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Technical Review

Interim Draft – Calleguas Creek Watershed Toxicity TMDL

Prepared by

Dr. Mel Suffet
Environmental Science and Engineering Program
Institute of the Environment
UCLA
Los Angeles CA 90095

Interim Draft Report - Introduction

The introduction of the "INTERIM DRAFT Calleguas Creek Watershed Toxicity TMDL" states that the TMDL addresses impairments caused by "water column toxicity, sediment toxicity, organophosphate (OP) pesticides in water and chlorpyrifos in fish tissue". ……. "This report summarizes the analyses completed to determine the causes of these impairments, loading from various sources and measures to remove these impairments." The TMDL must be based upon the basin plan and anti-degradation Policy of CA State Board To complete these tasks, the report follows the logical elements in sections:

1. Introduction
2. Problem Statement
3. Current Conditions
4. Numeric Targets
5. Source Analysis
6. Linkage Analysis
7. TMDL and Allocations
8. Implementation Plan
9. Monitoring and Implementation Schedule

Reviewer's Mission

The following review is completed within the spirit of ensuring that the technical rational underlying the numeric targets and the sources and linkage analyses are sound. All the comments should be considered for future studies. The review has evaluated:

1. the technical rational underlying the numeric targets and the sources and linkage analyses
2. the effectiveness of the proposed allocations to attain water quality standards and
3. the effectiveness of the implementation plans, including a monitoring plans, special studies, and standard actions.

The review process was conducted as a typical scholarly review of a report of any project prepared for a governmental agency. For example, the review points out concerns about the science and interpretations. The review suggests approaches that may be necessary to have the report acceptable to the reviewer, or to suggest further ideas to make the document better scientifically. The review will be as thorough and specific as possible. However, the reviewer will not do the work that is considered necessary or suggested to be done to modify or improve the TMDL document.

The review includes the following if they can be done.

1. Review of numeric targets to ensure they can support development of waste load and load allocations and measure the progress of water quality improvement.
2. Review source analysis for completeness and accuracy.
3. Review linkage analysis assumptions.
4. Review waste load allocation derivations.

The review is divided into General Comments and Specific Comments about each section of the report.

Reviewer's General Comments

1. An executive summary and recommendations section is essential for the TMDL Report.

2. Stakeholders and their affiliations should be listed in an Appendix. Authors of the report should be listed by sections prepared or as a list in the Appendix.

3. The word "analysis" is used to mean, "evaluate", and this should be changed to the word "evaluate" where appropriate in the report. Analysis has the connotation of specific data collection and laboratory analysis.

4. Section 2 of the report, "Problem Statement", makes the argument that direct measurement of the Organophosphate Pesticides (OPs) and not "ambient water column toxicity' should be used as the basis of the TMDL. This needs to be highlighted in the report as a major conclusion. The reviewer agrees with this.

5. Section 2 and Section 3.3 – Major Critique 1. - Organophosphate insecticides (OPs) share a primary mode of biological action, acetylcholinesterase inhibition. Thus, a relative potency factor (RPF) approach should be used to estimate the cumulative potential toxicity of OPs and should be used to develop the TMDL, along with specific OPs, if desired.

In the reviewer's opinion, the comment in Section 2 about chlorpyrifos applies to all the organophosphate pesticides and should be stated clearly. How do the authors know if it is chlorpyrifos rather than a combination of organophosphates that is causing the toxicity? The mechanism of biological action of all the organophosphate pesticides is the same. Thus, the TMDL should be based upon an accepted chemical analysis of all organophosphate pesticides. There are accepted EPA analytical methods that determine most if not all organophosphate pesticides simultaneously including chlorpyrifos and diazinon.

There is an accepted peer reviewed literature on the toxicity of organophosphorus insecticides demonstrating that OPs share a primary mode of biological action, acetylcholinesterase inhibition. Thus, a relative potency factor approach should be used to estimate their potential toxicity and should be used to develop the TMDL. In the RPF approach, each organophosphate chemical is assigned a potency factor relative to a reference compound. This approach is completely defined with literature references in Chapter 3 of the 2001, UCLA thesis under my mentorship by Dr. Joel Pedersen (see attached). There appears no reason why this approach was not considered and adopted as it fits the spirit of the TMDL approach presented in Chapter 2. There is a secondary reason to consider this approach. If diazinon and chlorpyrifos are the only OPs regulated, the funds to develop this TMDL will be wasted as EPA is phasing out the use of diazinon and chlorpyrifos and other OPs could be substituted instead. This is discussed in Section 5.3, of the report but not acted upon.

In Section 3.3, Additive/Synergistic Toxicity**,** the authors show the peer review literature that agrees with the above approach for chlorpyrifos and diazinon. Further, the authors acknowledge that OPs share a primary mode of biological action, namely, acetylcholinesterase inhibition. However, the authors disregard these findings as they discuss other causes of toxicity including triazine herbicides instead of separating the discussion of the OPs from the triazines as they should have.

Section 3.3. Additive/Synergistic Toxicity and Table 2.1 on p. 36 raises the issue of the combined toxicity of OPs and other chemicals such as triazine herbicides (atrazine, simazine etc). To the best of the reviewer's knowledge, the treatment of the additive/synergistic toxicity of different chemicals exhibiting multiple modes of toxicity is unresolved at present in the peer-reviewed literature. The reviewer agrees that the combined effects of triazines and OP warrants further research and is not yet applicable for a TMDL. However, the combined toxicity of all the OPs should be considered using a RPF approach. The dissolved fraction of OPs are the most likely to exert toxic effects on aquatic organisms. This should be a part of the executive summary as well in a shortened form as it summarizes how TMDL were developed.

P22. Para. 2 states that the analytical chemistry data are available for chlorpyrifos and diazinon. The data for all the other OPs should be available and included in the relative potency factor approach. The same analytical methods used for chlorpyrifos and diazinon are used for most other OPs.

6. Section 3.1.1.1 para 1. Major Critique 2. Data Base: Whole sample data vs. data of separate analysis of dissolved and suspended solids. Whole sample data are flawed as the amount of suspended solids present in a sample can strongly influence the results. If the chemical of concern is well adsorbed by the suspended solids, higher concentrations of the chemical will be determined when the suspended solids content is higher. A proper analysis would include the determination of concentrations of soluble pollutant, the suspended solids-associated pollutant and suspended solids themselves. If needed, the correct whole sample concentration per liter then can be calculated. Chapter 3 of the 2001, UCLA thesis under my mentorship by Dr. Joel Pedersen (see attached) shows that on average 45% of chlorpyrifos and 14 % of diazinon are in the suspended solids phase in agricultural runoff. The theoretical underpinnings for this are described in the Modeling Section 6.5 of the report on pages 93-94. Thus, the total concentration of chlorpyrifos would be significantly affected by the amount of suspended solids in each sample. This needs discussion in the document especially for future TMDL monitoring and development of best management practice.

The amount of suspended solids collected in a sample is affected by ambient environmental conditions at the sampling location. For example, depending on whether a sample is collected after a storm, downstream from the discharge point of a field during an irrigation event or under quiescent conditions, different amounts of suspended solids will be present in the sample. The sampling location in the stream will also affect the amount of suspended solids collected. Is the sample taken at the bank, in midstream in the top layer, in midstream near the bottom, etc.? Is the sample integrated by depth or flow or time composite? The objective of taking the sample should determine the type of sample to take. Therefore, the total suspended solids should be reported for each sample taken as should the type of sample (grab or composite), the location of the sampling point in the stream and the stream condition.

Section 3.1 Uses of Data. The present database for chlorpyrifos and diazinon is shown in Table 12. An Appendix of all data in Table 12 that is used in the report is needed for those interested. In other words, the specific data for Tables 13-31 are needed. This could be in the form of a CD. Information about how the samples were collected should be included as well. In toto, the samples that have been separated into aqueous and suspended solids phases should be given more weight.

7. Section 3.1.1. Major Critique 3. Data Base Usage Decisions - The decision to use grab and composite data as equivalent for flowing stream evaluation. The data from each stream reach is aggregated to determine characteristic concentrations in that part of the stream. The database is a set of data taken during many different studies with different study goals. This reviewer has assumed that the TMDL must be done by law and thus, this has to be based upon this available knowledge.

The data base treats grab samples and composite samples as equivalent (P25. Para 2). Grab samples have much higher variability as they are dependent upon stream conditions, such as flow and suspended solids

content. Composite samples better represent average concentrations of chemicals in a stream and are more reasonable for TMDLs development in the reviewer's opinion. Flow composite samples should be given more weight in the evaluation because they better depict average environmental conditions of the streams. The authors should endeavor to do this. Tables 14-28 could be better presented as box and whisker data plots to show variability and the composite samples noted and compared to the grab samples under the author's assumption of a log normal data distribution.

The authors implicitly assume that the average of the grab samples would approximate an average value. Apparently, if the authors did not do this, they would not have sufficient data to develop an average value. They should state this method of approach clearly in the introduction, and discussion for Section 3 and in the executive summary of the document. However, to restate: Tables 14-28 could better be presented as box and whisker data plots to show the variability of the data and the composite samples noted and compared to the grab samples. A statistical comparison of composite vs. grab samples would be justified. Flow composite sampling should be stated as the goal for future analyses.

The authors assume the environmental data follows a log normal distribution in Section 3.1.1. Grab samples can be from any one point in the distribution. However, Tables 14-28 show a mean ± standard deviation of the data which does not describe a log normal data distribution. The box and whisker plot would best describe the data and then the data should be evaluated in terms of a log normal distribution and its average value, the geometric mean.

The Censored Data discussion in Section 3.1.1, (P. 24-25) describes removing high level non-detect data. The authors should reconsider this after reading the attach paper submitted for publication from work completed at the LA Water Board with the reviewer. "H. Park et al., submitted to Environmental Science and Technology, 2005".

Section 5.1.2 Source Analysis - The summary statistics proposed are exactly the same as used in Section 3.1.1. The two types of source input are non-point source runoff listed in Table 36 and point source runoff from treatment plants. The data are evaluated in a consistent manner with Section 3.1.1 for Treatment Plant Effluent by using grab samples of effluent. Point source runoff from treatment plants can be directly compared with a stream sample, as both are continuous flowing streams. As argued above, it would be best to complete flow composite analysis. In fact, that would be recommended for all future sampling. All of the criticism presented above applies as well for point source samples including data presentation. Non-point source runoff is evaluated in General Comment 8. In toto, composite samples should be given more weight.

8. Sections 5.1.1. and 5.3.3.2. Major Critique 4. Data Base Usage Decisions - The decision to use grab and composite data as equivalent for non-point source runoff data. This reviewer does not think that grab sample data can be evaluated properly for non-point source runoff such as from agriculture or urban land. In Chapters 3, 4 and 5 of Joel Pedersen 2001, UCLA thesis, under my mentorship, (attached) Joel and many other authors in the literature measure "Event Mean Concentration" (EMC) for non-point source runoff as the episodic and diffuse nature of surface runoff makes it difficult to quantify average mass load contributions of pollutants during a storm or irrigation event for agricultural or urban runoff. The EMC is a flow-weighted average (flow-weighted composite) concentration defined as the ratio of the event pollution load to total event runoff volume.

There are no papers in the peer reviewed literature that this reviewer is aware of where an evaluation has been made of the optimum time to take a grab sample that represents the EMC of a runoff event. Thus, grab sample analyses of a storm or irrigation event cannot give you average values. For example, agricultural and residential runoff data shown by Pedersen's thesis that EMCs for chlorpyrifos and diazinon in irrigation water from crops varied over 2 to 4 orders of magnitude. Residential runoff varied over 10 orders of magnitude. The

magnitude of the agriculture and urban runoff was about the same, indicating that residential land use is important. The EMC should be used to compare sites. Figures 12 and 13 should be from EMCs and not grab sample data as described above. Figure 14 is a log normal plot based upon grab samples. This plot should again be from EMCs for the reasons discussed above. If one assumes a worst case scenario that the grab samples represent low values of EMCs, the plot still shows that 75% of the data are above the chronic criteria of 15 ng/L for diazinon. The authors concerns about total sample analysis and not separating suspended solids and aqueous phase concentrations as described above remain as a problem.

Reviewer's Specific Comments about the Document

Section 2. "Problem Statement" - Specific Comments About Section 2
P.5. References for 2.1 Para 2 last two lines are needed.

P.7. Before 2.1.4 – How is the agricultural drainage water and industrial wastewater drainage transported to Mugu Lagoon and estuary? This should be stated in the report.

P.7. 2.1.5 end of sentence 1 – add -- a Mediterranean climate.

P.8. The last paragraph – Table 2 needs clarification. The units of the parameters are missing. First, the range of general water quality characteristics for surface water in general from all the locations in the area has no meaning for any specific situation especially if the data has more points for location x versus y and z. How were data chosen for the table? What criteria were used? What are the references for this data? The data are too variable for a table like this. It can be said that the variability of the surface water flow and water quality data are very large because of wet vs. dry season, effluent dominated streams, rain events, etc.

Table 2a-x - A more meaningful Table 2a-x would be from USGS gauging stations on the streams. Stream data are available at specific stream sampling locations for base flow and storm flow. Also, dry season vs. wet season data should be compared. Average values for ephemeral streams lack meaning. The USGS hydraulic flow data at the locations should be included. This would also be good for Mugu Lagoon at tidal sites. The main streams for this watershed are described in section 2.1.6. Another approach could be to define the water quality by stream reach and season.

In contrast to Table 2, Table 3 the groundwater characteristics shows consistent basin-wide water quality characteristics. What was the database for this table? Chloride would be an interesting parameter to include here because of the brine line. The comment on conductivity variability is countered by the other data in the table and should be checked. How were the data chosen for this table? This should be stated.

Section 2.1.10 on Reach Designation – The water quality of each reach can be added instead of using Table 2. Also, a base flow could be added for each reach. Footnote for Table 4 - Define WRP, POTW, etc from notes. The yearly base flow and average flow per day in the wet and dry seasons should be added to the note right after the name of the plant.

Table 5. All of the codes used need to placed in the footnotes, so someone can understand the table. At present, it is not readable. I can only guess at some codes. Also, each of the beneficial uses come from some EPA list. That list should be referenced and commented upon.

2.3 Basis for Listing – The authors realized the futility of the use of a TMDL for water column toxicity. The reviewer wholeheartedly agrees as described in general comment 1.

2.4 Problem Statement Summary is not a summary. Besides an explanation of Table 11 (a repeat of Table 1), the summary should state the key conclusion presented in Sections 2.3 and 2.4 that the TMDL will focus on measurement of organophosphorus pesticides and not "Ambient Water Column Toxicity" and justify why. This is a key point of the TMDL development and the reviewer agrees with the scientific validity of the conclusion. However, the point is buried in Section 2.3 and 2.4 without emphasis. It needs highlighting in the report conclusions and executive summary.

Section 3. Current Conditions. In the introduction to this section a paragraph that generally shows the plan of evaluating the stream reaches should be presented.

P22. Para. 2 states that the analytical chemistry data are available for chlorpyrifos and diazinon. The data for all the other OPs should be available and included, as the relative potency factor approach presented in general comment 4 should be developed. The same analytical methods used for chlorpyrifos and diazinon are used for most other OPs.

Section 3.2 Sediment Toxicity. The authors showed very little data about sediment toxicity. However, the bioavailability of the pollutant via pore water was indicated as potential approach in the future. More data are needed to evaluate the situation. This consideration should be addressed in the document and future studies. The potential sources of pesticides should be stated and as the data unfolds the waste treatment plant discharges (from homes and industry), industrial sources and agricultural sources should be specified, as they are known. The question of the effect of suspended solids and sediment on the approach to toxicity and how to obtain correct data for the evaluation and implementation of the approach are discussed in other sections of the critique.

Section 3.4 and 3.5 Water and Sediment Toxicity Summary. A more complete summary should be written including the above comments. Finally a summary table at the end of the Section 3 is needed. The table can draw upon Table 29 and indicates conclusions for each reach and the potential causes and needs for TMDLs. This table should be part of executive summary as well. The summary should include a discussion of the problems of using TIEs e.g., Table 31. Possibly, a picture of the stream and reaches showing successively with a box and whisker plot of concentration of OPs could put the watershed in the perspective.

Section 4. Numeric Targets

As stated above, the mechanism of biological action of all the organophosphate pesticides is the same. This is the first key disagreement of this reviewer with the scientific validity of author's conclusions. Thus, the TMDL should be based upon an accepted chemical analysis of all organophosphate pesticides.

Section 4.3.1 and 4.3.2 OP Targets

The authors chose water quality criteria developed by other government agencies to develop the numeric target for each pesticide in fresh and salt water. The reviewer read the documents that developed the choices for the Chronic Levels of Toxicity chosen and fined them to be acceptable. The criteria chosen as shown in the Footnote of all Tables need to be justified in the document and the source of the data properly referenced. This is the basis of the TMDL. Why was this criteria chosen over other criteria? Chapter 3 of the UCLA thesis under my mentorship by Dr. Joel Pedersen chose acute toxicity only for dissolved OPs. The values are compared below for reference.

		Diazinon	Chlorpyrifos	
1. TMDL –Water Board	(Total - ng/L)	100	14	Chronic – documents
2. Table 3.3 Pedersen Thesis*	(Dissolved - ng/L)	200	38	96-hr LC 50 (Acute)

*Thesis – Chapter 3, Table 3.3.

Three approaches are different in the TMDL development by 1 and 2 above.

1. Dissolved only vs. total concentration. Pedersen's is less conservative as only dissolved phase concentrations are used. This is important especially for chlorpyrifos as it was shown in the study to average 46 % in suspended solid phase at equilibrium with the water phase. The dissolved criteria for stream water, the reviewer feels is best as the chemical must be soluble to be bioavailable.
2. Choice of criteria for toxicity. Pedersen's is less conservative as chose 96-hr LC 50 (Acute), vs. chronic values of the TMDL document. That is fine. The toxicity criteria is the authors choice.
3. A "relative potency factor" approach is used to estimate potential toxicity of OPs by Pedersen.
The reviewer takes exception to the authors choice of individual levels alone for OPs and feels strongly that the "relative potency factor " approach can be used to estimate total potential toxicity of OPs. A combination of individual OPs and a Total Toxicity of OPs would also be acceptable.

The numeric targets for chlorpyrifos and diazinon on P. 49 and 51, respectively should be evaluated by a toxicologist. However, an estimate potential toxicity of all OPs should be developed by using relative potency factors as per Chapter 3 of the 2001, UCLA thesis under my mentorship by Dr. Joel Pedersen.

Section 4.4 and 4.5 Water and Sediment Toxicity Target. This section seems strange after the authors have stated clearly that this is a poor approach for hazard. Section 2 of the report, "Problem Statement", makes the argument that direct measurement of the Organophosphate Pesticides (OPs) and not "ambient water column toxicity' should be used as the basis of the TMDL. The issue of a TMDL for sediment especially in the estuary can be address if sediment pore water is analyzed to account for bioavailability.

Summary Section for Section 4. A summary section for section 4 is needed. None is presented.

Section 5. Source Analysis

5.1.1 Use of Environmental Data in Source Analysis Section

A CD of Table 35 data should be made available to those that desire it. Table 35 does not include available data from surface runoff from 4 irrigation crops, 1 orchard and 2 residential sites during irrigation and rainfall events in southern Ventura County, Sept. 1999 to April 2000, Chapters 3, 4 and 5 on land use-specific organophosphorus insecticide flux load estimations from the UCLA thesis under my mentorship in 2001 by Dr. Joel Pedersen, (see attached) for these data and associate water quality.

Section 5.1.2 Development of Summary Statistics. The summary statistics proposed are exactly the one used in Section 3.1.1. The two types of source input are non-point source runoff listed in Table 36 and point source runoff from treatment plants. The data are evaluated in a consistent manner with Section 3.1.1 for Treatment Plant Effluent by using grab samples of effluent. This is a direct comparison with a stream sample as both are continuous flowing streams. As discussed before, it would be best to complete flow composite analysis. In fact, that would be recommended for all future sampling. All of the comments presented in reviewer's General Comments 7 for the decision to use grab and composite data as equivalent applies here as well for point source samples from the treatment plant effluents. This includes data presentation.

This reviewer does not think that grab sample data can now be evaluated properly for non-point source runoff. This is completely discussed in General Comment #8. EMC should be used to compare sites.

Of importance, other OPs were not evaluated and should be part of the TMDL standard in terms of the relative potency factors as completely discussed in General Comment #5. A combination of individual OPs and Total Toxicity of OPs would also be acceptable to this reviewer. The authors concerns of using total sample analysis and not separating suspended solids and aqueous phase concentrations are completely described in General Comment #6.

5.3.2 Phase Out of Use of Diazinon and Chlorpyrifos. The phase out of chlorpyrifos and diazinon is recognized by the authors. Once again, this is the reason to investigate all OPs and develop TMDL standard in terms of the relative potency factors as described above. This section recognizes the problem of phase out and accepts it, but does not act upon it. It should act upon it.

5.3.3.3 Agricultural Application Compared to In-Stream Concentrations. No correlation was observed on Figure 15. The reviewer feels this is probably the case because of the use of total sample analysis (General Comment # 6) and grab sample analysis (General Comment # 7) especially for agricultural runoff. An understanding of soluble and suspended solid EMCs from agricultural runoff vs. in-stream composite samples of the aqueous phase alone and the suspended solids phase alone would be a more appropriate evaluation.

5.3.4.2 Estimated Time Frame/Reduction as a Result of Phase Out
This discussion again should investigate all OPs and develop TMDL standard in terms of the relative potency factors as completely described in General Comment #5.

5.4 Summary. The summary should summarize the chapter. The summary that is presented belongs within the discussion of this section of the TMDL. Figures from Pedersen's data should be plotted in the same manner and compared to the data shown as these data are for EMCs and correctly reflect soluble diazinon and chlorpyrifos runoff events. Data for malathion is also available from Pedersen's study.

The reviewer does not understand the basis of Figure 24 about loading by land use. If the basis is by actual concentrations by grab sampling analysis, the reviewer believes it is not correct because EMC loading should be compared as completely described in General Comment #7. The attached Chapter 3-5 from Pedersen's thesis approaches this evaluation by EMCs.

Section 6. Linkage Analysis. This reviewer suggests a linkage analysis addressing all OPs is needed. The more detailed model and linkage analysis was not provided to the reviewer.

Section 6.1. Model Selection. The scientific reasoning for understanding sources and sinks of OPs by modeling is well stated. Table 47 describes the different models. Table 47 should list the models on top of the columns and not Type 1 etc. The choice of model, the "large box model", is acceptable.

Section 6.3. Data Used in Model. The authors in this section describe the limitations of the data available to validate the model. The reviewer agrees with their analysis.
- Detection levels for the majority of chlorpyrifos samples are too high to be environmentally relevant.
- Several subwatersheds do not have detected data corresponding to wet weather sampling.
- Most of the runoff and receiving water data sets have < 40% detected values. Therefore statistics are considered estimates and are subject to error.

The authors should consider the following limitations of the model and data available to validate the model.
-The model assumes equilibrium conditions between phases (e.g., aqueous and a solid phase). Therefore samples collected and equilibrated with the solid phase within the sample before analysis is the approach for field analysis and comparison to the model.
- The suggested changes in the use of grab and composite samples as equivalent and equally representative of the sampled water as completely described in General Comment #7. Composite samples should be given more weight.
- The data use of total sample concentration data from the different sources as completely described in General Comment #6. Samples that have been separated into aqueous and suspended solids phases should be given more weight.

- The data from agricultural and urban sources is treated as grab sample data. The reviewer has described in General Comment #7 that the EMC should be used from agricultural and urban sources and the model should be developed to be able to accept EMCs. This is not the way the data are used now for the model.
- The reaches that only have POTWs as primary inputs could use grab sample and composite sample input loads and concentrations in the model. Composite samples should be given more weight. However, again, the problem of using the total sample concentration data instead of the soluble and suspended solid data analysis data must be considered.
- The reviewer questions the following statement "estimated and qualified data are used as normal detected values". This is not quantitative data and is best not treated as such.

Section 6.4. Computational Elements. Figure 26, I agree with this, in concept. The sediment phase is not included in the model and appears very important for chlorpyrifos as described above. Sediment should be extremely important in the estuary. This should be considered in the model especially for the estuarine part. The authors use a power curve as a regression for the data, which is fine. The inputs to the model are the data calculated throughout the document. Since this reviewer has problems with the data used for modeling (Section 6.3 above), the modeling exercise presented is just that - an exercise with input numbers.

Section 6.5 Model Output. The model output is described as overpredicting the data measured.

Section 6.6 Conclusions. The reviewer feels the conclusions should list all the model assumptions and problems. The sensitivity analysis indicates that the data are not sensitive to change of concentration values. This is explained by the authors as caused by the high amount of reduction of OPs needed (70-99). If more precise data was collected, would the model be able to meet its objective of "understanding sources and sinks" of OPs. (Page 81)? Will the model be quantitatively valid to changing concentrations?

Figure 29 (so-called Figure 1 on P. 95) shows the model output of concentration vs. river flow using the TMDL data input presented in the report. The model output is said to, "overpredict" the measurements. The reviewer questions the appropriateness of the input measurements. If the measured data were refined, will they better conform to the model output?

7. <u>TMDL and Allocations</u>. The approach used by the authors appears straightforward, if the data was available and used appropriately.

7.2 Comparison of Capacity to Current Loads

The authors hypothesize that the sediment criteria is met if the water quality goals are met. The reviewer does not subscribe to this conclusion in Mugu Lagoon. In Mugu Lagoon, the time the OPs are present in the sediment may be extensive. The analysis of sediment pore water and sediment needs to be completed in the estuary to prove the hypothesis.

The % reduction for chlorpyrifos sources is >98 %, if the data in the report is correct. Thus, almost no use of chlorpyrifos appears acceptable for any purpose. The % source reduction for diazinon is > 85 % except in the estuary, where it is degraded. This essentially says alternative chemicals must be used. However, if these alternatives are OPs, no TMDL will exist. This is another strong reason to conduct the TMDL evaluation for all OPs as completely described in General Comment #5.

7.3 Waste Load Allocations and Load Allocations

The reviewer agrees that alternative 5 using Numeric Targets is best for a total OP TMDL. In fact, P. 109 almost calls for it as stated "due to the possibility of additive or potentiated toxicity" other OPs are additive. The authors back out of the statement holding it off for the future. This reviewer says now.

The other chemicals that could cause synergistic effects on toxicity such as the triazines need further research. This is a future consideration.

8.3 <u>Special Studies</u>
#1 Estuary Sediment – Studies should include estuary sediments and pore water study to define bioavailable concentrations of all OPs and their RPF, as described above.
#2 Modeling – The EMCs of non-point source runoff should be calculated and used in the model as inputs and not grab samples as completely described in General Comment #8.

8.3.1. Special Study 1. This study was completed by Joel Pedersen 2001, UCLA thesis under my mentorship, Chapters 3, 4 and 5 (attached).

8.5. Monitoring Plan. The monitoring plan is acceptable if changed to include the recommendations of the General Comment section.
- All OPs should be monitored.
- The solid and the aqueous phase should be monitored individually.
- Composite samples should be collected for flowing stream evaluation. If grab samples are collected, composite samples should be given more importance.
- Flow weighted composite samples should be collected for "Event Mean Concentration" data for non-point source runoff data to quantify average mass load contributions of pollutants during a storm or irrigation event for agricultural or urban runoff.

8.5.1 Compliance Monitoring. Table 61 should add sediment and fish samples for Mugu Lagoon, as that is where juvenal fish are exposed. Table 61 should include soluble and SS analysis for organics.