

**Comments on
“The Santa Monica Bay Restoration Plan, September 1994”
for Stormwater Runoff Water Quality Management**

Submitted by

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In September 1994 the Santa Monica Bay Management Committee approved a Santa Monica Bay Restoration Plan. This Committee was co-chaired by the Chairman of the State Water Resources Control Board, the Director of Water Management Division US EPA Region IX, and the Vice-Chair of the California Regional Water Quality Control Board, Los Angeles Region. This Plan included a proposed expenditure of about \$40 million devoted principally to the development of structural BMPs for the control of heavy metals and few other chemical constituents in urban stormwater runoff from the Santa Monica Bay watershed. A review of the technical validity of the basis for development of this part of the Bay Restoration Plan shows that it is not based on a reliable assessment of the water quality problems caused by current discharges of heavy metals to Santa Monica Bay derived from urban street and highway runoff in the Santa Monica Bay watershed. Comments on the serious technical deficiencies of the final Santa Monica Bay Restoration Plan components devoted to the proposed approach for management of urban runoff heavy metals are presented below.

Background to these Comments

In the spring of 1994, C. Tyrrell, Director of the Santa Monica Bay Restoration Project, made a presentation to the California State Stormwater Quality Task Force in which she discussed the approaches that were being used to develop the Santa Monica Bay Restoration Plan components devoted to stormwater runoff quality management. The author of these comments was present during that presentation and indicated to Ms. Tyrrell after the presentation that based on his over-30 years of experience in evaluating the impacts of and managing chemical constituents in stormwater runoff that the approaches that were being used to identify real water quality problems associated with current stormwater runoff from the Santa Monica Bay watershed were technically invalid. The author offered to Ms. Tyrrell to critically review this issue and provide comments on any technical deficiencies found in the approach that was being followed. In May 1994 a copy of a public review draft for “The Santa Monica Bay Restoration Plan - Actions for Bay Restoration” dated April 1994 was received by the author of these comments. In June 1994, prior to the deadline for receipt of comments on this draft, a detailed set of comments (16 pages) were provided to Ms. Tyrrell principally on the inappropriate technical approaches that were used. Those comments included not only review of the draft Restoration Plan, but also of the back-up documents upon which the Plan was said to be developed.

In August 1994 a set of responses was provided to the author of these comments. A review of these responses, however, in the key areas of concern about the technical validity of the approaches used to justify the expenditure of approximately \$40 million over the next five years for the development of structural BMP's to control heavy metal inputs to Santa Monica Bay from urban stormwater runoff showed that the responses were highly superficial and did not appropriately address the key issues of concern. In September 1994 comments on the inappropriate responses were provided to Ms. Tyrrell, reiterating the importance of not adopting those components of the Restoration Plan devoted to control of heavy metals in stormwater runoff until a real water quality problem - use impairment of Santa Monica Bay waters was found that could be attributed to the current inputs of heavy metals from streets, highways and other urban areas in the Santa Monica Bay watershed. The supplemental comments provided by the author in September cover the same issues as those provided in June. Subsequently, in December it was learned that the Santa Monica Bay Restoration Project Plan had been adopted by the Management Committee in September 1994. Ms. Tyrrell did not provide the author of these comments with a copy of this Plan or with other information pertinent to the finalization of this Plan.

The Problem

As discussed in the June 1994 comments, the stormwater urban runoff components of the draft Plan incorrectly assumed that because copper, zinc, lead, nickel, cadmium, silver and chromium from other sources such as mining or plating wastes had caused water quality problems in some waterbody (not Santa Monica Bay) these same metals in urban stormwater runoff from streets and highways in the Santa Monica Bay watershed would be significantly adverse to the designated beneficial uses of Santa Monica Bay waters. Those familiar with the elements of aquatic chemistry and aquatic toxicology as they relate to the development of technically valid, cost-effective approaches for management of real water quality problems know as is well-documented in the literature that it is highly inappropriate to assume that all lead, zinc, cadmium, silver, chromium, nickel, copper, etc. from any source is always significantly adverse to the beneficial uses of any waterbody into which these metals enter. One of the fundamental tenets of aquatic chemistry and aquatic toxicology is that chemical constituents such as heavy metals exist in aquatic systems in a variety of chemical forms, only some of which are toxic -available to adversely affect aquatic life. This tenet was ignored in the conduct of the Santa Monica Bay Restoration Project Restoration Plan development.

Information that shows it is inappropriate to use total chemical constituents concentrations as a basis for developing control programs is not new. The National Academies of Science and Engineering in 1972 as part of developing the "Blue Book of Water Quality Criteria" discussed these issues and adopted a recommended approach for regulating heavy metals based on toxicity measurements. It was well-known then that measurements of chemical concentrations of heavy metals were not a reliable approach for regulating heavy metals from any source. In the mid-1980s, the US EPA acknowledged the same problem in developing the "Gold Book" water quality criteria for heavy metals where the Agency stated for each of the heavy metals of concern that the total heavy metal was not a reliable basis for regulating the heavy metal and that regulating based on total heavy metals could result in over-regulation. In October 1993 the US EPA finally adopted dissolved heavy metals as the basis for regulating heavy metal impacts in ambient waters.

There have been numerous studies conducted across the US and in other countries that show that heavy metals in urban stormwater runoff from residential and commercial areas are not in toxic - available forms. They are principally in particulate forms which are inert. This information was ignored by the Santa Monica Bay Restoration Project Management Committee.

As discussed in the author's comments on the draft Proposed Plan for Action, the assumption that heavy metals in urban stormwater runoff must be controlled by structural BMP's at considerable expense to the public because these heavy metals persist in Santa Monica Bay sediments is obviously technically invalid to those who understand the aqueous environmental chemistry of heavy metals and their toxicity to aquatic life. As pointed out in the original comments on the draft report, the author of them had worked for over 30 years on sediment quality issues where he had supervised over \$2 million in research devoted to evaluating the water quality significance of heavy metals and other chemical constituents in aquatic sediments as they may impact the designated beneficial uses of the waters in which the sediments are located. In the 1970s he conducted over \$1 million of research specifically devoted to developing sediment quality criteria that could be used to regulate heavy metals and other constituents in contaminated sediments that were to be dredged as part of navigational channel maintenance in US waterways. The work that he and others did in the 1970s confirmed what was already well-known then that it is unreliable to try to use total concentrations of heavy metals in sediments as a basis for judging potential impacts on water quality. This arises from the well-known fact that the number of components in a sediment matrix interact with heavy metals and other constituents to detoxify them.

In the 1970s the US Army Corps of Engineers and the US EPA found that chemical measurements of heavy metals in sediments was an unreliable approach for evaluating potential toxicity to aquatic life. At that time it was decided that the only reliable approach to evaluate the toxicity of heavy metals in sediments was to measure toxicity directly. This is the approach that has been used over the last approximately 20 years for regulating contaminated dredged sediments.

When the author reviewed the back-up documents to the April 1994 draft Restoration Plan for Santa Monica Bay, it was found that the Management Committee for this Project had used Long and Morgan co-occurrence-based values for concentrations of heavy metals in sediments of Santa Monica Bay as justification for spending large amounts of public funds for the control of heavy metals in urban stormwater runoff from the Santa Monica Bay watershed. The co-occurrence-based approaches rely on total heavy metals and other constituents. They do not use the toxic - available forms as the basis for regulation. This approach, therefore, is obviously technically invalid. The US EPA as part of their attempts to develop water quality criteria for heavy metals did not adopt that approach because of its well-known unreliability. However, even after having this unreliability pointed out to the Management Committee of the Santa Monica Bay Restoration Project in June 1994, this Committee persisted with the draft recommendations of control of heavy metals in urban stormwater runoff from the Santa Monica Bay watershed based on the fact that heavy metals were present in Santa Monica Bay sediments above some highly arbitrary co-occurrence-based values. These values were used to justify that these heavy metals were toxic in the sediments and therefore had to be controlled in stormwater runoff. No measurements were made in the 4-year period that the Santa Monica Bay Restoration Project had been active prior to the development of the Restoration Plan of sediment toxicity and where toxicity occurred, whether this toxicity was due to heavy metals present in urban stormwater runoff that was entering the Bay at this time.

Recently the State Water Resources Control Board's staff have released a draft functional equivalent document covering the implementation of the Bay Protection and Toxic Hot Spot regulations. While in 1991 this staff proposed to utilize several co-occurrence-based approaches similar to the Long and Morgan approach as a basis for developing sediment quality objectives for the state, in the recently released draft that approach has been abandoned in favor of a narrative approach for developing sediment quality objectives. While the details of what the narrative approach will be, certainly any valid narrative approach that addresses sediment toxicity will have to include toxicity measurements. The State Board staff's recent action in abandoning co-occurrence-based approaches for developing sediment quality objectives is one more example of the lack of technical validity of the co-occurrence-based approaches that were used in the Santa Monica Bay Restoration Project as a technical basis for developing a proposed plan. Even the authors of the Long and Morgan co-occurrence-based approach (Ed Long) would not approve use of the values developed from his work as the Santa Monica Bay Restoration Project has done where based solely on the exceedance of certain numeric values an approximately \$40 million program is to be implemented controlling input of heavy metals from stormwater runoff.

For the Santa Monica Bay Restoration Project Management Committee to adopt a mass emission strategy for control of heavy metals in the stormwater runoff in 1994 shows either a complete lack of knowledge of basic issues pertinent to developing technically valid approaches for evaluating and managing water quality in stormwater runoff or a total disregard of the substantial literature that exists that should have been reviewed as part of formulating the urban stormwater runoff management components of the Restoration Plan.

Mismanagement of the Technical Components of the Project

It is clear that the use of technical information in developing the Restoration Plan for the urban stormwater runoff components was badly mismanaged. A few individuals who chose to ignore the vast technical literature on water quality impacts of heavy metals in urban stormwater runoff and in sediments controlled the information that was available to the Management Committee. The Management Committee, on the other hand, chose to ignore reviewers' comments which included substantial reference to the literature that should have been reviewed as part of developing a technical base for formulating the Restoration Plan components devoted to urban stormwater runoff. The way the Santa Monica Bay Project Final Plan was adopted did not include the opportunity for input, including peer review of the technical approaches used in developing the Plan. Further, the managers of the Project did not even inform all of the reviewers when the Management Committee was meeting to consider the adoption of the Plan. In addition, the development of this Restoration Plan was conducted outside of the normal State Water Resources Control Board public review process.

Recommended Approach

It is very important that no public funds be spent developing structural BMP's for control of urban stormwater runoff of heavy metals in the Santa Monica Bay watershed until a real water quality problem - use impairment of Santa Monica Bay waters has been found due to the current heavy metal inputs. As outlined in the original comments made by the author on the draft Plan, the first thing that should be done is to determine whether the sediments in Santa Monica Bay are, in fact, toxic to aquatic life. Second, since

many sediments are toxic from natural and other causes, it is important to determine whether any sediment toxicity found is, in fact, of significance to the designated beneficial uses of Santa Monica Bay waters.

If there is significant sediment toxicity that is impairing the designated beneficial uses of Santa Monica Bay waters, then studies should be conducted to determine the cause of this toxicity. If the cause of this toxicity is heavy metals, then studies should be conducted to determine the source of the heavy metals that lead to toxic heavy metals in Santa Monica Bay sediments. If the source is found to be urban and highway runoff which is very unlikely based on the large number of studies that have been conducted, then studies should be conducted to determine if the toxic heavy metals in highway and street runoff can be controlled at the source. With the above information, it will then be possible to determine that there is, in fact, a real water quality problem associated with heavy metals in Santa Monica Bay sediments that are derived from current stormwater runoff from the Santa Monica Bay watershed.

Only after proper definition of a real water quality problem that is attributable to heavy metal runoff from streets and highways in the Santa Monica Bay watershed that cannot be controlled at the source should a management plan be developed that incorporates structural BMPs for control of heavy metals. As discussed in the enclosed recently published papers, preprints of which were made available to the Santa Monica Bay Restoration Project Management Committee, the conventional structural BMPs of the type discussed in the Restoration Plan will not likely be effective in removing heavy metals in urban stormwater runoff that are toxic - available. Structural BMPs such as detention basins remove particulate forms of heavy metals which are well-known to be non-toxic. The structural BMPs that would have to be used to control toxic - available forms of heavy metals in urban street and highway runoff will likely be significantly different than those proposed in the final Santa Monica Bay Restoration Plan.

Chapter 3 of the September 1994 Action for Bay Restoration presents a discussion of stormwater/urban runoff issues. In the box on the first page, it is stated,

“A Best Management Practice is any method, activity, maintenance procedure, or other management practice for reducing the amount of pollution entering a water”.

[The issue is not the amount of pollution entering a water; it is the amount of pollutant entering a water that remains a pollutant within the waterbody. Also of concern are non-pollutants that become pollutants in the waterbody. One of the fundamental problems with the Santa Monica Bay Project is that those responsible for conducting the Project do not understand the meaning of “pollution” and “pollutant.” These terms are used inappropriately at many locations in this final report.](#)

For example, the first sentence of the summary of Chapter 3, page 3-1, states that stormwater and urban runoff is the most significant source of nonpoint pollution to Santa Monica Bay. Stormwater runoff from urban residential areas is a problem with respect to trash, debris and waterborne pathogen indicator organisms, all of which impair the designated beneficial uses of Santa Monica Bay waters. There is no evidence that the five heavy metals singled out for structural BMP control from street and highway runoff in the Project are causing any pollution to Santa Monica Bay waters at this time.

Mention is made on page 3-3 about an SMBRP study in 1990 that allegedly found that stormwater/urban runoff resulted in significant loadings of many categories of pollutants. The author has examined the report from that study and found that that report improperly defined “pollutants.” The so-called “loads of pollutants” are loads of chemical constituents without regard to whether they are in available or toxic forms and whether they cause an impairment of the designated beneficial uses of Santa Monica Bay waters. The labeling of chemical constituents in urban stormwater runoff as pollutants without a proper evaluation of whether they cause pollution in Santa Monica Bay is highly inappropriate.

Pollution is clearly defined in federal and state regulations as the impairment of the designated beneficial uses of waterbodies. The current discharges of trash, debris and waterborne pathogenic indicator organisms to the Bay from the Santa Monica Bay watershed is impairing the use of the Bay waters and therefore causing pollution. However, to label heavy metals in urban stormwater runoff as pollutants because they accumulate in sediments as was done in this project is technically invalid. For these heavy metals to be pollutants they must significantly impair the designated beneficial uses of the Bay through toxicity in the sediments or through bioaccumulation that is adverse to higher trophic level organisms.

The approach outlined on page 3-24 through 3-28 for implementation of BMPs is not technically valid. As discussed in the appended papers, in order to develop technically valid, cost-effective BMPs for stormwater runoff, first there has to be a real water quality problem found that the BMP is addressing. With the problems identified, as discussed above, it is then possible through logical, appropriate testing and evaluation to determine the cause of the problem and then design a BMP that is appropriate to control the cause. Following the approach adopted in the Santa Monica Bay proposed Restoration Plan could result in massive waste of public and private funds and have little or no impact on the designated beneficial uses of Santa Monica Bay waters. Before any funds are spent even in pilot studies of BMP's, it will be necessary to define real water quality problems - use impairments of Santa Monica Bay that are to be addressed by the BMPs. These problems are not simply the presence of heavy metals in sediments as is currently been done by the Project management.

Page 3-38 in Table 3-3, mentions “*filter media devices for pollutant removal from transportation drainage systems*”. Since these filtering media devices are to remove oil and grease and heavy metals, it appears that the authors of that section have ignored the well-known fact that particulate heavy metals are not pollutants.

In Table C-i in the Appendix, Menu B Candidate BMPs which include in 4.b. under “Comprehensive Treatment Based Controls” detention/retention/infiltration basins. While such basins may be effective in controlling suspended solids which would affect the rate of siltation of Santa Monica Bay, they are not likely to be very effective in controlling the heavy metals and many other constituents that could be adverse to Bay waters.

Appendix B presents a hypothetical “Application of Mass Emissions Approach to Management of Lead.” In the second paragraph of this discussion mention is made that the lead in some of the sediments of Santa Monica Bay exceed the ER-M value of 110 ppm dry weight. The authors of that section did not understand the lack of technical validity of the ER-M values in judging potential water quality problems. No one knowledgeable in aquatic chemistry or aquatic toxicology and water quality would ever try to use

ER-M or ER-L values as a basis for defining a water quality problem. These values are based on total concentrations and an inappropriately assessed co-occurrence with alleged problems.

The statement in the third paragraph about “Current levels of emissions from nonpoint sources still occasionally exceed Ocean Plan objectives...”. The Ocean Plan objectives were not developed in an appropriate manner to define real water quality problems whenever an exceedance occurs.

The statement made in the fourth paragraph on page 1 of this discussion about the principal source of lead being aerial fallout from automobile exhaust was true when there was widespread use of leaded gasoline. Since leaded gasoline is no longer used, there are significant questions as to the principal sources of lead today.

In the fifth paragraph on page 1 of this write-up, is a discussion of “Establishment of Initial Mass Loading Discharge Performance Goals for Lead.” Those responsible for managing the project report development evidently did not understand that lead exists in the environment in a variety of forms, only some of which are toxic - available to adversely impact water quality and humans. Through the work that the author has been doing over the past five years, first with the Sacramento City Council and now for the Northern California Legal Services who are concerned about protection of low-income housing children from exposure to excessive lead in redeveloped Superfund sites, the author is well aware of the current state of information on the impacts of lead on public health and the environment. It has been known since the 1960s that total lead is a very poor measure of toxic - available forms for aquatic life as well as for human uptake via ingestion of lead-containing material. The author has published in refereed journals and conference proceedings several papers that address the problems of trying to regulate total lead.

A peer review of the appropriateness of developing a mass loading discharge performance goal based on total lead would show that such an approach would be generally perceived as being highly wasteful of public funds. What should be done is to find a real problem caused by lead in Santa Monica Bay waters and determine the sources of lead that are responsible for the problem. To mechanically attack all sources of lead independent of whether lead is toxic or available is inappropriate.

Near the bottom of page 2 of this discussion are some recommendations of approaches that should be adopted to refine the performance goal. This proposed approach is highly deficient since no effort is proposed to address whether the current discharges of lead to Santa Monica Bay waters from the Santa Monica Bay watershed are adversely affecting the designated beneficial uses of the Bay waters. That should be the first step of the implementation of any management plan for Santa Monica Bay lead-related issues.

The top of page 3 under item 4 mentions, “*Verify the sources of lead other than leaded gasoline.*” It is not clear that those responsible for writing this section know that leaded gasoline has not been sold to any significant extent for many years in the US as well in the Santa Monica Bay watershed.

On page 3 is a discussion of the establishment of sediment quality objectives for lead in the receiving waters. It will be very difficult if not impossible to develop sediment quality objectives for lead as proposed. These objectives must be based on impacts, not chemical concentrations.

Examination of the glossary of terms at the end of the report, for “Pollutant load” on page 10 states, “See ‘mass emission’.” Under “Mass emission” on page 8 it is defined as

“The total amount of a contaminant that reaches the Bay. Mass emissions are calculated by multiplying the concentration of the contaminant by the volume or flow discharged.”

That is a technically invalid approach. A “pollutant” should have been defined as a material that impairs the designated beneficial uses as prescribed by federal and state regulations. It is not possible to reliably evaluate pollutant loads through multiplying the total concentrations of constituents by the flow or discharge.

On page 18-9, Figure 18-1 shows a Cost Comparison - Priority Action areas. Urban runoff is listed at \$40 million which is about eight times higher than any other category. As discussed herein and is obvious when critically reviewed in light of what is known about the impact of chemical constituents in urban runoff on beneficial uses of waterbodies, it is essential that before any significant part of that \$40 million is spent to control urban stormwater runoff associated chemical constituents, that real water quality problems be found in Santa Monica Bay associated with the runoff which are attributable to chemical constituents.

Basically, what needs to be done is to start over on the Santa Monica Bay Project and do what should have been done during the first five years of the Project—focus on finding real water quality problems in the Bay that are of sufficient significance to the public to cause the expenditure of funds for their control. Once these water quality problems - use impairments have been identified, then follow the common-sense approach of defining their cause and the specific source of constituents added to the Bay today that are contributing to their continued significance.

Rather than spending funds for controlling the five heavy metals that were selected for control as part of the Project from urban and highway runoff using detention basins, “filtering media,” etc., a clear definition of what is to be expected in the way of improved water quality as a result of an expenditure for these structures should be available so the public knows what it is getting for its money. As discussed in the original comments on the draft Plan, there are some real water quality problems associated with Santa Monica Bay from urban runoff. These are beach closures and aesthetically unpleasing situations associated with trash and debris on the beaches. It may be far more cost-effective and beneficial to the public to devote funds available to addressing these issues rather than spending large amounts of money in controlling particulate forms of heavy metals by detention basins, filtering media, etc.

If heavy metals in stormwater runoff are, in fact, having a significant adverse impact on the designated beneficial uses of Santa Monica Bay waters, then the \$30 million prescribed in this Plan would be a small part of the total cost that will be needed to control these impacts. The BMPs that are typically prescribed today as set forth in this Plan will not be effective in controlling the heavy metal adverse impacts, if there are any.

Overall, the Project needs to start over with respect to defining a Restoration Plan associated with heavy metals and other chemical constituents in urban stormwater runoff. The approach that has been used

is typically invalid and can readily result in massive waste of public funds being mis-directed towards control of chemical constituents that are not significantly impairing the uses of Santa Monica Bay waters.

The days of simply throwing money at environmental problems without regard to the technical validity and cost-effectiveness have come to an end in many areas and should come to an end in the Santa Monica Bay watershed. As it stands now, the urban stormwater component of the Santa Monica Bay Restoration Plan is already becoming recognized as having been conducted in a highly inappropriate manner. It will, if those responsible for implementation of the Santa Monica Bay Restoration Plan pursue implementation of this Plan as adopted in September 1994, be recognized as one of the most technically invalid and inappropriately developed restoration plans devoted to evaluating the significance of chemical constituents in sediments and for the control of chemical constituents in urban stormwater runoff. A long-standing, common-sense principle of water quality management was violated in the Santa Monica Bay Restoration Project by failing to define a real water quality problem before developing a Restoration Plan.

List of Enclosures

Lee, G.F. and Jones-Lee, A., "Stormwater Runoff Quality Evaluation and Management - Need for a Different Approach Part I: The Problem, Part II: Implementation of Urban Stormwater Runoff Quality Management Regulations, Part III Issues in Managing Urban Stormwater Runoff Quality," accepted for publication *Water Engineering and Management* (1995).

Lee, G.F. and Jones-Lee, A., "Stormwater Runoff Management: Are Real Water Quality Problems Being Addressed by Current Structural Best Management Practices? Part One," *Public Works*, 125:53-57, 70-72 (1994); Part Two 126:54-56 (1995).

Lee, G.F. and Jones-Lee, A., "Deficiencies in Stormwater Quality Monitoring," *Stormwater NPDES Related Monitoring Needs*, proceedings of an Engineering Foundation Conference, American Society of Civil Engineers, pp. 651-662, New York (1994).

Lee, G.F. and Jones-Lee, A., "Independent Applicability of Chemical and Biological Criteria/Standards and Effluent Toxicity Testing," published in *The National Environmental Journal*, January/February (1995).

Urban Stormwater Quality Evaluation and Management Publications of Drs. G. Fred Lee and Anne Jones-Lee. Copies of these Enclosures are available from Dr. Lee's website, <http://members.aol.com/gfredlee/gfl.htm>.