implement agreed upon Phase I measures and develop Phase II Work Plan	Brake pads
I-2	Update findings and recommendations of transportation/impervious surface "forum" and implement agreed upon Phase I measures and develop Phase II Work Plan	Brake pads, other vehicle sources
I-3	Update and re-evaluate source identification (MCMP for copper) and prioritize sources based on effectiveness evaluation of future potential control actions. Prepare and implementation plan reflecting the priorities and implement agreed upon Phase I control actions.	All sources
I-4	Prepare and implement a Phase I plan for improved corrosion control based on evaluation of results of Baseline measures	Copper pipes
I-5	Evaluate street sweeping and other design, operation and maintenance practices to identify potential improvements. Prepare and implementation plan reflecting the priorities and implement agreed upon Phase I control actions.	Brake pads, other vehicle sources, soil
I-6	Follow-up on relevance of copper in diesel exhaust	Diesel fuel
I-7	Develop Phase II Implementation Plan for POTW expansion for water recycling	Wastewater (conveys copper from many sources)
I-8	Evaluate and investigate important topics that influence uncertainty with LSB Impairment Decision • Phytoplankton toxicity and movement (IAR Section 5.3.1) • Sediment cycling • Loading uncertainty	n/a
I-9	Evaluate and investigate important factors that influence copper fate (potential reduction in uncertainty is moderate to high) • Investigate flushing time estimates for different wet weather conditions • Investigate location of northern boundary condition • Determine Cu-L1 and L2 complex concentrations Investigate algal uptake/toxicity with competing metals	n/a
I-10	Evaluate results of tracking industrial virtual closed-loop wastewater efficiency measures and develop potential actions. Prepare an implementation plan reflecting the priorities and implement agreed upon Phase I control actions.	Industrial copper uses
I-11	Develop Phase II implementation plan for POTW process optimization	Wastewater (conveys copper from many sources)
I-12	Develop a Phase II plan include a re-evaluation for Phase I actions	All sources

Table A-3. *Copper Action Plan* Phase II (Table 4-3) Actions

Action	Description	Cu Source
II-1	Reconsider usefulness of management stormwater through POTWs	Urban runoff (conveys copper from many sources)
II-2	Implement agreed upon Phase II surface control measurement (transportation/imperviousness/brakepad)	Brake pads, other vehicle sources
II-3	Implement plan for additional corrosion control measures	Copper pipes
II-4	Discourage use of copper based pesticides	Copper-based pesticide
II-5	Implement control actions identified for copper in diesel exhaust	Diesel fuel
II-6	Implement Phase II POTW process optimization measures	Wastewater (conveys copper from many sources)
II-7	Implement agreed upon Phase II expansion of water recycling programs	Wastewater (conveys copper from many sources)
II-8	Re-evaluation Phase II Plan (developed as part of I-1) and finalize for implementation	All sources

APPENDIX B. Pesticide Calculations

Information in this appendix:

Table B-1. Bay Area Copper-Containing Pesticide Use Estimate, 2002

Table B-1. Bay Area Copper-Containing Pesticide Use Estimate, 2002

Pesticide	% Cu	2002 Sales (lb A.I.)	2002 Statewide Reported Use (lb A.I.)	Reported Ag. Use (lb A.I.)	Reported Boat Use (lb A.I.)	Reported Water Use (lb A.I.)	Estimated Statewide Urban Use (lb A.I.)	Copper in Statewide Estimated Use (lb Cu/yr)	Estimated Bay Area Copper Use* (lb Cu/yr)
Copper	100	326,000	45,857	38,661	0	534	286,805	286,805	56,501
Copper 8-quinolinoleate	18		10	0	0	0	10	2	0
Copper Ammonia Complex	100	14,277	5,543	4,580	0	0	9,697	9,697	1,910
Copper Ammonium Carbonate	33		42	30	0	0	12	4	1
Copper Bronze Powder	100		25	0	25	0	0	0	0
Copper Carbonate	57	14,274	7,878	0	0	1,650	6,228	3,550	699
Copper Ethanolamine Complexes, Mixed	100	171,230	17,721	19	0	4,893	166,318	166,318	32,765
Copper Ethylenediamine Complex	100		2,557	0	0	1,101	1,456	1,456	287
Copper Hydroxide	65	3,940,156	2,592,460	2,584,220	0	0	1,355,936	881,358	173,628
Copper Naphthenate	10	380,620	84,476	15	0	0	380,605	38,061	7,498
Copper Oxide (Cupric)	80		127,523	1,313	0	0	126,210	100,968	19,891
Copper Oxide (Cuprous)	89	1,146,625	229,214	213,518	15,032	0	918,075	817,087	160,966
Copper Oxychloride	58	84,997	58,934	58,508	0	0	26,489	15,364	3,027
Copper Oxychloride Sulfate	100		174,700	174,700	0	0	0	0	0
Copper Resinate	9		18,612	18,577	0	0	35	3	1
Copper Soap (Copper Octanoate)	18	250	0.007	0	0	0	250	45	9
Copper Sulfate (Basic)	53	1,455,054	876,722	875,681	0	173	579,200	306,976	60,474
Copper Sulfate (Pentahydrate)	25.5	5,646,324	2,916,477	2,867,412	0	129,280	2,649,632	675,656	133,104
Copper Thiocyanate	52		61	0	52	0	9	5	1
Copper Triethanolamine Complex	100	256	2	0	0	0	256	256	50
TOTAL								**3,303,610**	**650,811**

Source: TDC Environmental calculations with data from DPR (DPR, 2004; DPR 2003a; DPR, 2003b).

EXHIBIT "K"

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CLEAN ESTUARY PARTNERSHIP

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EXHIBIT "K"

PREFACE

This document was prepared for the Clean Estuary Partnership to support Technical Task 4.11, Basin Planning Assistance for Cu/Ni North of the Dumbarton Bridge, Sub-task 4.0, Basin Plan Amendment Assistance: Copper Management Strategy Development. Views or information expressed in this report may not necessarily reflect those of the funding agencies.

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COPPER MANAGEMENT STRATEGY DEVELOPMENT RESOURCES

Final

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1.0 INTRODUCTION

The purpose of this document is to support development of the stormwater related sections of the Copper Management Strategy (CMS) for San Francisco Bay North of the Dumbarton Bridge. It contains information to support development of the CMS.

This information and this format are intended to support stakeholder discussion of the CMS. Finalization of the CMS and its elements will involve discussions both internal to and external to the Clean Estuary Partnership that are beyond the scope of this document. *This is an information document—not a regulatory or policy document. This document does not set priorities among copper sources or among available control measures for each copper source.* Prioritization involves many considerations—including practical and policy considerations—that are specific to individual stakeholders.

In accordance with the scope of work, this document:

- Briefly describes the nature of the copper source.
- Identifies potential non-monitoring leading indicators for assessing the significance of the source and the effectiveness of control programs.
- Identifies control measures available to urban runoff programs to address the source, considering potential roles for other entities and regional activities.
- Identifies activity and effectiveness metrics for control measures.
    - An activity metric is a measure of the level of effort expended in addressing a source category. The activity metric should bear a relationship to the prospects of success.
    - An effectiveness metric is a measure of the effect that the action is having. Examples could be a measure of a behavior change, a load reduction, or a change in an environmental concentration or some combination.
- Lays out a sequence and time frame for implementation of control measures.

The information in this document is based on the recommendations of the report *Copper Sources in Urban Runoff and Shoreline Activities* (Copper Sources Report) (TDC Environmental 2004). The Copper Sources report provided copper source load estimates for urban runoff and shoreline activities (see Tables 1 and 2 on the next page), estimated the relative degree of uncertainty in each estimate, reviewed available control measures for each copper source, and identified priority for investigation of sources and control measures. Indicators and metrics included in the annual *Copper Action Plan Report*, prepared by the City of Palo Alto (Palo Alto 2005), have also been considered in this report. Using information from the Copper Sources Report, this report reflects existing control strategies used in urban runoff programs in the San Francisco Bay Area and elsewhere.

Available management strategies addressing copper sources are described in the following sections:

2.0 Architectural Copper	5.0 Marine Antifouling Coatings
3.0 Copper Pesticides	6.0 Existing Permit Requirements
4.0 Vehicle Brake Pads	7.0 Public Outreach

Table 1. Summary of Copper Sources in Urban Runoff (Pounds of Copper per Year Discharged to San Francisco Bay)

Copper Source	Load Estimate	Uncertainty[a]
Architectural copper	4,500	Moderate-High
Copper pesticides *Estimate includes:* *Landscaping* *Wood preservatives* *Pool, spa, and fountain algaecides*	<8,000 – <10,000 *1,200 to 2,500* *1,400 to 2,800* *<5,000*	High
Vehicle brake pads *Estimate includes:* *Original equipment pads* *Replacement brake pads* *Brake pads on heavy-duty trucks, off-road vehicles, rail cars, and motorcycles*	>10,000 *10,000* *?* *?*	High
Industrial copper use	3,300	Moderate
Deposition of copper air emissions *Estimate includes:* *Diesel and gasoline fuel combustion* *Industrial facilities* *Residential wood burning and forest fires* *Unknown*	8,800[b] *3 – 60* *130* *110* *>8,000*	Low to Moderate
Soil erosion *Estimate includes:* *Construction* *Hydromodification*	7,000 *2,600* *<5,000*	Moderate
Copper in domestic water discharged to storm drains	3,000	Moderate-High
Vehicle fluid leaks and dumping	600	Moderate-High

[a]Uncertainty is defined as follows: Low indicates that the estimate has an error within 50%; Moderate indicates that the estimate has an error up to 2 fold; Moderate-high indicates that the estimate has an error up to 5 fold; High indicates an error up to 10 fold.
[b]May overlap with vehicle brake pad estimate.
Source: TDC Environmental, *Copper Sources in Urban Runoff and Shoreline Activities*, prepared for the Clean Estuary Partnership, 2004.

Table 2. Summary of Shoreline Copper Sources (Pounds of Copper per Year Released to San Francisco Bay)

Copper Source	Load Estimate	Uncertainty
Marine antifouling coatings	20,000	Moderate-High
Copper algaecides applied surface waters	4,000	High

Source: TDC Environmental, *Copper Sources in Urban Runoff and Shoreline Activities*, prepared for the Clean Estuary Partnership, 2004.

2.0 ARCHITECTURAL COPPER

The major types of architectural copper features are roofs, gutters, and copper-treated composite shingles. While all copper pieces start with a shiny metal appearance, if left untreated, the copper will develop a patina, oxidizing to shades of green and brown as it ages. Factory or field copper oxidation treatments are often used to give the copper a desired patina immediately. Oxidation forms compounds that are soluble in water to varying degrees; these are incrementally washed off in runoff. Copper metal exposed to air continues to oxidize and incrementally wash off throughout its service life, which may extend for 100 years or longer.

Some composite roofing shingles are made with copper granules to retard moss and mildew growth. Like the copper in pure copper roofs, the copper granules will age, oxidize, and be subject to runoff when it rains.

Use of copper architectural features is relatively infrequent in the San Francisco Bay Area. The current best estimate of the frequency of copper architectural material use is:[1]

- Copper roofs—0.05% of residential structures and 0.3% of industrial commercial structures.
- Copper gutters—present on all structures with copper roofs plus another 0.01% of residential structures.
- Composite roofing shingles with copper biocides—0.03% of residential structures (use on other structures is believed to be negligible).[2]

The Copper Sources Report estimated that architectural copper annually releases about 4,500 pounds per year of copper. Of this amount, more than 90% is estimated to be released from copper roofs, about 5% from copper gutters, and about 1% from copper biocides in composite roofing shingles. This load estimate has a moderate-high uncertainty, due to uncertainty in architectural copper surface areas in the Bay Area, copper release rates, copper losses between building discharge points and surface waters, and the omission of possible discharges from patina treatments and cleaning solutions from the estimates.

Based on the relative importance of estimated load from the major types of architectural copper, the discussion below focuses on structures with copper roofs, as these structures and their gutters (which are usually copper) comprise more than 98% of the estimated load. Other structures (those without copper roofs that have copper gutters and those with copper-containing composite roofing shingles) comprise less than 2% of estimated copper releases.

2.1 CONTROL MEASURES

The Copper Sources Report described the control measures available to address architectural copper. This section briefly describes each option; describes how the option could be implemented in an effective manner (considering whether entities other than urban runoff programs that could play a role in implementing the control measure and generally how they can be engaged and whether regional actions would be appropriate); identifies important implementation issues; and identifies appropriate activity metrics and effectiveness metrics.

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[1] Barron, T. S., *Architectural Uses of Copper: An Evaluation of Stormwater Pollution Loads and BMPs*, prepared for the Palo Alto Regional Water Quality Control Plant, November 2000, revised March 2001.
[2] Use may be increasing, as these products are relatively new in California market.

Strategy AC-1: Targeted Public Education

Education of architects, planners, and the public has the potential to reduce architectural copper use.[3]

Effective Implementation Design

Educational programs are most effective when designed in a targeted manner using information from previous, related programs.[4] In this case, the two key target audiences are (1) businesses or individuals applying for permits for projects involving installation of copper roofs and (2) architects.[5] Reaching these audiences would be most effectively accomplished in collaboration with partners.

Permit applicants for copper roofs can be identified when they approach a municipality to initiate a permitting process. The initial contact may occur in one of two ways: (1) to obtain a permit for installation of a copper roof (e.g., a re-roofing job), generally from a Building Division (2) to obtain approvals for building construction (this usually requires a site plan and architectural review), generally from a Planning Division. An effective education program for permit applicants would require partnering with building and planning staff within each municipality.[6] While partnerships would need to be developed locally, educational materials may be most cost-effectively developed regionally.

Architects must be licensed by the California Architects Board to practice in California. This state board could be of assistance, but has relatively limited resources. The more likely partner for an education program is the American Institute of Architects (AIA). There are at least four AIA chapters in the Bay Area, which provide continuing education, convene professional meetings, and distribute newsletters. Since architects are highly trained professionals, outreach would need to involve well-designed, highly credible materials and messengers. Developing—and perhaps implementing—an educational program for architects would likely be more cost-effective at the regional level than at the local level.

Implementation issues

A highly targeted, well-designed education program for copper architecture could achieve behavior change rates in the 10-15% range.[7] Since the uncertainty in tracking mechanisms is probably at least 10-15%, education programs by themselves are unlikely to have a measurable effect on the installation rate for copper roofs. Nevertheless, education is an important step along the road toward regulating a pollutant source:

- Education programs make affected parties aware of the link between a pollutant source and a water quality threat.

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[3] Educating copper roof installers about best management practices for wastewater management is also feasible; see Strategy AC-3.

[4] For example, outreach to designers about copper plumbing.

[5] Consideration should be given to including non-architect designers in educational programs if they are found to specify a meaningful fraction of copper roof installations.

[6] Urban runoff programs have already been working to develop such partnerships to implement other elements of their permits (e.g., new development requirements), but these relationships have proven challenging for many municipalities.

[7] Less targeted programs would have lower rates. See Larry Walker Associates, *Tools to Measure Source Control Program Effectiveness*, prepared for the Water Environment Research Foundation, Project #98-WSM-2, 1999.

- Voluntary actions resulting from an education program provide helpful examples that the requested change is feasible (or occasionally prove that a change is infeasible).
- Agencies that operate education programs can clarify the technical and policy issues that need to be faced prior to initiating a regulatory program.

If a regulatory program is implemented, an education program can usually be downsized or eliminated.

Activity metric

Activity metrics would need to be developed when the outreach program was designed, as they should relate specifically to the program design. Examples of activity metrics include number of architects attending presentations and number of brochures distributed by Planning/Building Divisions. Caution must be exercised in evaluating activity metrics for public education, as metrics rarely relate to the actions actually taken by the target audience.

Effectiveness metric

Measuring the number of things that are <u>not</u> done (i.e., the number of copper roofs that are not installed) is exceptionally difficult. It would be rare that the selection of an alternative roof in response to an education program could be documented. Colloquial reports, while interesting, are not sufficiently reliable as a metric to merit the cost of collecting them from each municipality. While various metrics are theoretically possible (i.e., surveys, comparison to controls), the cost would be relatively high and the maximum value measured is unlikely to be significant. Adequate evaluation should be available from the leading indicator (see Section 2.2).

<u>Strategy AC-2: Regulate Copper Roof Runoff</u>

Occasionally, copper architectural materials may be clear-coated to maintain a desired hue (typically a penny-colored brown). In theory, all architectural copper features could be coated in a manner that would maintain the copper's appearance, but would prevent release of copper to the environment. In practice, the efficacy of such coatings has not been demonstrated, particularly for copper with a green patina layer. Treatment of roof runoff for copper removal is also possible. Voluntary implementation would be unlikely to be successful due to the cost for roof owners and the need for urban runoff agencies to ensure that the coating or runoff treatment system is maintained.

Effective Implementation Design

Each municipality would need to pass an ordinance regulating runoff from copper roofs. Requirements for coating and roof runoff treatment would need to be implemented in coordination with municipal building permit issuance. The program would need to specify treatment performance requirements, maintenance frequencies, inspection authorities, reporting requirements, and penalties.[8] Funding would be needed to manage the program, which could potentially be fee-based.[9] Regulatory requirements would likely need to focus on new installations, as requirements for existing copper roofs would pose both political and logistical challenges.

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[8] Requirements for collection and management of copper-containing wastewater from cleaning and treatment should be integrated into any regulatory program (see Strategy AC-3).

[9] Fees that provide full cost recovery could be perceived as relatively high.

Implementation issues

Runoff treatment systems have significant technical downsides—they require management and maintenance. Runoff treatment systems have incomplete copper removal. Without maintenance, performance of runoff treatment systems can fall to near zero over a period of a few years. Costs for treatment include building owner costs for installation and maintenance, and municipal costs to ensure that treatment systems meet performance standards. The coating option is likely to be less costly for both roof owners and municipalities than runoff treatment, but would still entail meaningful owner costs for applying and renewing the coating and municipal costs to ensure the coatings are renewed. Municipalities would also incur one-time costs to adopt a local ordinance regulating copper roof runoff and to set up the new regulatory program to implement the requirements. (To reduce these costs, regional development of a model ordinance is recommended in Section 2.3). Implementing such controls for certain types of buildings (e.g., single-family homes) would likely be impractical.

While coating has the theoretical potential to essentially eliminate copper discharges, questions remain regarding the practicality, efficacy, and maintenance requirements for copper roof coatings. (A study to address these questions is recommended in Section 2.3, below). Coatings may have other negative impacts—for example, some coatings contain chemicals that post worker safety risks or contribute to air quality problems. If coating copper is practical and effective, it offers a more complicated—but perhaps politically less difficult—alternative to completely prohibiting architectural copper use.

Activity metric

Activity could be measured by counting the number of copper roofs installed with coatings or treatment.

Effectiveness metric

Using literature values for coating and treatment system efficacy in combination with the proposed activity metric, an effectiveness metric can be calculated. Since system performance tends to decline between maintenance events, it may be necessary to adjust the metric to account for actual maintenance frequencies. If treatment system regulations require sampling to prove system efficacy, these data could be used to develop a more accurate estimate of treatment efficacy. Note that this metric would only indicate the increase in copper releases (unless regulatory requirements were applied to existing roofs).

Strategy AC-3: Collecting Copper Wastewater During Construction

Cleaning and treating copper architectural features (particularly patina treatments) creates corrosive waste solutions that may contain relatively high concentrations of copper. These treatments occur when a roof is installed. Solutions could be collected, tested to determine their waste classification, and managed according to accepted best management practices for wastewater from building surface cleaning activities.[10]

Effective Implementation Design

This measure could be implemented through either enhanced enforcement or targeted outreach. Enhancing implementation of existing wastewater management requirements would entail coordination with municipal building

[10] Bay Area Stormwater Management Agencies Association (BASMAA), Best Management Practices for Surface Cleaning, 2000.

permit issuance. Most municipalities already have the legal authority necessary to require proper wastewater management, but have not targeted copper roof treatment waste for enforcement. Since municipal wastewater treatment plants vary in their criteria for acceptance of copper-containing wastewater, if procedures addressing this specific topic were not worked out when the Bay Area Stormwater Management Agencies Association (BASMAA) surface cleaning program was implemented, municipality-specific procedures could need to be developed to provide specific guidance to roof installers about how wastewater would need to be managed.

Since copper roof installers consist of a relatively small group of specialized roofing companies, an effective education program could support or serve as an alternative to enhanced enforcement. An effective education program would involve one-on-one contacts with firm owners and/or managers to educate them about proper waste solution management and the regulatory consequences of improper management. Due to the regional nature of these businesses and the need to ensure that educators can provide complete and reliable information to installers, this program would be most cost-effectively developed and implemented regionally. Local implementation issues for multiple municipalities would need to be addressed.

The quantitative benefits of this measure have not been estimated (due to lack of data on the discharges) and thus are not included in the load estimates in Table 1. Reductions would involve one-time "slug" discharges.[11]

Implementation issues

Since most of the issues were worked out when BASMAA implemented the surface cleaning program, implementing this strategy would be generally less difficult and costly than implementing the other identified strategies (however, there may be some exceptions). Because a roof installer education program would be backed by existing regulatory requirements, its behavior change rate would likely be higher than success rates for typical education programs (perhaps as high as 50%).[12] Implementation of an enhanced regulatory program would require an effective partnership with municipal building permit divisions, particularly with regard to enforcement of the requirements.[13]

Activity metric

Activity could be measured by counting the number of copper roofs installed that were subject to wastewater management requirements during construction.

Effectiveness metric

Proper management should eliminate this load, which means that the activity metric could also serve as an effectiveness metric. Alternatively, load reductions could potentially be estimated on the basis of copper concentration and wastewater volumes. Copper loads could be grossly estimated (no literature values were identified) or they could be estimated on the basis of data compiled from roof installers (regional compilation would be necessary to achieve a

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[11] In the absence of additional information, it would be reasonable to assume that current loads are somewhat less than the total annual load from architectural copper, based on the copper treatment process, its one-time nature, and that some of this wastewater is probably not currently discharged to storm drains.
[12] Based on similar programs; see Larry Walker Associates, *Tools to Measure Source Control Program Effectiveness*, prepared for the Water Environment Research Foundation, Project #98-WSM-2, 1999.
[13] As noted previously, developing these partnerships have proven challenging.

sufficient size data set within a reasonable period of time). (Note that if non-compliance rates are high, these metrics would overestimate effectiveness.)

Strategy AC-4: Prohibiting Architectural Copper Use

Local governments have the authority to regulate the use of building materials. For example, the City of Palo Alto has an ordinance prohibiting the use of copper for new roofs and gutters (including composite roofing shingles with copper biocides).

Effective Implementation Design

Each municipality would need to pass an ordinance addressing architectural copper use. Like the Palo Alto ordinance, which includes provisions to protect historic buildings, it is likely that municipal ordinances would need to include certain exemptions in response to local policy issues. Implementation would entail partnering with building and planning divisions to ensure the requirements were implemented during building permitting and design review.

Implementation issues

Prohibiting installation of copper architectural features would eliminate new copper releases from architectural copper (except to the extent that exemptions are provided in local ordinances). Municipalities would incur one-time costs for ordinance development and minor ongoing costs for implementation. (To reduce ordinance development costs, regional development of a model ordinance is recommended in Section 2.3). While prohibiting architectural copper use is technically feasible, completely eliminating the opportunity to use copper may be politically unpalatable in some communities. To address this concern, use limitations could potentially be structured to allow installation with coating and/or treatment measures; however, offering these options would significantly increase implementation cost (see above). Although regulatory bans are among the most cost-effective pollutant source controls, municipalities would incur one-time costs for developing and adopting the ordinance and ongoing costs for enforcing it.

Activity metric

Since ordinance adoption would effectively eliminate additional copper roofs, a one-time activity metric to record adoption is appropriate.

Effectiveness metric

No metric is needed—a prohibition would essentially eliminate increases in the architectural copper load. Estimating the amount of load prevented would be difficult, as the current annual installation rate for copper roofs is unknown.

2.2 LEADING INDICATORS

Leading indicators are actions that can be tracked and used to assess the change in significance of a pollutant source (trends). These differ from effectiveness metrics, which evaluate the response to a specific control measure. Leading indicators should track actions that occur prior to environmental impacts.[14] Ideal leading indicators involve information that can be easily collected and compiled. Ideal leading indicators correlate with the magnitude of the pollutant source and/or effectiveness of addressing the source.

The amount of copper washed off copper roofs is proportional to the roof area. Therefore, good leading indicators for copper roofs will be proportional to roof area. Possible indicators and their pros and cons are listed in Table 3. Continuous tracking of

[14] Water quality monitoring is not a leading indicator, but rather a trailing indicator indicating the environmental response to a pollutant management action.

Table 3. Potential Leading Indicators for Architectural Copper Use

Potential Indicator	Comments	Recommended?
1. Number of permits issued for installation of copper roofs	Can be tracked on the basis of building permits. Should be possible to use a statistical sampling method to track, rather than asking every municipality to record every roof. Since copper roof installation rates are variable and often involve clusters of buildings, sample size would need to be relatively large to ensure that it is representative. Tracking is imperfect (some roofs are installed without permits despite the requirement that projects of this size obtain permits). Because roof sizes vary, correlates with increase in roof area but does not quantify that increase. Only reflects increase in roofing stock.	✓Yes
2. Area of new copper roofs installed	Similar to above indicator, but would require tracking of the area of each installed roof. Would require more data management than #1.	No. Management costs exceed indicator's value.
3. Percent of new roofs installed that are copper	Similar to #1, but would also entail recording all building permits that include roofs. Data challenges similar to #2.	No. Management costs exceed indicator's value.
4. Change in copper roof area	Can be tracked using high-resolution aerial photographs. 100% coverage would not be necessary—a sampling method could be used (see sample size caveat in #1). Commercially purchased aerial photos at the necessary resolution can be quite expensive ($70 for 10 acres).	No, unless aerial high-resolution aerial photos can be obtained at very low cost.
5. Sales of copper roofing material	Not feasible to track. Unlikely to be able to obtain such data for a reasonable price due to the nature of the marketplace (national) and confidential nature of sales data.	No. Not feasible.
6. Copper roofing contractor sales survey	Can be tracked by conducting a local market survey for copper roofing installers. Probably necessary to pay installers to participate in survey and to keep individual installer reports confidential. Data likely to be not entirely quantitative. Data could not be readily verified. Might not be feasible—could be difficult to obtain a meaningful sample size (particularly if survey is linked to copper roof control programs). If agency staff time costs are considered, could be least expensive option.	Yes, if feasible (best alternative to #1).
7. Number of copper roofs removed	Not feasible to track. Building and demolition permits generally do not indicate composition of existing roof. Since copper roofs have long lifetimes (100+ years), removal from service will be relatively rare.	No. Not feasible.
8. Roofing materials market forecasts	Forecasts of roofing materials markets can be purchased from market research firms (for example, http://freedonia.ecnext.com/coms2/summary_0285-32036_ITM). Such market reports can be expensive (thousands), but sometimes sections can be purchased for reasonable prices ($100 or less). Market reports usually do not cover regions as small as the San Francisco Bay area, so they would not reflect effectiveness of local control measures.	No. Unlikely to reflect local control measures and could be expensive.

indicators is not necessary as long as recent indicator data are available to support management decisions. For some indicators, properly designed representative samples can be used. For municipalities that have prohibited installation of copper roofs, no tracking would be necessary since no increase in copper roof area would occur.

Since copper roofs have very long service lifetimes (100+ years), in the near term copper roof area is much more likely to increase (reflecting new installations) than decrease (reflecting removal or demolition of the building). For all practical purposes, an indicator reflecting roof installation would be sufficient to track trends in copper roof area.

2.3 IMPLEMENTATION SEQUENCE AND TIME FRAME

Table 4 (on the next page) and Figure 1 (on page 12) lay out an appropriate initial implementation sequence and time frame for implementation of a copper management strategy for architectural copper. To ensure all elements are addressed, both Table 4 and Figure 1 envision maximum implementation of the strategy (partial implementation is also feasible; see below). Figure 1 clarifies that two parallel implementation approaches exist; jumping from one approach to another is possible. The time frames in Table 4 and Figure 1 recognize that some of these strategies require action from every Bay Area municipality that issues building permits—with at least 85 municipalities, this is no small task.

While full implementation would provide the most complete control of this urban runoff copper source, less than full implementation is entirely feasible, as long as the effectiveness level is judged acceptable (see descriptions above for effectiveness estimates for individual strategies). If partial implementation is selected, implementation of Strategy AC-1 is recommended prior to implementation of Strategies AC-2 or AC-4 (see the description of Strategy AC-1 in Section 2.1).

Available Copper Load Reduction

The strategies identified would only serve to slow the increase in copper quantities in urban runoff from architectural copper. This means that *even full implementation of the strategy would not reduce the quantity of copper in urban runoff from architectural copper.*

Post-Implementation Actions

Post-implementation reviews would evaluate progress and effectiveness of the strategy and identify appropriate modifications. For example, modifications could increase effectiveness, reduce costs by eliminating unnecessary activities, or modify strategies in response to newly identified issues. Reviews are recommended at the following times:

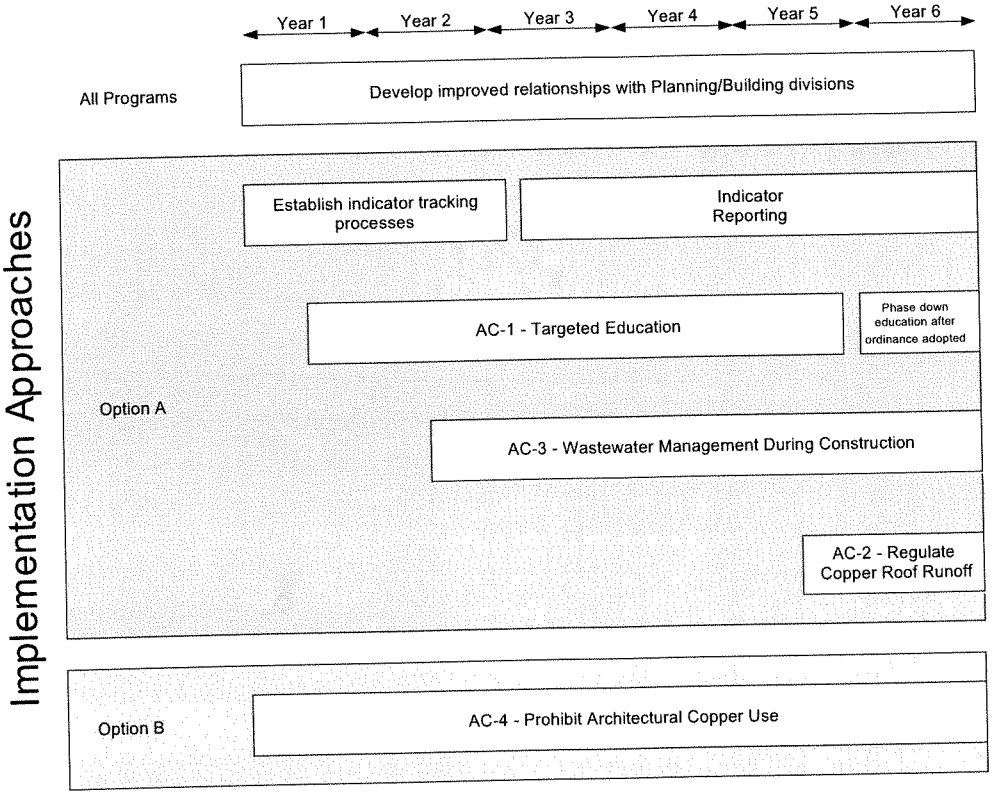
- About Year 4 – after completing the investigation in Action #5. This review can provide information (e.g., results of investigation, lessons from education program) to support development of model ordinance language.
- About year 10 – after the report documenting long-term testing to determine maintenance requirements for coatings (assuming this study is conducted). This review can identify adjustments needed based on lessons learned from the regulatory program.
- Every 5 years thereafter – Long-term reviews should consider the need for and frequency for continued tracking of various indicators.

The recommended time periods are flexible. Combining the review process with reviews of other CMS elements would be most efficient.

Table 4. Potential Framework for Implementation of All Architectural Copper Strategies

Action	Implementing Agency	Time Frame
1. Develop improved relationships with municipal Planning/Building divisions (necessary for successful implementation of actions below)	Individual municipalities	Start: Already being implemented for other reasons Implementation: ongoing
2. Establish tracking and reporting of the leading indicator and for activity and effectiveness metrics as strategies are implemented	Tracking—Individual municipalities Reporting—Regional preferred (may not be practical for metrics)	Start: Tracking established within 2 years; begin reports in year 3 Implementation: ongoing (every 1-2 years recommended initially); end if copper roofs are prohibited
3. Implement Strategy AC-1, conduct targeted outreach & education about copper roofs	Individual municipalities with regional support	Start: Begin implementing within 1 year Implementation: ongoing; end or downscale if copper roofs are regulated or prohibited
4. Implement Strategy AC-3, requirements for management of wastewater from copper roof installation	Individual municipalities	Start: Implement within 2 years Implementation: ongoing; end if copper roofs are prohibited
5. Investigate the practicality, efficacy, and maintenance requirements for copper roof coatings; if initial results are promising, continue testing to determine long-term maintenance requirements	One regional study	One-Time Task: Initial literature review within 1 year; initial study report within 3 years; continued testing to determine maintenance requirements may require 7-10 years
6. Develop model ordinance language for Strategy AC-4, Prohibiting Architectural Copper Use and Strategy AC-2, Regulate Copper Roof Runoff (provide options such that AC-2, AC-4, or a combination could be selected)	Regional model to serve as a resource for individual municipalities	One-Time Task: Complete within 4 years
7. Adopt ordinances to implement Strategy AC-4, Prohibiting Architectural Copper Use and/or Strategy AC-2, Regulate Copper Roof Runoff	Individual municipalities	Start: Progress report in year 5; complete adoption by year 6 Implementation: ongoing

Figure 1. Potential Framework for Implementation of All Architectural Copper Strategies



3.0 COPPER PESTICIDES

Copper-containing pesticides are widely used to control fungi, mildew, algae, and roots. As of February, 2004, there were 19 copper-containing pesticide active ingredients in products registered for sale in California. Primary uses are as algaecides, marine antifouling paint biocides, root killers, wood preservatives, and agricultural and garden fungicides.[15] In the San Francisco Bay area, municipalities have sought to reduce the use of copper-containing pesticides through a variety of efforts including public outreach to reduce copper algaecide use in swimming pools, spas, and fountains, and working with the California Department of Pesticide Regulation (DPR) to secure a 1995 prohibition on the sale and use of copper root control products in the Bay Area. Even so, copper pesticides are used in the Bay Area for a variety of applications.

The copper-containing pesticide use in the Bay Area can be divided into 3 categories: Landscaping fungicides, Wood preservatives, and Pool, Spa and Fountain Algaecides. Marine antifouling paint, which is also technically a pesticide, is addressed in Section 5. Copper-based root control products are assumed not to be used—in compliance with the state prohibition. Algaecides applications to surface waters in urban areas (e.g., to reservoirs and lagoons) are considered in Section 6, because they are regulated by the Aquatic Pesticide General Permit program managed by the State and Regional Water Boards.

[15] TDC Environmental. *Copper Sources in Urban Runoff and Shoreline Activities*. Information Update. Prepared for the Clean Estuary Partnership. November 2004.

The Copper Sources Report estimated that copper-containing pesticide use in the Bay Area amounted to approximately 650,000 lbs of copper annually. It was estimated that the release of copper to San Francisco Bay area urban runoff from landscaping fungicide use was 1,200 to 2,500 pounds per year. Release to Bay Area urban runoff of copper from wood preservative use was estimated as 1,400 to 2,800 pounds annually and from non-regulated algaecide use (i.e., applications to pools, spas, and fountains) was estimated as <5,000 pounds annually. This load estimate has a high uncertainty, due to uncertainty in statewide sales data extrapolations to the Bay Area, pesticide washoff rates, inaccuracies in DPR databases and assumptions regarding relative importance of various pesticide uses, proportion of copper pesticides used for pools, and copper release rates from pools.

The discussion below evaluates control measures for algaecides, landscaping pesticide use, and wood preservatives. Of these copper pesticide uses, pool, spa, and fountain uses appear to be the most significant copper source; however, this conclusion should be viewed cautiously, as the uncertainties in the available load estimates are greater than the differences among the loads.

3.1 CONTROL MEASURES

The Copper Sources Report described the control measures available to address copper pesticide use. The discussion below refers to these measures and is divided into control measures addressing pool, spa, and fountain algaecides, landscaping pesticides, and wood preservatives. This section briefly describes each option; describes how the option could be implemented in an effective manner (considering whether there are entities other than urban runoff programs that could play a role in implementing the control measure and generally how they can be engaged and whether regional actions would be appropriate); identifies important implementation issues; and identifies appropriate activity metrics and effectiveness metrics.

The control measures are selected based on the significance of the source and the potential for measurable reductions to be achieved by targeting a given source. The pool, spa, and fountain algaecides and the wood preservatives are anticipated to provide greater reduction potential for copper in urban runoff due to available alternatives and potential significance of the loading contributions for these sources. Landscaping pesticides are anticipated to offer a smaller reduction potential due to the expected lack of feasible safe alternatives. Therefore, the selected source control measures are more limited in scope for this source.

Pool, Spa, and Fountain Algaecides

Because the load estimate associated with the use of pool, spa, and fountain algaecides developed for the Copper Sources Report is highly uncertain and the estimated load is moderate, the relative importance of this source is not fully understood. A study to refine load estimates is recommended in Section 3.3 below. The refined load estimate should be used to determine whether implementing additional control strategies is warranted and if strategies are warranted, which strategies should be implemented.

Alternatives to copper algaecides are commonly available and widely implemented and promoted in California. They include improved maintenance practices that prevent algae from growing (i.e., maintaining proper biocide levels, maintaining water filtration and circulation and products containing polymeric quaternary amine compounds).

Strategy CP-1: Targeted Public Education

Education of pool service companies and pool owners has the potential to reduce discharges from the use of copper based algaecides. This strategy relies on voluntary actions by pool service companies and pool owners.

Effective Implementation Design

Educational programs are most effective when designed to target specific audiences using messages that resonate with that audience and using methods that target the specific audience. For outreach on pool algaecides, the key target audiences would be pool cleaning services, public swimming pool managers, pool product retailers and private pool owners. Initial efforts could focus on the businesses (i.e., cleaning services, pool managers, retailers) with outreach to private pool owners as a follow-up activity. Outreach materials have been developed by some Bay Area communities that target pool owners & pool companies and explain the issue of copper and water pollution and how use of algaecides in swimming pools, fountains, and spas contribute to copper discharges to local water bodies. These materials could be updated and modified to be used regionally. If practical non-copper alternatives are offered and practices directing discharges to the sanitary sewer that are easy to implement are recommended, some behavior change is also possible. An effective education program would involve direct contacts with firm owners and/or managers to educate them about proper waste solution management and the regulatory consequences of improper management. Due to the regional nature of these businesses and the need to ensure that educators can provide complete and reliable information to installers, this program would be most cost-effectively developed and implemented regionally. Local implementation issues for multiple municipalities would need to be addressed. Adding a certification element to this program may help to increase participation by the businesses.

As a second element of this outreach program, working with retailers to place education materials and signage where pool chemicals are sold increases the likelihood of copper reducing practices being adopted by private pool owners. A recognition program for retailers that place the educational materials in their stores will increase the effectiveness of this part of the program.

Implementation Issues

A highly targeted, well-designed education program for swimming pool algaecides could achieve behavior change rates in the 10-15% range.[16] Since the uncertainty in tracking mechanisms is probably at least 10-15%, education programs that rely on voluntary actions by themselves are unlikely to have a measurable effect on the reduction in use of copper based pool algaecides. Nevertheless, education is an important step along the road toward regulating a pollutant source:

- Education programs make affected parties aware of the link between a pollutant source and a water quality threat.

[16] Less targeted programs would have lower rates. See Larry Walker Associates, *Tools to Measure Source Control Program Effectiveness*, prepared for the Water Environment Research Foundation, Project #98-WSM-2, 1999.

- Voluntary actions resulting from an education program provide helpful examples that the requested change is feasible (or occasionally prove that a change is infeasible).
- Agencies that operate education programs can clarify the technical and policy issues that need to be faced prior to initiating a regulatory program.

The effectiveness of such a program may be improved by enlisting the help of pool service companies. Adding a certification program or recognition program for companies that recommend the use of non-copper algaecides or who provide services to redirect backwash flow to the sanitary sewer may increase the rate at which pool owners adopt the recommended practices. If a regulatory program is implemented, an education program can usually be downsized or eliminated.

Other issues include ease of redirecting discharges to the sanitary sewer and Publicly Owned Treatment Works (POTW) policies regarding acceptance of swimming pool discharges. In general, POTWs will accept filter backwash but their criteria varies for acceptance of discharges associated with draining of swimming pools. If procedures addressing this specific topic were not worked out for a previous pool education program, municipality-specific procedures may need to be developed to provide specific guidance to pool maintenance firms and pool owners about how pool emptying would need to be managed.

Activity metrics

Activity metrics would need to be developed when the outreach program was designed, as they should relate specifically to the program design. Measurement of activity implementation of an outreach program can include the number of brochures distributed, the number of pool service company employees attending workshops, number of articles or advertisements placed, number of retail establishments displaying outreach materials, or the number of brochures taken from a retail display. If materials include a phone number or website, tracking the number of calls or website hits can also be a measure of activity.

Effectiveness metrics

Again, the effectiveness metric would best be designed in concert with the design of the education program. To determine if recommended practices are being adopted, surveys or random site inspections could be conducted for both private pool owners and for pool service companies. Low rates of implementation may be observed due to the voluntary nature of the program. Adequate evaluation should be available from the leading indicator (see Section 3.2).

If pool chemicals sold in local hardware stores are targeted, shelf surveys that track what is available for sale may be useful. Shelf surveys would require that a baseline survey is conducted prior to starting an outreach program so that reductions could be measured.

Strategy CP-2: Require Specific Management Practices for Pool, Spa, and Fountain Discharges

Ordinance modifications and permit programs could be used to require that certain management practices be implemented to reduce copper discharges from swimming pools, spas, and fountains.

Effective Implementation Design

Regulatory authority to require actions of commercial and industrial facilities exists in most municipalities. In most municipalities, this authority does not extend to residents. Specific management practices could be required of pool service companies and swimming pools, spas, and fountains operated by businesses, non-profit organizations, or public agencies. The specific management practices would focus on requiring discharges to be directed to the sanitary sewer (or otherwise not to the storm drain in the case of filter backwash) and permission to be obtained from the POTW for pool emptying. It may be possible to offer the alternative of certifying that copper algaecides have not been used in the pool or that copper concentrations are below a certain threshold.[17] Educational materials explaining the requirements would be needed as would outreach to the regulated community. Input from pool service companies and public and private pool, spa, and fountain facility managers should be sought during development of requirements to ensure that requirements are achievable.

Implementation Issues

Regulating fixed facilities (e.g., municipal and fitness club swimming pools and spas, fountains at private businesses) would be relatively straightforward since they could be inspected to assess physical facilities and to evaluate management practices and most would have facility managers who could be responsible for ensuring compliance. Inspections would involve costs (e.g., staff time). Costs would be proportional to the number of fixed facilities in the municipality. It might be politically challenging to use fees to recover costs associated with regulating this class of facilities.

Given the regional and mobile nature of the pool service business, finding dischargers presents a significant practical challenge. A regulatory program addressing pool service companies would need to be supplemented by public education efforts to be more effective.

Regulation would only reduce discharges from a portion of pools, spas, and fountains, because many private pool owners conduct their own maintenance and do not use a service. A regulatory program also requires that a municipality have adequate resources and staff to enforce the program through inspections, permitting and compliance actions.

Regulatory programs are far more effective than voluntary programs if they are enforced. Regulatory programs can achieve 90% or greater compliance. Determining compliance for pool service companies may also be challenging. It would require verifying that the pools that are being served by the companies are set up to discharge properly. It may be possible to verify compliance based on reported algaecide use.

Activity metrics

The primary measures of implementation of a regulatory program would be to track the number of businesses contacted, the number of permits issued, or the number of inspections.

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[17] This option may require careful structuring because other constituents in pool, spa, and fountain water may pose hazards to water quality, such as chlorine and the biocide polyhexamethylene biguanadine (PHMB), which does not readily evaporate or decompose.

Effectiveness metrics

Compliance rates are the primary metric to determine the effectiveness of a regulatory program. As noted above, there are challenges associated with determining compliance for pool service company management of private pools. Assessing compliance could be accomplished by random inspections of pool service events or inspection of pools to see if the proper connections and equipment are available to allow discharge to the sanitary sewer and to see if copper algaecides are in use.

Strategy CP-3: Require Installation of Appropriate Sewer Discharge Connections for Pools, Spas, and Fountains

Pools, spas, and fountains are occasionally emptied, usually for cleaning and repair. Swimming pools and spas also have routine discharges of wastewater generated from backwashing their filter systems. Requiring that pool and spa filter backwash discharge to the sewer and that pools, spas, and fountains have a conveniently located sewer discharge connection location (generally an indirect connection or a sewer cleanout) would prevent copper discharges to the storm drain.

Effective Implementation Design

Each municipality would need to adopt an ordinance to modify its building and plumbing codes to require sewer discharge connections to be available for pools, spas, and fountains. Implementation would entail partnering with Building and Planning divisions to ensure the requirements were implemented during pool, spa, and fountain permitting and design review. Regulatory requirements would likely need to focus on new installations, as retroactively implementing requirement for existing pools, spas, and fountains would pose both political and logistical challenges.

Implementation Issues

Because pool, spa, and fountain discharges would be redirected to the sanitary sewer, this program would need to be developed in coordination with the local POTW to ensure compatibility with the POTW's policies regarding acceptance of wastewater. Local sewer system managers would also need to be involved, as sizing and design of the connection for emptying the entire pool, spa, or fountain, would need to prevent flows large enough to impair sewer system operation.

This action is probably only feasible for new construction and remodeling. It would primarily serve to prevent increases in copper discharges rather than result in significant reductions.

Activity metrics

Since ordinance adoption would effectively eliminate additional copper discharges from pools, spas, and fountains, a one-time activity metric to record adoption is appropriate.

Effectiveness metrics

No metric is needed—a convenient sewer connection would essentially eliminate increases in the pool, spa, and fountain copper load. Estimating the amount of load prevented would be difficult, as the current annual installation rate for pools, spas, and fountains is unknown.

Landscaping Pesticides

Copper-containing pesticides are used to control fungus growth on lawns and in gardens. Copper-containing pesticides are considered among the least harmful of the available fungus control pesticides, because they are safer for humans and are allowable under organic food standards. Since it is not clear that increased use of alternative fungicides would not be harmful for human health, an evaluation of alternatives is recommended in Section 3.3 prior to implementation of any control strategy for landscaping fungicides. The expected lack of safe alternatives is anticipated to limit the reduction potential for this source regardless of the control measure implemented.

Strategy LP-1: Public Education and Outreach

Educating the general public regarding the potential impact of copper containing lawn fungicides and providing information on alternative practices may have the potential to reduce use of these pesticides. However, a less toxic alternative would have to be identified to make this program effective.

Effective Implementation Design

As noted above, public outreach is most effective when it has a targeted message and reaches the appropriate audience. Abundant resources are available regarding less toxic pest management and information regarding fungus has been developed. Many municipalities have public education programs targeting pesticide use and have identified good vehicles for communicating these messages including working with lawn and garden retailers to train them to assist customers and working with master gardeners programs to the same end. Adding messages regarding copper containing pesticides to existing programs will facilitate the development of a successful program. Fact sheets or brochures containing information on recommended practices would be developed. Links to websites or phone numbers would be included in all outreach materials to allow residents to obtain more detailed information. However, to be effective, a safe alternative must be identified. Practices that prevent fungal growth reducing the need for fungicides may be promising if they are determined to be feasible. If safe practices or products are identified, incorporating this outreach message into an existing regional program may enhance the effectiveness of the program. For example, the *Our Water, Our World* program works with retailers to promote less toxic pest control alternatives. Working through this program may be worthwhile.

Implementation Issues

Public outreach is more effective for creating awareness than for changing behavior (see CP-1, above). In addition, to be effective, ongoing programs over several years are necessary which may require a significant investment of resources. Most chemical alternatives to copper landscaping pesticides are more toxic to humans. Unless a safe alternative is identified, this strategy is unlikely to achieve significant reductions.

Activity metrics

Activity metrics would need to be developed when the outreach program was designed, as they should relate specifically to the program design. Measurement of activity implementation of an outreach program can include the number of

brochures distributed, number of workshops conducted, or number of people attending a workshop or public event.

Effectiveness metrics

Effectiveness of education programs would need to be measured through surveys, since local pesticide sales data are not available. Phone or mail surveys can be used to assess general awareness of impacts of copper pesticides and awareness of alternatives. Intercept surveys or card surveys conducted at lawn and garden stores may be useful in assessing behavior changes in addition to awareness. Shelf surveys may be used to assess behavior by tracking availability of copper and non-copper pesticides.

Wood Preservatives

Most wood preservatives intended for outdoor use contain copper—the primary alternatives (creosote and pentachlorophenol) have limited allowable uses due to the environmental and human health hazards they pose. Concentrations of copper in preserved wood recently increased with the phase out of most allowable urban uses of chromated copper arsenate (CCA), as alternative preservatives rely solely on copper compounds for their functionality. The primary control measure is use of non-wood construction materials. Non-wood construction materials are not drop-in substitutes—they may not be feasible or appropriate in all applications, and some (e.g., recycled plastic lumber) may pose risks to aquatic ecosystems. Guidelines for substitution would need to be developed to ensure that substitutes function appropriately and do not create new environmental problems. Treated wood products used in and near water (i.e., creek and marine uses) have greater potential to discharge copper directly to water than wood products used in commercial and residential applications. Therefore, control strategies should focus on uses in and near water.

Strategy WP-1: Minimize Municipal Copper Wood Preservative Use Near and In Water

Use of alternatives to treated wood in construction at public marinas, along shorelines (e.g., shoring), across creeks, and other locations near water bodies will reduce the amount of copper released to surface water from wood preservatives.

Effective Implementation Design

Guidelines for selection of and use of non-wood alternatives for the various specific applications of copper-treated wood need to be developed, as recommended in Section 3.3. Municipalities can incorporate these guidelines into their design specifications for new public projects and major maintenance of public facilities in or near water (e.g., public marinas, waterfront shoring, bridges, and creek and waterfront landscaping). Specific design, maintenance, and purchasing policies would need to be developed. Staff would need to be trained regarding acceptable materials and maintenance requirements.

Implementation Issues

Guidelines for selection and use of non-wood alternatives would need to be developed in association with Public Works departments, Parks departments, recreation departments, marina facility managers, and agencies that regulate creek and shoreline activities (e.g., flood control districts, Bay Conservation and Development Commission).

This program would be associated with construction of new facilities and major maintenance of existing facilities. Because major maintenance intervals are long

(treated wood has a lifetime of 15-20 years), implementation of this measure would be gradual. Alternative materials may be more costly, less aesthetically pleasing, or technically infeasible for certain applications, which would make it unlikely that all copper treated wood could be replaced with alternatives. Copper reductions achieved through this strategy would be gradual and would rely on feasible replacement materials being available.

Activity metrics

A one-time metric would be appropriate to record adoption of a municipal policy regarding use of treated wood in and near water. Because change is necessarily gradual, it would be worthwhile to periodically evaluate how the policy is being implemented.

Effectiveness metrics

Effectiveness could be measured based on the amount of copper-treated wood materials being installed each year in and near water. Alternatively, effectiveness could be measured by an inventory of treated wood use in and near water. A baseline assessment of the amount of treated wood or an inventory of treated wood use locations in and near water in a municipality would be necessary to facilitate measuring effectiveness.

Strategy WP-2: Minimize Private Copper Wood Preservative Use Near and In Water

Use of non-wood materials in privately owned marinas and other locations near water bodies will reduce the amount of copper discharged from wood preservatives.

Effective Implementation Design

Guidelines for selection of and use of non-wood alternatives for the various specific applications of copper-treated wood need to be developed, as recommended in Section 3.3. Policies and practices developed for publicly owned facilities could be used as a model for this program. Outreach to privately owned marinas to promote the use of non-wood materials during remodeling and repair activities would be included in this program. Contractors would also need to be trained regarding use of non-wood materials. This could first be implemented voluntarily and then by regulation in the building code if necessary. Using regulatory approaches to require privately owned marinas to take certain actions is an approach that can be taken depending on the priority of this source. Regulatory programs are much more effective than voluntary programs.

Implementation Issues

Guidelines for selection, use and maintenance of non-wood alternatives would be developed based on previously developed municipal policies or would need to take into consideration requirements of local agencies that regulate creek and shoreline activities.

This program would be associated with construction of new facilities and major maintenance of existing facilities. Because major maintenance intervals are long (treated wood has a lifetime of 15-20 years), implementation of this measure would be gradual. Alternative materials may be more costly, less aesthetically pleasing, or technically infeasible for certain applications, which would make it unlikely that all copper treated wood could be replaced with alternatives. Copper reductions achieved through this strategy would be gradual and would rely on feasible replacement materials being available.

Activity metrics

Activity could be measured by the number of marinas contacted and provided with information regarding the impact of wood preservatives and promoting the use of alternative materials. Under a regulatory program, activity would also be monitored based on the number of permits issued.

Effectiveness metrics

Effectiveness could be measured based on the amount of copper-treated wood materials being installed each year in and near water. Alternatively, effectiveness could be measured by an inventory of treated wood use in and near water. A baseline assessment of the amount of treated wood or an inventory of treated wood use locations in and near water in a municipality would be necessary to facilitate measuring effectiveness. Selected permit owners could be audited as another effectiveness assessment measure.

All Pesticides

Strategy P-1: Ask DPR to Regulate Copper-Containing Pesticides

Only the California Department of Pesticide Regulation has the authority to regulate pesticides in California. Municipalities and the Regional Water Board could request that DPR restrict use of copper-containing pesticides in the San Francisco Bay area. DPR has already put such restrictions in place for copper-based root control products, which cannot be used in the 9 San Francisco Bay area counties. Given the relative magnitude of the potential copper load and the cost of alternative control measures, regulation would be most cost-effective for controlling copper-based pool, spa, and fountain algaecides.

Effective Implementation Design

DPR generally requires quantitative information about the water quality and/or permit compliance problems associated with a pesticide (including quantification of the pesticide's relative contribution to the problem) before it will consider restricting a pesticide's sales and use. A request for DPR action is most likely to be successful if it is made jointly by water quality agencies and is supported by appropriate scientific information.

Implementation Issues

It is uncertain whether DPR would consider such a request to be of a high enough priority to invest the necessary staff time to go through the regulatory process. If the request is made jointly with the Regional Water Board (preferably including the State Water Board) and with other regions of the state it would have an increased chance of success.

DPR may not have the modeling tools and other resources necessary to make the required legal case for regulatory controls. DPR's budget has not historically allocated funds to evaluate or implement regulatory requests by water quality agencies. Water quality agencies may need to be ready to provide information and scientific support to DPR to help its staff complete its regulatory process.

Activity metrics

Since a request to DPR would be a one-time event, no activity metric is appropriate.

Effectiveness metrics

Load reduction estimates would probably need to be created to support any regulatory decision by DPR. These would be an appropriate effectiveness metric. Since any regulatory action would likely be permanent, a one-time estimate would be sufficient.

3.2 LEADING INDICATORS

Leading indicators are actions that can be tracked and used to assess the change in significance of a pollutant source (trends). These differ from effectiveness metrics, which evaluate the response to a specific control measure. Leading indicators should track actions that occur prior to environmental impacts.[18] Ideal leading indicators involve information that can be easily collected and compiled. Ideal leading indicators correlate with the magnitude of the pollutant source and/or effectiveness of addressing the source.

The amount of copper pesticides washed off into urban runoff would be proportional to the amount of copper used in urban applications (recognizing that different uses have different copper wash-off fractions). Therefore, good leading indicators for copper pesticides will be proportional to pesticide uses and will consider wash-off fractions. Possible indicators and their pros and cons are listed in Table 5 (on the next page). Year-to-year variations in pesticide use are common for copper-containing pesticides, as weather is an important factor in the decision to use many of them. This means that annual tracking of indicators and evaluation of multi-year data sets is necessary to support management decisions.

For some indicators, properly designed representative samples can be used. Reported pesticide usage can be tracked on a county-wide basis. Breaking it down into smaller jurisdictions may not be possible. However, municipalities can track their own usage (i.e., publicly owned pools, public open spaces, parks, and other landscaping, and publicly owned marinas). In addition, municipalities can conduct shelf surveys perhaps working with the Our Water Our World program to determine the amount of pesticides available for sale.

3.3 IMPLEMENTATION SEQUENCE AND TIME FRAME

Table 6 (on pages 24-25) and Figure 2 (on page 26) lay out a potential initial implementation sequence and time frame for implementation of a copper management strategy for copper pesticides. The basis for the time frames relates to the estimated time it takes to initiate a certain program. After the program is started, the time frames were relative to how long it could take to complete and evaluate results of the first action before moving on to the next action. To ensure all elements are addressed, both Table 6 and Figure 2 envision maximum implementation of the strategy (partial implementation is also feasible; see below). The time frames in Table 6 and Figure 2 recognize that some of these strategies require action from every Bay Area municipality—with at least 85 municipalities, this is no small task.

While full implementation of the actions listed below in Table 6 would provide the most complete control of this urban runoff copper source, less than full implementation is entirely feasible, as long as the effectiveness level is judged acceptable (see descriptions above for effectiveness estimates for individual strategies). Assessing load estimates and/or determining if feasible alternatives are available are important steps in

[18] Water quality monitoring is not a leading indicator, but rather a trailing indicator indicating the environmental response to a pollutant management action.

the development of most strategies. The order of implementation is based on the need to develop some background information prior to implementing certain strategies and then implementing control measures based on their potential to achieve reductions. Landscape pesticide strategies are expected to meet with limited success in achieving reductions and may pose challenges due to expected limitations of available alternatives. Therefore, it is recommended that they are implemented only if needed after seeing the results of other strategies. DPR regulation of copper pesticides would be difficult to obtain; it is included as a fall-back plan, as it would likely only be possible if all measures under local control are first exhausted. If partial implementation is selected, strategies targeting municipal sources (e.g., publicly owned pools, publicly owned marinas, public parks and open spaces) could be implemented first to serve as role models for subsequent programs targeting commercial businesses and the general public.

Table 5. Potential Leading Indicators for Copper Pesticide Use

Potential Indicator	Comments	Recommended?
1. Copper load to Bay, estimated on the basis of statewide sales, local reported use, and estimated wash-off fraction.	Similar to method used to generate Copper Source report. Can be updated with current information. Relatively inexpensive. Data reported to DPR are relatively accurate and readily available. Professional use is reported only on a county-wide basis. Requires extrapolation of statewide sales data to estimate non-reported uses (of the uses covered by this strategy, only professional application of copper landscaping pesticides require reporting); does not reflect local or regional actions affecting retail sales. Cannot be used to assess the progress of an individual municipality.	✓Yes. Shows trends. Would need to be supported by other indicators of local non-reported use.
2. Shelf surveys for copper containing pesticides	Surveys of copper pesticides and copper-treated wood products available for sale at retail outlets provide an indicator of copper pesticide use, particularly non-reported uses. However, does not provide sales or use data, may not account for internet purchasing or purchasing across jurisdictions.	✓Yes. Only way to explore effects of regional & local control measures.
3. Quantity of copper pesticide use estimated on the basis of statewide sales and local reported use.	Data reported to DPR are relatively accurate and readily available. Professional use is reported only on a county-wide basis. Requires extrapolation of statewide sales data to estimate non-reported uses (of the uses covered by this strategy, only professional application of copper landscaping pesticides require reporting); does not reflect local or regional actions affecting retail sales. Cannot be used to assess the progress of an individual municipality.	No. Does not reflect relative importance of various pesticide application locations.
4. Quantity of pesticides used by municipal staff	Should be straightforward to track as municipalities keep records of pesticide use. May require significant data management.	No. Only covers a small portion of copper pesticide use.
5. Copper pesticides sales	Only available for free on a statewide basis. Unlikely to be able to obtain local data for a reasonable price due to the confidential nature of sales data.	No. Not feasible.

Table 6. Potential Framework for Implementation of All Copper Pesticide Strategies

Action	Implementing Agency	Time Frame*
1. Refine pool algaecide loading estimates	One regional study	Start: In 1st year of program Implementation: Complete by year 2. Completed early in program because it informs later strategies.
2. Assess feasibility of alternatives to wood preservatives	One regional study	Start: In 3rd year of program Implementation: Complete by year 5. Completed early in program because it informs later strategies.
3. Establish tracking and reporting of the leading indicator and for activity and effectiveness metrics as strategies are implemented	Tracking—Individual municipalities Reporting—Regional preferred (may not be practical for metrics)	Start: Tracking established within 2 years; begin reports in year 3 Implementation: ongoing (every 1-2 years recommended initially); end regulatory controls are adopted for all copper pesticides.
4. Implement Strategy CP-1, conducting targeted outreach & education about pool, spa & fountain pesticides	Individual municipalities with regional support	Start: After load estimate has been refined, if this is still indicated to be a significant source. The sequence of implementation of this and Strategy WP-2 should be set based on updated load estimates generated by Action #1. Implementation: Outreach should be coordinated with other outreach efforts so as not to introduce too many new concepts at once.
5. Implement strategies WP-1 targeting municipal activities for marinas	Individual municipalities	Start: After feasible alternatives have been identified. Implementation: Ongoing.
6. Implement Strategies WP-2 to conduct targeted outreach & education about wood preservatives	Individual municipalities with regional support	Start: After feasible alternatives have been identified and municipal programs have been implemented. The sequence of implementation of this and Strategy CP-1 should be set based on updated load estimates. Implementation: Outreach should be conducted in a phased approach so as not to introduce too many new concepts at once.
7. Implement Strategies CP-2, requirements for directing pool discharges to sanitary sewers	Individual municipalities	Start: Approximately 1year after public outreach is established Implementation: ongoing
8. Develop model ordinance language for Strategy CP-3	Regional model to serve as a resource for individual municipalities	One-Time Task: Complete within 4 years depending on success of voluntary programs and priority of source

Table 6 Cont'd. Potential Framework for Implementation of All Copper Pesticide Strategies

Action	Implementing Agency	Time Frame*
9. Adopt ordinance to implement Strategies CP-3	Individual municipalities	Start: If success level of voluntary programs and priority of source are determined to warrant regulation, complete progress report in year 5, complete adoption by year 6 Implementation: ongoing
10. Assess feasibility and safety of alternatives to landscape fungicides	One regional study	Start: Initiate if additional strategies are deemed necessary based on results of algaecide and wood preservative control measures.
11. Implement Strategy LP-1 to conduct targeted outreach & education about landscape fungicides	Individual municipalities with regional support	Start: After feasible and safe alternatives have been identified. Do not initiate if feasible & safe alternative are not found. Implementation: Outreach should be conducted in conjunction with existing pesticide education programs.
12. Work with DPR to regulate use of copper containing pesticides	Regional action.	Start: Initiate if additional strategies are deemed necessary. Implementation: One-time action.

***Time frames based on time to develop and implement a new program or to implement and evaluate a program before moving on to the next task.**

Available Copper Load Reduction

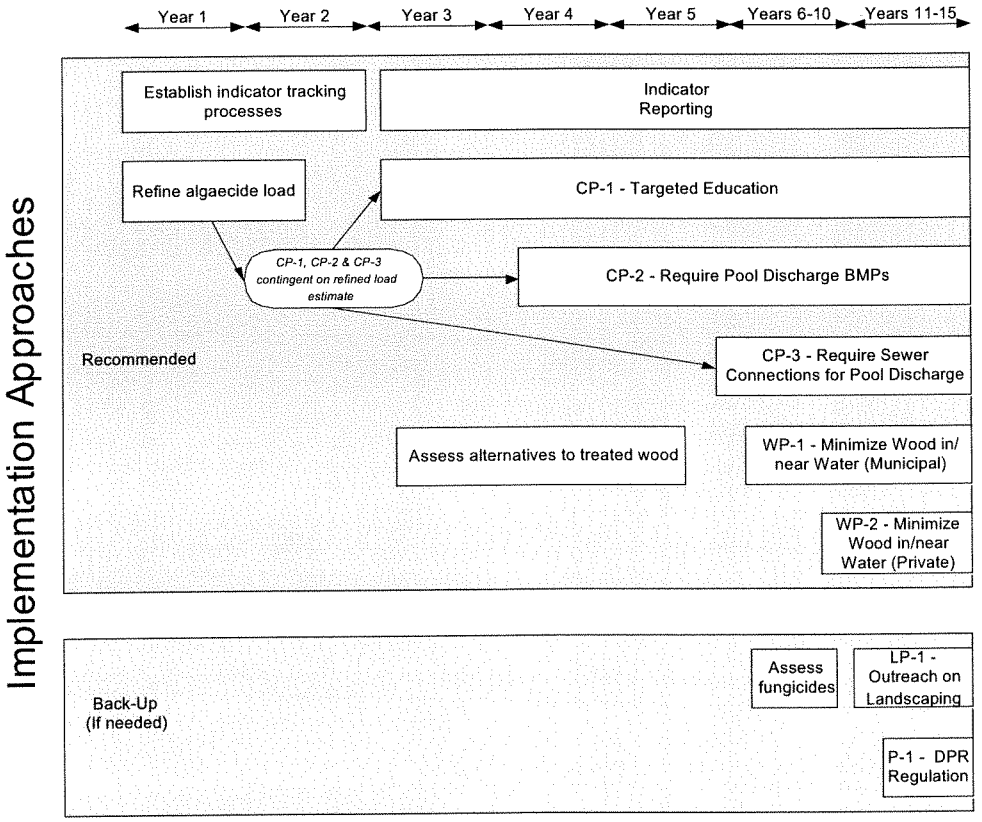
For pool algaecides, it is possible to avoid any increase in the load with code changes, or to try to reduce the load through various measures. Redirecting discharges from pools to the sanitary sewer will eliminate copper algaecides as a source to urban runoff but will still result in some copper being discharged to water bodies. Wastewater treatment plants have copper removal efficiencies in the 80-95% range. For landscaping pesticides, it may not be possible to achieve a reduction unless a safe alternative is identified. For wood preservatives, non-wood alternatives exist that are feasible for many applications, but it is unlikely that a 100% reduction would be achieved because there are applications where wood will remain the preferred approach. The greatest reduction could be achieved through regulation by DPR of copper pesticide use. However, obstacles to implementation make this likely only as a last resort.

Post-Implementation Actions

Post-implementation reviews would evaluate progress and effectiveness of the strategy and identify appropriate modifications. For example, modifications could increase effectiveness, reduce costs by eliminating unnecessary activities, or modify strategies in response to newly identified issues. Reviews are recommended at the following times:

- About Year 2 – after completing assessment of loading estimates and alternatives to treated wood to determine the relative priority of pool algaecides and wood preservatives as copper sources. Decide whether copper load from pools, spas, and fountains merits control strategy implementation by comparing to the load estimates for other copper sources (see Table 1).

Figure 2. Potential Framework for Implementation of All Copper Pesticide Strategies



- About Year 5 – after completing the investigation in Action #2 in Table 6. This review can provide information (e.g., results of investigation, lessons from education program) to support development of model ordinance language. In addition, results of public outreach programs will be useful for determining the need for more regulatory approaches.
- Every 5 years thereafter – Long-term reviews should consider the need for and frequency for continued tracking of various indicators and the need to move from voluntary to more regulatory approaches. Long term reviews should also consider the need for additional actions (i.e., specifically actions 10 – 12 in Table 6) as well as the elimination of actions that are not effective or no longer warranted based on updated information and data collection.

The recommended time periods are flexible. Combining the review process with reviews of other CMS elements would be most efficient.

4.0 VEHICLE BRAKE PADS

San Francisco Bay Area drivers use their brakes millions of times a day, each time releasing small amounts of brake wear debris to the environment. In 1993, the Santa Clara Valley Nonpoint Source Pollution Control Program retained Woodward-Clyde to investigate the potential that vehicle brake wear debris contained water pollutants. The resulting report[19] identified vehicle brake pads as a potentially significant source of copper in urban runoff, sparking Santa Clara Valley water quality agencies' interest in vehicle brake pads, and eventually leading to the formation of a partnership with the brake pad industry and other interested stakeholders to explore the issue.

The Brake Pad Partnership (BPP) is currently conducting investigations that will lead to a reliable estimate of the contribution of vehicle brake pads to copper levels in San Francisco Bay. The approach of the BPP is to characterize brake wear debris and to conduct environmental transport and fate modeling to predict how copper released from brake pads enters the Bay and affects both the short-term and long-term concentrations of copper in the Bay. Results of these studies, which involve air, watershed, and Bay modeling, are anticipated in late 2006.

Since the BPP estimates are not yet complete, the Copper Sources Report estimated copper releases from vehicle brake pads by estimating brake pad copper releases in the watershed, and then estimating the fraction of copper released that is washed off in runoff. The best available data on brake pad copper content is from the BPP. As part of the BPP, U.S. brake pad manufacturers have developed a procedure for reporting on the amount of copper used in brake pads on new vehicles ("original equipment" brake pads) each year. Reporting began in 1998; data are currently available through vehicle model year 2002 (see Table 7). Although these data are not intended for use in copper load calculations, they are the most comprehensive and reliable data available regarding the copper content of automotive brake pads.

Table 7. Copper Use in Brake Pads on the 20 Best Selling Domestic Light Duty Vehicles, Model Years 1998-2004

Model Year	1998	1999	2000	2001	2002	2003	2004
Copper per vehicle (kg)	0.0402	0.0517	0.0564	0.0561	0.0766	0.0769	0.0650
Copper per vehicle (lb)	0.0886	0.114	0.124	0.124	0.169	0.169	0.143

Source: Brake Pad Partnership, *Copper Use Monitoring Program Results for Model Years 1998-2004*, January 2006.

Using the BPP data, the Copper Sources Report estimated that vehicle brake pads release more than 10,000 pounds per year of copper. This load estimate has a high uncertainty and likely understates brake pad copper releases, due to the unavailability of copper data for replacement brake pads or brake pads used on heavy-duty trucks, off-road vehicles, rail cars, and motorcycles. Additionally, the estimate of the portion of vehicle brake wear debris washed from urban surfaces used to generate this load estimate is highly uncertain because it was based on preliminary results of U.S. EPA modeling of copper runoff in Castro Valley.

4.1 CONTROL MEASURES

The Copper Sources Report described the control measures available to address vehicle brake pads. This section briefly describes each of the options; describes how

[19] Woodward-Clyde Consultants, *Contribution of Heavy Metals to Storm Water From Automotive Disc Brake Pad Wear*, prepared for the Santa Clara Valley Nonpoint Source Pollution Control Program, October 1994.

the option could be implemented in an effective manner (considering whether entities other than urban runoff programs that could play a role in implementing the control measure and generally how they can be engaged and whether regional actions would be appropriate); identifies important implementation issues; and identifies appropriate activity metrics and effectiveness metrics.

Several theoretically possible control measures (including two options identified in the Copper Sources Report–street sweeping and reducing vehicle miles traveled–have been determined to be unlikely to result in meaningful reduction in copper releases from brake pads.

- Street sweeping. As described in the Copper Sources Report, street sweepers are relatively inefficient in collecting fine particles. Brake Pad Partnership research data show that brake pad wear debris is comprised of extremely fine particles, averaging about 2.7 µm in diameter. Because of its tiny particle size, brake wear debris is distributed throughout urban areas, including impervious and pervious areas; it does not just fall on roads, as had been assumed previously. Therefore, street sweeping is not an effective control measure for brake pad wear debris.
- Reducing vehicle miles traveled (VMT). Due to population increases and land use patterns, the significant regional efforts toward reducing vehicle miles traveled in the Bay Area have been successful in moderating the increase in VMT, but not in reducing it. Data from these efforts show that measures within the control of water quality agencies (e.g., public outreach) would not be effective at reducing VMT, and therefore would not be effective at reducing copper releases from vehicle brake pads. This report assumes that air quality and transportation agencies will continue their long-term efforts to control VMT.
- Car washing. The amount of copper from brake pad wear debris that is released to the environment during vehicle washing outdoors is relatively minor (less than 5% of total releases).[20] This copper is also released during normal driving, rain events, and washing at commercial carwashes. Therefore, public outreach pertaining to vehicle washing would not be an effective control measure for brake pad wear debris.

The following strategies are believed to be the most effective options for controlling copper from brake pad wear debris.

Strategy BP-1: Participate in the Brake Pad Partnership

This strategy calls for continued participation in the Brake Pad Partnership, through the conclusion of the partnership's ongoing studies and final decision-making process. The BPP is a voluntary partnership effort involving stakeholders from the brake pad industry, environmental organizations, and state, federal, and local government agencies. The main focus of the BPP is to examine the link between brake pad wear debris and surface water quality impairment. If the Partnership concludes that copper from brake pads is a significant source of water quality impairment, manufacturers have committed to voluntarily introducing new, lower copper products within five years.[21]

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[20] Inferred from data on residential car washing behavior and estimated release to car washes from Process Profiles, *Copper Released from Brake Lining Wear in the San Francisco Bay Area*, prepared for the Brake Pad Partnership, 2006.

[21] http://www.suscon.org/brakepad/

Effective Implementation Design

Implementation will involve continued active participation in BPP meetings, providing information to the BPP about Bay Area and other California problems with copper in surface waters, making timely decisions on the basis of the outcome of the BPP's scientific studies at project-concluding decision points, and advocating (as appropriate based on the BPP's scientific findings) for a partnership outcome that meets Bay Area water quality compliance needs for brake pad copper.

Implementation issues

Implementation is dependent on the outcome of ongoing study results and cooperation between participating entities. New brake pad materials must meet safety standards, and there is concern regarding vehicle manufacturer acceptance of new pad formulations.[22] Additionally, although alternative brake pads may be offered to the vehicle manufacturers, vehicle manufacturers are not obligated to purchase low copper or copper free brake pads. If the outcome of the BPP is that brake pad manufacturers do agree to offer lower copper products, Bay Area agencies may need to develop strategies to promote their acceptance by vehicle manufacturers.

The BPP does not currently cover replacement brake pads, or brake pads used on heavy-duty trucks, off-road vehicles, rail cars, and motorcycles. If BPP research shows that these brake pad categories are significant sources of environmentally important copper, methods for achieving desired copper reductions through or outside of the BPP will need to be considered.

Activity metric

Activity for this strategy could be measured by tracking progress on the BPP grant funded studies and final project deliberations.

Effectiveness metric

For original equipment brake pads, effectiveness can be measured by tracking the amount of copper in brake pads reported by the brake pad manufacturers. Since this metric does not address replacement brake pads, or brake pads used on heavy-duty trucks, off-road vehicles, rail cars, and motorcycles, a more complete metric will be needed if these other brake pad types prove to be significant sources of environmentally important copper. Another method of tracking effectiveness would be to collect tunnel air measurements or air deposition measurements. This type of testing is expensive, but could potentially be implemented every few years through partnerships with air quality agencies to track the release of copper from brake pads.

Strategy BP-2: Seek Regulation of Brake Pad Copper Content

This strategy would entail efforts to have an appropriate agency regulate the copper content of vehicle brake pads. A specific plan of action would need to be developed if this strategy is implemented, based on a legal review of options and a timely political analysis of the legislative bodies that could be approached.

[22] Moran, K. D., BASMAA representative on BPP Steering Committee, personal communication, March 2005.

Effective Implementation Design

Since Federal law generally prohibits local regulation of products like vehicle brake pads, if brake pad copper content is to be regulated, regulation by a State or Federal agency would probably be required. New State or Federal law would probably be necessary to enact such regulation.[23] A legal review should be completed to identify specific, feasible options for brake pad copper content regulation that do not create brake safety liability for the regulating agency or municipalities. Likely options for this strategy include legislation to regulate brake pad copper content directly or a law that provides an appropriate agency with necessary regulatory authority to control brake pad copper content as needed to protect surface water quality. Regulation under an existing authority may be possible. For instance, there is some possibility that the California Air Resources Board could use its authority to regulate motor vehicle emissions to reduce brake pad copper content. A regulatory program should be capable of achieving reductions necessary to meet Bay Area water quality compliance needs for brake pad copper.

Implementation issues

Opposition (particularly from brake pad manufacturers) is likely. A strong case—based on good scientific information and reasonable policies—would be necessary to overcome opposition. The development of the action plan would need to consider what options are viable politically. The regulatory program would need to consider the environmental impacts of the reformulated brake pad materials, because the manufacturers' voluntary promise to incorporate the BPP's evaluation approach into their product development processes to avoid using potentially harmful ingredients would not be applicable to a regulatory program.

The cost to the regulatory agency would need to be addressed. Costly new regulatory programs are often rejected by lawmakers. Unfunded activities are difficult for agencies to implement.

Activity metric

Activity for this strategy could be measured by tracking progress on the implementation of the plan of action. Since adoption of a law or regulation would effectively control copper content in brake pads, a final one-time activity metric to record adoption is appropriate.

Effectiveness metric

No metric is needed—a law or regulation would probably reduce or eliminate the copper load from brake pads. Estimating the amount of load prevented would be possible but could be difficult, depending on how the regulation was designed. Post-implementation monitoring of the leading indicator (see Section 4.2) may be sufficient to provide a quantitative estimate of effectiveness.

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[23] Catherine C. Engberg. *The Regulation and Manufacture of Brake Pads: The Feasibility of Reformulation to Reduce the Copper Load to the San Francisco Bay*. Prepared for the Palo Alto Regional Water Quality Control Plant July 1995. http://www.cityofpaloalto.org/public-works/documents/cb-brkrpt.pdf. Information obtained by the authors subsequent to completion of this report indicates that unlikely that any of the agencies identified in this report have regulatory authority over brake pad composition.

Strategy BP-3: Urban Runoff Treatment Controls

Various alternatives are available for capturing and treating copper in urban runoff. The California Stormwater Quality Association (CASQA) Stormwater Best Management Practice Handbooks[24] describe various measures that are capable of reducing copper concentrations in urban runoff, including porous pavement, detention ponds, and vegetation-based methods (like grassy swales). Requirements are already in place to treat runoff from new development.[25] These requirements address (but do not completely eliminate) increases in copper from new vehicles and new impervious surfaces in the Bay Area. Current requirements do not address runoff from existing areas. Runoff from existing areas may possibly be treated in the future to address other pollutants of concern in targeted areas.

Effective Implementation Design

The design would depend on the goal of the program. For example, if additional copper increases are to be prevented, it is theoretically possible to require new development projects to be "copper runoff neutral". Since few runoff treatment systems can reduce copper content in runoff to pre-development levels, it would likely be necessary to require new developments to obtain offsetting reductions from other copper runoff sources (e.g., installing runoff treatment systems for an appropriate area of existing development).

If copper reductions are deemed necessary and cannot be achieved through other means, treatment of runoff from existing development would need to be considered. This would entail substantial financial, legal, and technical challenges since much of existing development in the Bay Area is dense—and much of the available land in the downstream part of urban watersheds is environmentally sensitive (e.g., wetlands bordering San Francisco Bay). To capture and treat urban runoff from existing development, both region-wide and community specific approaches would need to be identified. In addition to determining financially and technically feasible approaches, the design would need to ensure that systems perform appropriately, by specifying treatment performance requirements, maintenance frequencies, inspection authorities, reporting requirements, and penalties.

Implementation issues

Treating all urban runoff in the Bay Area is almost certainly financially and technically infeasible under current conditions. A growing portion of urban runoff will be treated in response to other permit requirements (e.g., for new development and redevelopment). Treatment may also be implemented in targeted areas to address other pollutants of concern. If properly designed, these treatment systems could reduce copper loads (but would likely only treat a small fraction of the San Francisco Bay watershed's urban runoff). Prior to implementing any substantial new requirement for runoff treatment (particularly if it involves treating runoff from existing development), agencies would need to develop widespread community support and be able to present a strong case about the need for such measures to community leaders.

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[24] California Stormwater Quality Association. Stormwater Best Management Practice Handbook. Municipal. January 2003.

[25] These are often referred to as the "C.3. requirements" because they are in that section of Bay Area urban runoff agency NPDES permits.

Runoff treatment systems have significant technical downsides—they require management and maintenance. Typical runoff treatment systems have incomplete copper removal; removal of dissolved copper is even more difficult than removal of total copper.[26] Without maintenance, performance of runoff treatment systems can fall to near zero over a period of a few years. Costs for treatment include costs for installation and maintenance, and costs to ensure that treatment systems meet performance standards. Installing runoff treatment devices for existing developments poses potentially significant retrofitting costs. Vegetation-based systems and infiltration methods, which are among the more efficient for removal of dissolved and fine particulate metals,[27] are among the lower cost end treatment systems to install and operate,[28] but may be difficult to implement due to limited land availability and soil types in the Bay Area. Because treating runoff occurs subsequent to the broad dispersion of fine copper-containing particles from brake pads into the environment, treating the runoff that carries the deposited copper to the Bay is an inefficient way of keeping the copper that is released from brake pads out of the Bay.

Activity metric

Activity could be measured by counting the number treatment devices installed. Ongoing methods of tracking of the implementation of runoff treatment requirements for new development should be evaluated for possible use as activity metrics for this strategy.

Effectiveness metric

The percent of total urbanized area where runoff flows through treatment systems could be tracked. While this indicator would show treatment system coverage, estimating copper reduction effectiveness would require estimates of copper reduction due to the treatment. Performance data from the literature could be used initially; however, because system performance tends to decline between maintenance events, it may be necessary to adjust the copper removal estimate to account for actual maintenance frequencies. If treatment system regulations require sampling to prove system efficacy, these data could be used to develop a more accurate estimate of treatment efficacy. Ongoing methods of tracking of the implementation of runoff treatment requirements for new development should be evaluated for possible use as effectiveness metrics for this strategy.

4.2 LEADING INDICATORS

Leading indicators are actions that can be tracked and used to assess the change in significance of a pollutant source (trends). These differ from effectiveness metrics, which evaluate the response to a specific control measure. Leading indicators should track actions that occur prior to environmental impacts.[29] Ideal leading indicators involve information that can be easily collected and compiled. Ideal leading indicators correlate with the magnitude of the pollutant source and/or effectiveness of addressing the source.

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[26] Winer, R. *Stormwater Treatment Practice Pollutant Removal Performance Database, for Stormwater Treatment Practices, 2nd Edition*, Center for Watershed Protection, 2000.
[27] *Ibid.*
[28] California Department of Transportation, *BMP Retrofit Pilot Program Final Report*, Report ID CTSW-RT-01-050, January 2004.
[29] Water quality monitoring is not a leading indicator, but rather a trailing indicator describing the environmental effects of a source.

Possible indicators for vehicle brake pad copper load and their pros and cons are listed in Table 8. Continuous tracking of indicators is not necessary as long as recent indicator data are available to support management decisions. For some indicators, properly designed representative samples can be used.

Brake pad manufacturers have agreed to report the copper content of original equipment brake pads to the BPP. This information serves as an indicator of how much copper can be expected to be released from original equipment brake pads. This indicator does not necessarily reflect copper use in replacement brake pads, or brake pads used on heavy-duty trucks, off-road vehicles, rail cars, and motorcycles. If BPP research shows that these brake pad categories are significant sources of environmentally important copper, an indicator that includes all types of brake pads will need to be considered; options for such indicators are presented in Table 8 (on the next page).

If voluntary programs such as that conceived by the BPP are to be relied on, verification of market changes by continued tracking of indicators will be necessary (Note that the BPP agreement does not include a promise from automobile companies to purchase lower copper brake pads). Continued tracking after the implementation period would probably be unnecessary if copper content in new and replacement vehicle brake pads was mandated by law or regulation.

4.3 IMPLEMENTATION SEQUENCE AND TIME FRAME

Table 9 (on page 35) and Figure 3 (on page 36) lay out a potential initial implementation sequence and time frame for implementation of a copper management strategy for vehicle brake pads. The basis for the time frames relates to the estimated time it takes to initiate a certain program. After the program is started, the time frames were relative to how long it could take to complete and evaluate results of the first action before moving on to the next action. To ensure all elements are addressed, both Table 9 and Figure 3 envision maximum implementation of the strategy (partial implementation is also feasible; see below). Although it would be theoretically possible to implement some identified strategies in parallel, sequential implementation is recommended because strategy BP-1 is more cost-effective than BP-2, and BP-2 is substantially more cost-effective than BP-3. BP-1 and BP-2 cannot be implemented in parallel, as implementation of BP-2 would probably terminate the Brake Pad Partnership. Strategy BP-1 is recommended as the primary strategy; Strategies BP-2 and BP-3 are recommended for consideration for sequential implementation as fall-back plans, should BP-1 (and subsequently BP-2) not achieve needed reductions.

When evaluating time frames for implementation of Strategies BP-1 and BP-2, it is important to recognize the time lags between agreements (or requirements) to reduce copper use in brake pads and achieving the actual reduction in releases to the environment. The time frames are longest for brake pads on new vehicles. Automobile manufacturers specify brake pad materials several years before a new vehicle design is brought to market. While subsequent changes in pad material do occur, it is not uncommon for the same pad material to be used for the lifetime of the specific design of that vehicle model (which may be several years). Based on this information and the commitment that brake pad manufacturers made to the BPP, if the outcome of the BPP is an agreement by manufacturers to reduce copper use in original equipment brake pads, and this agreement is achieved in 2007, lower copper or copper-free brake pads would appear on new cars starting in about 2012. Since copper brake pads have a service lifetime of approximately 3-4 years and reduced copper pad formulations would phase in as vehicle models are redesigned, reductions would phase in over the following

decade (2012 – 2022). Time frames for reductions in copper levels in replacement pads could be shorter.

Table 8. Potential Leading Indicators for Use of Copper in Brake Pads

Potential Indicator	Comments	Recommended?
1. Original equipment brake pad copper content	Reported to the BPP annually. Report does not include replacement brake pads, or brake pads used on heavy-duty trucks, off-road vehicles, rail cars, and motorcycles.	✓Yes
2. Air emission or deposition samples	Air emission or deposition samples could be collected around urban areas to track the release of copper from brake pads into the environment. (Brake pads are the primary source of copper in Bay Area vehicle emissions and in air deposition). Tunnel air emissions studies were used to estimate copper releases from brake pads; such studies are conducted on an irregular basis by air quality researchers in locations like the Caldecott tunnel. Alternatively, air deposition measurements could be performed similar to measurements performed by the BPP in Castro Valley.	Yes, if replacement and other pad types are determined to be significant copper sources and the industry or the BPP do not offer an alternative tracking mechanism. Air deposition sampling and tunnel studies are expensive and difficult to implement. However, if collaboration with researchers or air quality agencies is possible, useful information could be gained at relatively low cost.
3. Vehicle manufacturer environmental specifications	Vehicle manufacturers provide specifications to brake pad manufacturers regarding what materials are prohibited in their brake pads. These specifications could be obtained for all major manufacturers.	Yes, if the BPP copper use reporting program terminates. The BPP program provides more complete information.
4. Brake pad replacement	Information regarding the replacement of brake pads can provide information regarding wear rates as well as copper content of "in use" brake pads by monitoring what materials are used in replacement pads.	No. There are too many types of brake pads, with unknown or varying copper content. It would be nearly impossible to create a representative sample.
5. Analytical testing for copper content of replacement brake pads	Replacement brake pads could be purchased and sampled to determine copper content. These data could be used to supplement copper use reports from manufacturers of original equipment brake pads.	No. There are many types of brake pad formulations and sales data are not public, rendering creation of a representative sample impossible. It is costly to obtain a representative brake wear debris sample from a brake pad in the laboratory.
6. Vehicle type purchasing trends	Tracking of the sales of different vehicle types can be related to the amount of copper that may be released to the environment.	No. There is no longer a considerable difference in copper content of brake pads from different vehicle types or manufacturers.
7. Awareness of issues	Surveys can be conducted to assess general awareness of issues associated with copper brake pads and available alternatives for brake pad materials and car washing. However, awareness does not translate directly to behavior changes.	No. The public has little control over the copper content of brake pads being put on their vehicles. Likewise, brake pads are not likely a major consideration in vehicle purchases.

Table 9. Potential Framework for Implementation of All Brake Pad Strategies

Action	Implementing Agency	Time Frame*
1. Establish tracking and reporting of the leading indicator and for activity and effectiveness metrics as strategies are implemented	Tracking—Regional Reporting—Regional	Start: Tracking of BPP indicator already in progress. If other types of brake pads are found to be significant copper sources, establish tracking plans within 2 years; begin first measurements in year 3. Implementation: Reports every 3-5 years recommended); end if copper-containing brake pads become obsolete.
2. Implement Strategy BP-1, continued participation in Brake Pad Partnership	Regional	Start: Already ongoing Implementation: Through completion of BPP studies and final decision-making process (~2007)
3. Introduce low copper or copper-free brake original equipment brake pads to vehicle manufacturer.	Brake pad manufacturers	Start: By about 2012, dependent on BPP outcome. Implementation: ongoing
4. Implement Strategy BP-2, seek regulation of brake pad copper content	Regional (Statewide preferred)	Start: Immediately upon making the determination that the outcome of the BPP is insufficient. Implementation: First year--complete legal and political analyses and develop action plan. Ongoing—implement Action Plan. Implementation should be re-evaluated and possibly abandoned if not successful within 5-10 years.
5. Implement Strategy BP-3, urban runoff treatment controls and establish activity and effectiveness metrics	Individual municipalities	Start: Implement if BPP does not produce needed outcome and efforts to seek regulation of brake pads are determined to be unproductive. Implementation: ongoing

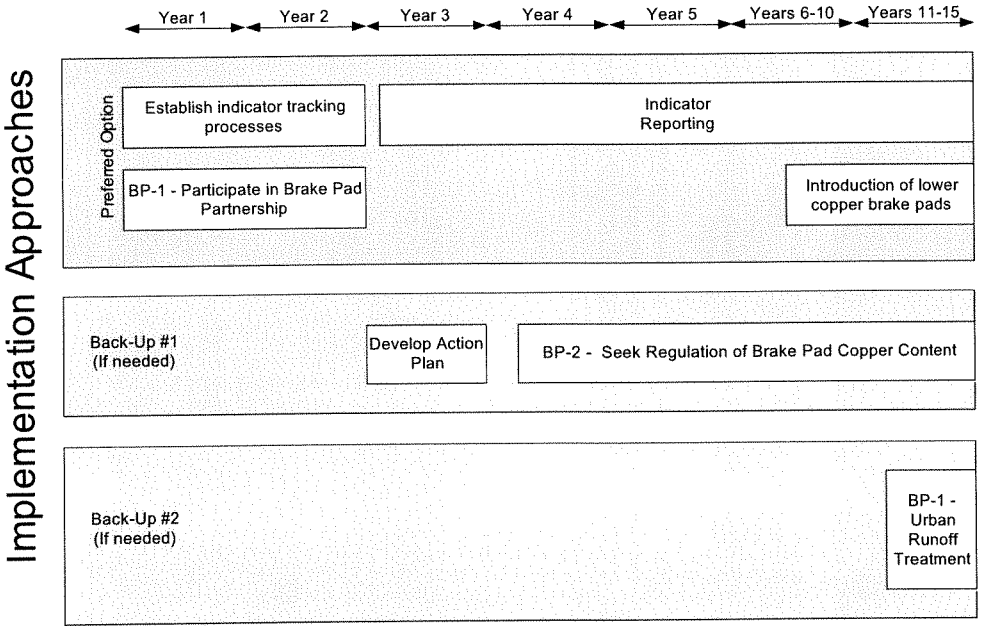
***Time frames based on time to develop and implement a new program or to implement and evaluate a program before moving on to the next task.**

Available Copper Load Reduction

The preferred strategy and the primary fall-back plan above would serve to reduce copper quantities in urban runoff from vehicle brake pads. The specific amount of the reduction is not known, but should be capable of achieving reductions necessary to meet Bay Area water quality compliance needs for brake pad copper. The reduction level can be influenced by Bay Area water quality agencies' actions and decisions. For instance, even if the BPP results in introduction of low or no copper original equipment brake pads, Option B may still be necessary to regulate the copper content of brake pads (such as replacement pads), or if voluntary reductions are not taking place.

In contrast, the second fall-back strategy identified above would have variable potential outcome and might not be capable of achieving necessary reductions. Due to technical constraints (including limited availability of land for treatment and inefficient removal of copper in runoff treatment systems) Strategy BP-3 offers the lowest potential reduction at the highest financial cost.

Figure 3. Potential Framework for Implementation of All Brake Pad Strategies



Post-Implementation Actions

Post-implementation reviews would evaluate progress and effectiveness of the strategy and identify appropriate modifications. For example, modifications could increase effectiveness, reduce costs by eliminating unnecessary activities, or modify strategies in response to newly identified issues. Reviews are recommended at the following times:

- After Year 1 – Determine if replacement brake pads, and brake pads used on heavy-duty trucks, off-road vehicles, rail cars, and motorcycles are significant copper sources; if so, plan for implementation of a leading indicator that covers all brake pad copper emissions (e.g., air emissions or deposition monitoring; see Table 9).
- After Year 2 – A review of the outcome of the Brake Pad Partnership should be completed to determine if the outcome is sufficient to ensure achievement of required reductions. If the outcome is insufficient, work on Strategy BP-2 should be initiated.
- After Year 5 – If the outcome of the BPP is satisfactory, this review should determine whether implementation of the agreement arising from the outcome is successful. If not, reopening the BPP or fall-back plans (Strategy BP-2) should be considered. If the outcome of the BPP was not satisfactory, the status of efforts on Strategy BP-2 should be evaluated and adjustments made as appropriate.
- After Year 10 – If the outcome of the BPP was not satisfactory and Strategy BP-2 is being implemented, the status of efforts should be evaluated. If BP-2 is not successful, available water quality data should be re-evaluated to determine whether Strategy BP-3 needs to be implemented, and if so, what the appropriate implementation design would entail.

- Every 5 years thereafter – Long-term reviews should consider the need for and frequency for continued tracking of various indicators.

The recommended time periods are flexible. Combining the review process with reviews of other CMS elements would be most efficient.

5.0 MARINE ANTIFOULING COATINGS

Paints applied to boats and ships to control unwanted "fouling" growth[30] on their hulls often contain copper-based biocides. When the use of tributyltin in marine coatings was phased out in the late 1980s, copper-based biocides—long used on recreational boats—became the primary antifouling coating option for recreational boats.

In the Bay north of the Dumbarton Bridge, there are major ports, industrial piers, and dozens of marinas. Thousands of boats are berthed in the Bay; recreational boaters put thousands of additional boats into the Bay for short-term use. Larger vessels include about 2,000 shipping vessels that dock in Bay ports each year, hundreds of commercial ships involved in trade and tourism, and hundreds of government-owned vessels to manage aquatic safety and resources. Boats and ships coated with copper-containing biocides may release copper directly into the Bay during storage, operation, and in-water maintenance. On-shore maintenance activities have the potential to release copper into urban runoff.

5.1 CONTROL MEASURES

The Copper Sources Report described the control measures available to address copper in marine antifouling paint. The discussion below refers to these measures. This section briefly describes each option; describes how the option could be implemented in an effective manner (considering whether regional actions would be appropriate); identifies important implementation issues; and identifies appropriate activity metrics and effectiveness metrics.

Currently there are no regional control measures in place to limit copper releases from marine antifouling paint in the San Francisco Bay Area. In response to issues raised in a San Diego Regional Water Board TMDL, DPR and the State Water Resources Control Board are working together to explore the relationship between marine antifouling paints and copper levels in surface waters. To facilitate exploration of this issue, the Interagency Coordinating Committee (IACC), an existing working group composed of 28 State agencies involved in implementing California's Nonpoint Source Pollution Control Program, has created the Copper Antifouling Paint Sub-Workgroup of its Marina and Recreational Boating Workgroup. The purpose of the subgroup is to assess the degree and geographical distribution of copper pollution caused by copper antifouling paints in California's aquatic environments. The San Francisco Bay Regional Water Board is participating in this work group.

Strategy AF-1: Department of Pesticide Regulation of Marine Antifouling Coatings.

To date, no California agency has prohibited use of copper marine antifouling coatings. DPR has the authority to restrict use of marine antifouling coatings. Recognizing that the situation that occurred in the San Diego TMDL may not be unique, DPR is implementing a strategy to determine the appropriate regulatory approach to biocides in marine antifouling coatings, including copper. Key elements of the DPR strategy include

[30] Growth of seaweed, barnacles and other organisms. The presence of such growth on the hull reduces boat speeds and increases motor boat fuel consumption.

completion of a monitoring study to evaluate the extent and magnitude of water quality impacts from marine antifouling paint ingredients (primarily copper) on California surface waters and sediments and coordination for development of safer alternative fouling control practices.

DPR has announced that it anticipates initiating a regulatory process called "re-evaluation" in 2006. This regulatory authority allows DPR to require specific information from makers of marine antifouling coatings.[31] To address the potential for regulatory action on copper-based marine antifouling coatings to switch users to another toxic coating, DPR intends to include most or all biocide-based marine antifouling coatings in its re-evaluation and (to the extent financially feasible) to address biocide alternatives in its marina monitoring study.

Based on information from its own monitoring, information obtained from manufacturers through re-evaluation, U.S. EPA's regulatory actions (if any), Water Board regulatory changes (if any), voluntary commitments by manufacturers (if any) and any other relevant available evidence, DPR intends to determine its appropriate regulatory action some time after the end of 2006. (DPR may also pursue non-regulatory actions). DPR has said that it intends to provide a timely response to the State Water Board's request for feedback by November 2007 (a deadline set when the State Water Board adopted the San Diego Region's Shelter Island Yacht Basin TMDL).

Effective Implementation Design

DPR generally requires quantitative information about the water quality and/or permit compliance problems associated with a pesticide (including quantification of the pesticide's relative contribution to the problem) before it will consider restricting a pesticide's sales and use. DPR's marine antifouling paint strategy is designed to provide it with the type of information it believes necessary to make appropriate regulatory decisions.

Implementation Issues

There is a chance that the DPR re-evaluation will not occur, that it will not be concluded in a timely manner, or that its outcome will not generate regulatory action by DPR that minimizes copper releases to San Francisco Bay from marine antifouling coatings and ensures that marine antifouling coatings do not cause water quality impairment. To address this, the State Water Board included in the resolution approving the San Diego Regional Water Board's Shelter Island Yacht Basin TMDL a commitment to address marine antifouling paint itself. If after two years (2007-2008), DPR (or U.S. EPA through its re-registration program) has not taken action to adequately address the impacts of copper-based marine antifouling coatings on water quality, the State Water Board intends to work with all coastal Regional Water Boards (including the San Francisco Bay Region) to

[31] Mechanically, a re-evaluation consists of the following steps. First, DPR develops a data requirement to present to marine antifouling paint manufacturers. DPR then works with manufacturers to complete acceptable studies to answer the questions listed in the data requirement. Normally, the data requirement calls for manufacturers to develop specific ways to prevent water quality problems. The results of the work done by the manufacturers are studies that must be approved by DPR. DPR then decides based on the studies and any other available information what regulatory action, if any, is appropriate. For example, studies could suggest specific changes to how marine antifouling coatings are used. These types of changes would typically be implemented through changes in product label language. However, it may not be possible to avoid water quality problems without severely limiting or prohibiting use of the certain biocides in marine antifouling coatings. In this case, DPR would need to consider a variety of factors, including the alternatives available and the economic and other reasons that the biocide might be necessary, in making its decision about potential regulatory controls.

develop a state policy for water quality control to address water quality impairments in coastal marinas from copper-based marine antifouling coatings.

Activity metrics

Tracking of manufacturer responses and the results of special studies being performed during the re-evaluation by DPR and manufacturers would provide a measure of activity. DPR issues semi-annual status reports on re-evaluations that are in progress; these reports would provide a suitable mechanism for tracking activity.

Effectiveness metrics

Effectiveness should be measured at the end of the re-evaluation or after Water Board action in lieu of DPR action. The appropriate effectiveness metric would depend on the design of the regulatory program. For example, if DPR or U.S. EPA prohibited all use of copper-based marine antifouling coatings or if manufacturers voluntarily withdrew them from the market, no metric would be necessary. If, on the other hand, Water Board authorities have to be used, metrics associated with the implementation of those authorities would need to be selected.

Strategy AF-2: Targeted Public Education for Alternative Marine Antifouling Coatings

Boats may be stored in the water or on shore. Only those boats that are stored in the water typically have antifouling coatings. These boats account for only a small fraction (perhaps 10-15%) of registered boats. Education of boaters and boat repair facility (boatyard) operators has the potential to reduce use of copper-based marine antifouling coatings. This strategy relies on voluntary actions by boaters and boatyards. Even if DPR proceeds with regulatory action to control water pollution from marine antifouling coatings, this strategy would be needed to assist with a timely and effective transition to less polluting alternatives.

Effective Implementation Design

Educational programs are most effective when designed to target specific audiences using messages that resonate with that audience and using methods that target the specific audience. For outreach on marine antifouling coatings, the key target audiences would be boaters and boatyard owners.

An effective education program would involve direct contacts with boaters and boatyard owners to educate them about alternative coatings. Due to the regional nature of these businesses and the need to ensure that educators can provide complete and reliable information to those involved with hull coating, this program would be most cost-effectively developed and implemented regionally. Many potential partners are already working with Bay Area boaters and boatyards (see the IACC Copper Antifouling Paint Sub-Workgroup participant list).[32] Three examples of specific opportunities for partnerships in the Bay Area include:

- The San Francisco Estuary Project's (SFEP's) Boater Education Program has worked with boaters and marinas since the early 1990s to develop and implement an education and outreach program to protect Bay water quality. The program has focused on marine waste management, encouraging

[32] Available on the workgroup web site http://www.cdpr.ca.gov/docs/sw/caps.htm.

boaters to use pump out and dump stations rather than discharging directly into San Francisco Bay and the Delta.

- The California Department of Toxic Substances Control (DTSC) is initiating a pollution prevention program for marine vehicle service and repair. This program, which plans to focus on hazardous waste generation and management, will be developing invaluable information (e.g., lists of boatyards) and networks. DTSC intends for its Berkeley office to be involved in implementing this program in the Bay Area.
- The Clean Marinas Program is a voluntary recognition program operated by California marina owners, operators, and yacht clubs. The program promotes implementation of best management practices that are intended to protect water quality. Several Bay Area marinas have achieved clean marina certification.[33]

It may also be possible to partner with the San Diego-based University of California Cooperative Extension Sea Grant program, which has been conducting pilot projects and education on non-toxic marine antifouling coatings in Southern California. Coordination with members of the Copper Antifouling Paint Sub-Workgroup the IACC Marina and Recreational Boating Workgroup is recommended.

An education program addressing marinas may also be useful. Although most marinas do not normally conduct boat maintenance,[34] they can influence boat owners via requirements for leasing slips for boat storage. Marinas would be most likely to assist with voluntary programs if they could foresee future regulatory pressures to improve water quality.

Implementation Issues

A highly targeted, well-designed education program for copper marine antifouling coatings could achieve behavior change rates in the 10-15% range.[35] Since the uncertainty in tracking mechanisms is probably at least 10-15%, education programs by themselves are unlikely to have a measurable effect on the amount of copper released to San Francisco Bay from marine antifouling coatings. Nevertheless, education is an important step along the road toward regulating a pollutant source:

- Education programs make affected parties aware of the link between a pollutant source and a water quality threat.
- Voluntary actions resulting from an education program provide helpful examples demonstrating that the requested change is feasible (or occasionally prove that a change is infeasible).
- Agencies that operate education programs can clarify the technical and policy issues that need to be faced prior to initiating a regulatory program.

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[33] For more information, see http://cleanmarinascalifornia.org/.

[34] According to a survey completed by DTSC, marine vehicle servicing or repair occurs at fewer than 10% of California marinas. (See DTSC OPPTD, *Pollution Prevention Report and Two-Year Workplan 2006-2008*, June 2006).

[35] Less targeted programs would have lower rates. See Larry Walker Associates, *Tools to Measure Source Control Program Effectiveness*, prepared for the Water Environment Research Foundation, Project #98-WSM-2, 1999.

If a regulatory program is implemented, an education program can usually be downsized or eliminated.

Due to the lack of San Francisco Bay-specific information on copper loss from marine antifouling coatings, boat owners and boatyard managers may reasonably question the importance of this copper source. Although the Copper Sources Report recommended a region-specific investigation of the copper load from marine antifouling coatings and related issues, such an investigation may not be necessary depending on the outcome of a study currently being conducted by DPR with funding from the State Water Board. This DPR study (which was mentioned above) will include more than a dozen Bay Area marinas in its evaluation of the extent and magnitude of water quality impacts from marine antifouling paint ingredients. The results of the DPR study, which are expected in early 2007, should be evaluated to determine if additional Bay Area specific work is needed to establish the need for (or lack of need for) changes in marine antifouling coatings.

Many alternatives to copper-based marine antifouling coatings exist; however, some alternatives are not practical, effective, or desirable. Although the focus has been on non-toxic alternatives to copper-based marine antifouling coatings, a number of toxic alternatives also exist. California registered marine antifouling biocides that are of particular concern with regards to water quality are Irgarol® and zinc pyrithione.[36] Prior to implementing this strategy, a review of alternatives should be conducted to determine which strategies are most likely to be practical and effective and least likely to have adverse environmental or human health consequences.

This strategy involves the use of antifouling coatings that are relatively new and currently considered "unproven" in the industry. To address this issue, pilot projects are recommended as the first step in implementing this strategy. Local pilot projects can demonstrate how alternative materials perform in Bay waters and how effective they are against Bay fouling species. Long-term testing of coatings under different operating conditions (i.e. heavy boat use versus extended moored periods) would be useful. Obtaining cost data is important, because cost of antifouling coating installation and maintenance is important to boat owners.[37] Government agencies that own water-stored boats and/or private entities connected to resource protection would be the most likely partners in pilot projects. Prior to implementing pilot projects, appropriate alternative coatings should be selected based on the review recommended above.

Before most of the currently available non-toxic marine antifouling coatings can be used, the current coating must be fully removed. Coating removal is time consuming and expensive; it is normally completed by professionals at boatyards. Due to this cost, boat owners have been reluctant to consider switching to alternative coatings until their current coating has reached the end of its useful lifetime. Although antifouling paint recoating typically occurs every 2-3 years, paint stripping only typically is completed about once every 15 years.[38]

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[36] TDC Environmental, *Pesticides in Urban Surface Water: Annual Research and Monitoring Update 2005*, prepared for the San Francisco Estuary Project, 2005.
[37] Johnson, L. T., and J. A. Miller, University of California Cooperative Extension—Sea Grant Program, "Nontoxic Antifouling Strategies Economic Incentives Study." UCSGEP-SD Fact Sheet 04-1 May 2004.
[38] See the Johnson and Miller reference cited above.

The effectiveness of such a program may be improved by enlisting the help of marinas. A certification program or recognition program for marinas that recommend or require the use of alternative anti-fouling coatings may increase the rate at which boat owners and boatyards adopt the recommended practices. If a voluntary incentive program is planned, the potential for cooperation with the Clean Marinas Program should be explored.

Activity metrics

Activity metrics would need to be developed when the outreach program was designed, as they should relate specifically to the program design. Measurement of activity implementation of an outreach program can include the number of brochures distributed, number of articles or advertisements placed, the number of boat and boatyard owners attending workshops, the number of boats involved in pilot projects, or the number of brochures taken from a display.

Effectiveness metrics

The effectiveness metric would best be designed in concert with the design of the education program. To determine if recommended practices are being adopted, surveys or random site inspections could be conducted at boatyards. Low rates of implementation may be observed due to the voluntary nature of the program.

Strategy AF-3: Hull Cleaning Best Management Practices

Marine antifouling coatings rely on slow release of a biocide impregnated in the coating to prevent fouling growth on the hull. Of the two formulation types, ordinary "hard" copper-containing antifouling paints must be cleaned often enough to remove early stages of fouling growth before it becomes established on the boat's hull. Unless the boat is removed from the water, the only practical cleaning method is to send divers underwater to remove any fouling growth from the hull. Vigorous cleaning dislodges some of the antifouling coating, releasing copper into the water.

Educational programs could be used to encourage that best management practices be implemented during hull cleaning to reduce copper discharges from antifouling coatings. Management practices that minimize copper release during hull cleaning have been developed by the University of California Extension Sea Grant program as well as by other U.S. coastal agencies.[39] Because available data indicate that only a relatively small fraction of copper releases from marine antifouling coatings occur during hull cleaning, this measure is recommended as a contingency measure. Implementing this measure may, however, be a useful step in obtaining boat owner cooperation with efforts to promote voluntary use of non-toxic alternative antifouling coatings (see Strategy AF-2).

Effective Implementation Design

For outreach on hull cleaning practices, the key target audiences would be boaters and underwater hull cleaning services. An effective education program would involve direct contacts with boat owners and underwater hull cleaning services to educate them about cleaning practices. Due to the regional nature of these businesses and the need to ensure that educators can provide complete and reliable information to boaters and hull cleaners, this program would be most cost-effectively developed and implemented regionally.

[39] See for example the U.C. Sea Grant Program Underwater Hull Cleaner's Best Management Practices, available on the Internet at http://seagrant.ucdavis.edu/underwater.htm.

An education program addressing marinas may also be useful. Although most marinas do not normally conduct boat maintenance,[40] they can influence boat owners via requirements for leasing slips for boat storage or by helping connect boat owners to hull cleaning services. Marinas would be most likely to assist with voluntary programs if they could foresee future regulatory pressures to improve water quality.

Implementation Issues

Since boat owners hire contractors for hull cleaning, it is difficult for them to ensure that appropriate management practices are actually being implemented when their boat hulls are being cleaned. Contract specifications and certification programs could help owners to ensure that management practices are being implemented.[41]

Although modifying underwater hull cleaning practices to minimize copper release is possible, data from San Diego suggest that even with relatively frequent underwater cleanings, modified procedures are likely have little impact on copper loads.[42]

Activity metrics

Activity metrics would need to be developed when the outreach program was designed, as they should relate specifically to the program design. Measurement of activity implementation of an outreach program can include the number of brochures distributed, the number of boat owners and hull cleaning service employees attending workshops, or the number of brochures taken from a display.

Effectiveness metrics

The effectiveness metric would best be designed in concert with the design of the education program. A survey of hull cleaning service companies could be one measure of the effectiveness of outreach programs. Low rates of implementation may be observed due to the voluntary nature of the program.

5.2 LEADING INDICATORS

Leading indicators are actions that can be tracked and used to assess the change in significance of a pollutant source (trends). These differ from effectiveness metrics, which evaluate the response to a specific control measure. Leading indicators should track actions that occur prior to environmental impacts.[43] Ideal leading indicators involve information that can be easily collected and compiled. Ideal leading indicators correlate with the magnitude of the pollutant source and/or effectiveness of addressing the source.

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[40] According to a survey completed by DTSC, marine vehicle servicing or repair occurs at fewer than 10% of California marinas. (See DTSC OPPTD, *Pollution Prevention Report and Two-Year Workplan 2006-2008*, June 2006.)

[41] See for example the U.C. Sea Grant Program's recommendations for boat owners "Selecting a Service Provider" available on the Internet: http://seagrant.ucdavis.edu/topside.htm.

[42] *Schiff, K. C; Diehl, D.; Valkirs, A.* Copper Emissions from Antifouling Paint on Recreational Vessels, *Technical Report 405, Southern California Coastal Water Research Project*, June 2003; *Carson, R.; Damon, M.; Johnson, L.; Miller, J.* Transitioning to Non-Metal Antifouling Paints on Marine Recreational Boats in San Diego Bay, *Final Report, prepared for the California Department of Boating and Waterways pursuant to California Senate Bill 315 of 2001*, 2002.

[43] Water quality monitoring is not a leading indicator, but rather a trailing indicator indicating the environmental response to a pollutant management action.

The amount of copper entering the Bay from antifouling paints would be proportional to the amount of copper antifouling paints used on boats in the San Francisco Bay. Possible indicators and their pros and cons are listed in Table 10 (on the next page). Evaluation of multi-year data sets is necessary to support management decisions. Year-to-year variations in marine antifouling coating use are likely, as weather is an important factor in recreational boating. This means that annual tracking of indicators and evaluation of multi-year data sets is necessary to support management decisions.

5.3 IMPLEMENTATION SEQUENCE AND TIME FRAME

Table 11 (on page 46) and Figure 4 (on page 47) lay out a potential initial implementation sequence and time frame for implementation of a copper management strategy for copper-based marine antifouling coatings. The basis for the time frames relates to the estimated time it takes to initiate a certain program. This timeline also gives coating companies time to research and develop new coatings and time for independent parties to evaluate the coatings in different geographic conditions and under different circumstances. After the program is started, the time frames are relative to how long it could take to complete and evaluate results of the first action before moving on to the next action. To ensure all elements are addressed, both Table 11 and Figure 4 envision maximum implementation of the strategy.

While full implementation of the actions listed in Table 11 would provide the most complete control of this copper source, less than full implementation is entirely feasible, as long as the effectiveness level is judged acceptable (see descriptions above for effectiveness estimates for individual strategies). Assessing load estimates and/or determining if feasible alternatives are available are important steps in the development of most strategies. The order of implementation is based on the need to develop some background information prior to implementing certain strategies and then implementing control measures based on their potential to achieve reductions.

Table 10. Potential Leading Indicators for Copper Marine Antifouling Coatings

Potential Indicator	Comments	Recommended?
1. Quantity of copper antifouling coating use estimated on the basis of non-reported cuprous oxide use.[44]	Data reported to DPR are relatively accurate and readily available. Requires extrapolation of statewide sales data, so does not reflect local or regional actions.	✓Yes. Shows trends. Would need to be supported by other indicators of local use if statewide regulatory action is not implemented.
2. Boatyard surveys for use of alternative antifouling coatings.	Surveys of antifouling products used by boatyards provide an indicator of penetration of alternatives in the Bay Area market. However, does not provide reliable quantitative data.	✓Yes. Only way to explore effects of regional control measures.
3. Marine antifouling coating sales.	Unlikely to be able to obtain local data for a reasonable price due to the confidential nature of sales data. Although statewide data are submitted to DPR, they are considered trade secret and thus normally must be kept confidential.	No. Probably not feasible.
4. Number of boats coated with copper-based paint.	Maintain records of all boats that are coated (including make, size, quantity of paint used, etc).	No. Not feasible, as this is not a practice requiring a permit.
5. Number of boats with copper-based coating removed and replaced with alternatives.	Maintain records of all boats that have their antifouling coating removed.	No. Not feasible, as this is not a practice requiring a permit.

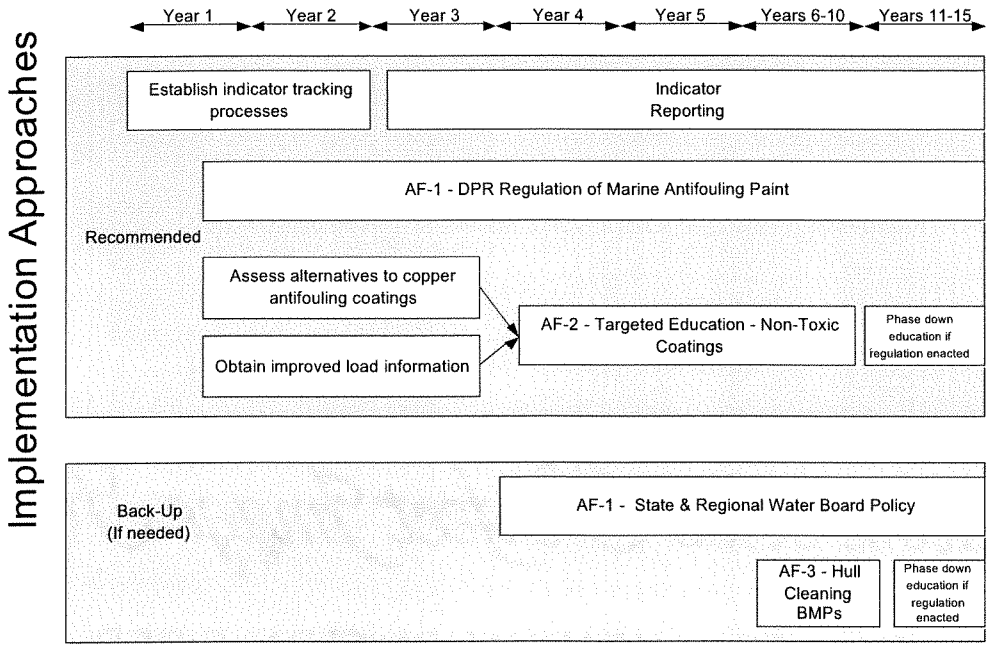
[44] Methodology described in City of Palo Alto Regional Water Quality Control Plant, *Copper Action Plan Report*, 2006.

Table 11. Potential Framework for Implementation of All Copper Marine Antifouling Coating Strategies

Action	Implementing Agency	Time Frame*
1. Begin DPR re-evaluation of antifouling coatings	DPR	Start: By Fall 2006. Implementation: Complete re-evaluation by year 5. Regulatory action would follow completion of re-evaluation; implementation of regulations would be ongoing.
2. Develop local antifouling coating load contribution estimates, if necessary	One regional study	Start: In 1st year of program, evaluate results of DPR marina monitoring study and determine if additional local data are needed. Implementation: If additional local data are needed, design and complete study by year 3. Completed early in program because it informs and assists with implementation of later strategies.
3. Review alternatives to copper-based antifouling coatings	One regional or statewide study	Start: In 1st year of program (exact timing could be modified to accommodate a statewide coordination opportunity). Implementation: Complete by year 3. Review will determine which alternatives are most likely to be practical and effective and least likely to have adverse environmental or human health consequences.
4. Establish tracking and reporting of the leading indicator and for activity and effectiveness metrics as strategies are implemented	Tracking—Regional Reporting—Regional preferred (may not be practical for metrics)	Start: Tracking established within 2 years; begin reports in year 3. Implementation: Ongoing; end if regulatory controls judged adequate by the Water Board are adopted for copper antifouling coatings.
5. Implement Strategy AF-2, conducting targeted outreach & education about non-toxic alternative antifouling coatings	One regional program	Start: After review of alternatives, assuming one or more promising alternatives are identified. Implementation: Start pilot projects in year 3; time start of outreach based on pilot project schedule. May take up to 20 years to fully implement alternatives.
6. Implement Strategy AF-3, conducting targeted outreach & education about hull cleaning BMPs	One regional program	Start: If additional strategies are deemed necessary. Implementation: Ongoing; end if adequate regulatory controls are adopted for copper –based marine antifouling coatings.
7. Develop and implement statewide policy regarding copper antifouling coatings	State and coastal Regional Water Boards	Start: If DPR's November 2007 response to the State Water Board (or subsequent regulatory action) does not adequately address the impacts of copper-based marine antifouling coatings on water quality. Implementation: Ongoing.

***Time frames based on time to develop and implement a new program or to implement and evaluate a program before moving on to the next task.**

Figure 4. Potential Framework for Implementation of All Copper Marine Antifouling Coating Strategies



Available Copper Load Reduction

Replacing current copper-based antifouling coatings with non-toxic alternatives could provide a substantial reduction in copper loading to the Bay from this source, as each replacement would eliminate that boat's entire contribution to the copper load. Reductions from implementation of underwater hull cleaning best management practices would be relatively small, since they would reduce—but not eliminate—the relatively small load contribution from hull cleaning (see above). The greatest reduction could be achieved through regulation of copper-based antifouling coatings.

Post-Implementation Actions

Post-implementation reviews would evaluate progress and effectiveness of the strategy (based in part on evaluation of the leading indicator and activity and effectiveness metrics) and identify appropriate modifications. For example, modifications could increase effectiveness, reduce costs by eliminating unnecessary activities, or modify strategies in response to newly identified issues. Reviews are recommended at the following times:

- About Year 2 – after DPR feedback to the State Water Board on its activities (due in November 2007), obtaining improved load information, and completing an assessment of alternative antifouling coatings. Even if regulatory action is imminent, moving forward with the first step of the education and outreach program (pilot projects) using recommendations based on results of the alternatives assessment is recommended to encourage and smooth the transition to safer alternatives. If a joint State and Regional Water Board decision on policy development has not been made, it should be made at this time.

- About Year 5 – in concert with five year reviews of other program elements. Review regulatory status and determine if fall-back regulatory action or the hull cleaning educational program is warranted. Determine whether the antifouling coating targeted education program should be modified (or terminated if no longer necessary due to regulations).
- Every 5 years thereafter – Long-term reviews should consider the need for and frequency for continued tracking of various indicators and the need to modify regulatory approaches. Long term reviews should also consider the need for additional actions (e.g., to address large commercial ships, which may have antifouling coatings applied outside of California) as well as the elimination of actions that are not effective or no longer warranted based on updated information and data collection.

The recommended time periods are flexible. Combining the review process with reviews of other CMS elements would be most efficient.

6.0 EXISTING PERMIT REQUIREMENTS

The Copper Sources Report identified several potentially significant copper sources that are already controlled by permits issued by the State Water Board. These are summarized below.

- Industrial Activities. Industry has long been a focus of environmental regulatory programs, including both wastewater pretreatment and stormwater permit programs. Any industrial facility in one of 10 broad categories of industrial activities must participate in the State Water Board's industrial stormwater permit program. Boat maintenance facilities, marinas, and other water transportation facilities are included in SIC code 44 (Water Transportation) and are part of the Transportation category covered by the State General Industrial Permit. According to the State General Industrial Permit, any facility in this category that has vehicle maintenance shops or equipment cleaning operations is subject to the requirements of the permit. About 1,500 industrial facilities in the San Francisco Bay Area are currently active participants in the program. Using industrial stormwater monitoring data, the Copper Sources Report estimated that about 3,300 pounds of copper are discharged annually in industrial runoff; this estimate has a moderate uncertainty, primarily because it involved extrapolation to create a regional estimate from Santa Clara County data.
- Soil Erosion. Each year, hundreds of construction sites cover thousands of acres of San Francisco Bay Area land, digging up the soil to build new homes, businesses, industries, and infrastructure. In order to prevent releases of soil and other pollutants into stormwater runoff, the State Water Board requires all construction sites 1 acre and larger to participate in the construction stormwater permit program. There were about 700 active construction sites in the San Francisco Bay Area in 2003. Construction of new impervious surfaces in Bay Area watersheds also changes the quantity and timing of runoff flows in urban creeks. These changes can accelerate erosion of stream banks—potentially contributing significantly to sediment loads in runoff. Recent new development related amendments to urban runoff agency permits require development of hydromodification management plans to protect beneficial uses in Bay Area creeks. Using previous estimates of the copper content of eroded soil, the Copper Sources report estimated soil erosion discharges at about 7,000 pounds

of copper per year (about two-thirds from hydromodification and one third from construction sites). This estimate has a moderate uncertainty.

- Copper Algaecides Applied to Surface Waters. For decades, copper has been used to control algae growth in reservoirs, lagoons, and drainage channels. In response to a 2001 Federal court decision, the State Water Board initiated a program to regulate applications of pesticides to surface waters. A study of the environmental effects of aquatic pesticide applications conducted by the San Francisco Estuary Institute found that dissolved copper from aquatic pesticide applications caused lethal and sublethal toxicity in juvenile trout for at least 24 hours after application, toxicity in *Ceriodaphnia dubia* (water flea) for at least a week after application, and may relate to increased sediment copper concentrations (though results on sediment toxicity were inconclusive).[45] The presence of the permit requirements has increased incentives for applicators (who are primarily public agencies) to reduce use of aquatic pesticides and to transition to alternative pesticides or to non-pesticide control methods for aquatic weeds and algae. The Copper Sources Report estimated that about 4,000 pounds of copper were applied to shoreline water bodies. This estimate, which was based on an incomplete database of reports to DPR and uncompiled reports to the State Water Board was judged highly uncertain.

Existing permit requirements for construction and industrial stormwater runoff, aquatic pest management, and hydromodification management planning address these copper sources. Implementation of these permit requirements is intended to ensure that these activities do not cause or contribute to exceedance of water quality standards in receiving waters. If these activities are found to be causing or significantly contributing to copper water quality standard exceedances, they may be modified as necessary. Given the basis of these permit requirements and the State and Regional Water Board's authority to modify the permits if necessary, additional copper management strategies for these copper sources are not necessary.

7.0 PUBLIC OUTREACH

The previous sections describe specific control strategies that are available to prevent and minimize discharges from the largest sources of copper in urban runoff and release from Bay shoreline activities. Other minor copper sources exist (for example, vehicle fluid leaks and dumping, domestic water discharged to storm drains). Copper may also be conveyed to surface waters by improper discharges (e.g., from car washing). These copper sources and conveyances can be addressed through public outreach programs, as appropriate within the context of other public outreach priorities.

All municipal stormwater management programs are required by their NPDES permits to operate public information and participation (PI/P) programs. The goals of these programs include changing behaviors that adversely affect water quality. Several of the control strategies identified in previous sections would be implemented in conjunction with the required PI/P programs. Public outreach for minor copper sources is not a top priority; however, there may be opportunities to address these sources in conjunction with programs addressing other pollutant sources. Opportunities to address minor copper sources and conveyances should be considered when setting program priorities each year.

[45] Siemering, G., *Aquatic Pesticide Monitoring Program, Phase 2 (2003) Monitoring Project Report*, prepared by the San Francisco Estuary Institute for the State Water Resources Control Board, February 2004.