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November 30, 2011

Mr. Harold Singer
Executive Officer
California Regional Water Control Board, Lahontan Region
2501 Lake Tahoe Blvd.
South Lake Tahoe, CA 96150

Subject: County of El Dorado Comment Letter on the 2011 Draft Municipal NPDES Permit

Dear Mr. Singer:

The County of El Dorado (County) respectfully submits this comment letter on the latest Draft Municipal National Pollutant Discharge Elimination System (NPDES) Permit (Permit) for your consideration. The County has proven its leadership in the effort of implementing sediment reducing best management practices (BMPs) in the Tahoe Basin since 1982 and we pledge our continued best future efforts toward restoring Lake Tahoe's clarity.

While our collective staff have been able to sort through many issues, there remain large overarching issues within the Permit that the County has significant, substantial concerns over. These concerns are not made obstreperously; rather, we agree a common public good is served with every inch of clarity achieved in Lake Tahoe. However, in order for us to implement the Regional Water Quality Control Board, Lahontan Region (Lahontan) Total Maximum Daily Load (TMDL) Program and the Lake Clarity Crediting Program (Crediting Program) we will require a substantial ramp-up in staff involvement and administrative process.

For instance, the TMDL Management System that is associated with tracking compliance within the Crediting Program has created many tools (Pollutant Load Reduction Model (PLRM), BMP Rapid Assessment Methodology (RAM), Road RAM, Catchment Credit Schedules and the Accounting and Tracking Tool) that the local jurisdictions must learn and utilize in order to track Permit compliance. It is our belief that these newly created tools are at times cumbersome, time consuming, have tremendous administrative burden associated with them and, in some cases, lack scientific backing. The tools are also not adequately integrated; meaning that many processes are either duplicative or are unduly inefficient to accomplish. Because of this and the upcoming Lake Tahoe TMDL Management System Project, which seeks to further integrate the tools and make many TMDL processes run more efficiently, the County requests that Lahontan delay Permit adoption until the TMDL Management System Project is complete so that the County does not expend resources that it currently does not have working through inefficient processes.

Furthermore, the six traditional NPDES Program minimum control measures (Public Education and Outreach; Illicit Discharge Detection and Elimination; Public Involvement; Construction Site Controls; Post-Construction Controls and Municipal Operations Controls) will require a substantial amount of work to ensure compliance and will take the focus away from the real intent of the Permit, which is reducing fine sediment loading to Lake Tahoe. The minimum control measures, while valuable in some jurisdictions, represent an outdated, one-size-fits-all approach that does not make sense in the Lake Tahoe Basin, where the focus is on Lake clarity.

The County has neither the financial nor staffing resources to devote to managing these elements on top of managing the Lake Clarity Crediting Program elements. It seems that with the recent Basin Plan amendments and the TMDL adoption that the focus of Lahontan is on the reduction of fine sediment loading to Lake Tahoe. As these minimum control measures do not contribute toward that goal, the County is requesting that these requirements be either omitted or lessened.

Given this, the Permit does considerably raise the compliance bar by continuing to require all of the elements in the County's existing NPDES Permit, along with all of the new requirements outlined in the Lake Clarity Crediting Program; the workload associated with Permit compliance will essentially double. Thus, the County does have significant concerns about meeting all of the requirements given the very difficult financial times and short staffing that the County is currently facing. Based upon County calculations, the cost associated with solely managing the Storm water Program to implement the requirements outlined in the Permit is estimated to be upwards of one million dollars ($1,000,000.00) per year. The County is willing to continue to spend an equivalent level, or a slightly enhanced amount of resources on its Storm water Program; however, complying with the Permit, as drafted, will require approximately two million dollars per year ($2,000,000.00) in resources that the County simply does not have.

Adopting the Permit at this time seems premature for the reasons stated above. The County respectfully requests that the Lahontan Board delay adopting the Permit on December 6, 2011, until these outstanding issues have been addressed. Perhaps there is an interim solution, such as an interim Permit, which can be adopted while we work together towards an end that satisfies the needs of both of our agencies?

The County appreciates the opportunity to submit these comments and looks forward to continuing to work with our partnering agencies in helping to protect Lake Tahoe. If you have any questions, or wish to discuss the items outlined in this letter further, please do not hesitate to contact Steve Kooyman at (530) 621-5932 or Brendan Ferry at (530) 573-7905.

Sincerely,

Raymond J Nutting
Chair, Board of Supervisors
County of El Dorado

Attachments

Attachment

County of El Dorado
Technical Discussion of Key Points of the
Lake Tahoe Total Maximum Daily Load (TMDL) Program and the
Draft Municipal National Pollutant Discharge Elimination System Permit

Connectivity

The concept of hydrologic connectivity is perhaps one of the least understood processes in the Lake Tahoe Basin. The general concept is that if a catchment or subwatershed is not connected to Lake Tahoe or its tributaries then there is no pollutant loading occurring at that point and therefore no associated load reduction requirement. This is one of the most critical topics when discussing total loads and load reduction opportunities. To date, there are no consistent methods to evaluate connectivity, yet most scientists and engineers in the basin know it to be a critical component of the TMDL. The concept of hydrologic connectivity was not evaluated or considered in the TMDL development, which then puts into question the validity of the total loads and required load reductions.

The Watershed model assumed the entire Lake Tahoe Basin was a series of hydrologically connected sub watersheds. The model used the Lake Tahoe Interagency Monitoring Program (LTIMP) stream network and tributary data to understand pollutant loading. All intervening areas, which do not discharge directly to streams, were considered directly connected to Lake Tahoe. During the calibration phase of the model development, any excess loads that could not be explained were distributed to all the source categories in the watershed. This was done to essentially place a 'connectivity factor' across watersheds, however it did not directly account for connectivity amongst watersheds in the Tahoe Basin. With the current understanding of hydrology in the Lake Tahoe Basin, we know that this strategy is inherently incorrect and thus the associated modeled loads and load reductions are flawed.

The County of El Dorado (County) has developed a measurement based study called the "Hydrologic Connectivity Transmission Distance Envelope Curve" (EDOT 08-12), which explored the importance of hydrologic connection of connected loads to Lake Tahoe and its tributaries and began a prioritization process based on total loads and load reduction opportunities. This understanding is critical for achieving load reductions and the development of a load reduction strategy and since this was not developed in the original TMDL watershed model, this endeavor must be undertaken by any entity wishing to better understand their respective jurisdiction.

The County questions the source load allocations as a result of this and is concerned that the adjustment of this parameter could modify the understanding of pollutant transport as we currently know it. For example, if the Tahoe Basin is only 50% connected to Lake Tahoe and its tributaries, then a 50% mass balance may be in error which is improperly accounted for from the urban source category. This could put more emphasis on the

Forested Uplands / Atmospheric sources and require larger load reductions for these source categories as a result.

Furthermore, the County also has concerns that the modeled loads in the TMDL are incorrect by a large factor. The 13267 Order issued by the Regional Water Quality Control Board (Water Board) in February 2011, required that the local jurisdictions develop individual baseline loads and quantify a total load from their respective jurisdictions using the regulatory agency developed Pollutant Load Reduction Model (PLRM). If the TMDL loads, as originally developed, were deemed correct, then why would the local jurisdictions be required to redo an exercise that the Water Board invested a substantial amount of resources to understand? The newly calculated baseline loads still do not account for a standardized method of connectivity, so it is anticipated that credits will be awarded in areas that are disconnected with load reductions given to those areas where there is no actual load, ultimately affecting the clarity of Lake Tahoe.

Lastly, it is uncertain how the newly developed load reduction targets and associated milestones outlined in the Draft Municipal National Pollutant Discharge Elimination System Permit (permit), fit into the watershed model / clarity model and how the connectivity issue could change the total load reduction needed to fulfill TMDL objectives. Conversations with Water Board staff have indicated that the modeling for the TMDL is complete and will not be revisited after permit adoption. The County believes that the total pollutant loading to Lake Tahoe, including connectivity, needs to be addressed and revaluated at a future date to ensure that reasonably accurate milestones and objectives are being required in the permit. Other concerns for TMDL loading include the accuracy of the LTIMP stream gauge water quality data and the resolution of the water quality data on an annual basis, which may not capture event based criteria, which can make calibrations to actual observed events difficult.

TMDL Management System

The TMDL Management System has been proposed as a method to integrate all of the tools developed for the TMDL into a seamless system, to essentially make the tools communicate with each other thus lessening the inherent inefficiencies which currently exist in the Program. The tools that were developed by the regulatory community and other agency funding partners have varying objectives and purposes for tracking and reporting field condition assessments, performing modeling work, outlining watershed work and maintenance, etc. The TMDL tools include the Pollutant Load Reduction Model (PLRM), the Road Rapid Assessment Methodology (Road RAM), the Best Management Practice Rapid Assessment Methodology (BMP RAM), the Catchment Credit Schedules (CCS) and the Accounting and Tracking Tool (A&T Tool), which are incorporated into the Lake Clarity Crediting Program (LCCP). As mentioned, the County did not develop these tools, yet is being required to use them or an equivalent, so lake clarity credits can be tracked and reported. The cost implications for using these tools, as estimated by the County, are incredibly high and include a significant amount of administrative burden in order to fully comply with them.

One example of inefficiency that is built into this new system is that the County currently has a tracking mechanism that has a nearly one million dollar investment to date that logs information similar to the BMP RAM, yet the County is required to prove that their system is equivalent to the BMP RAM and is forced to spend significant resources to adjust its system to 'fit' into the new system. Updating the current County system will be time consuming and will require technical staff to update, refine and incorporate data into consultant developed regulatory tools. A further, more in depth discussion of the administrative process associated with complying with the newly proposed Lake Clarity Crediting Program is discussed below.

The management of the Lake Clarity Crediting Program involves tracking credits (a 200 pound box of less than 16 micron particles or 1 x 10^16 particles). Credits are attained based on the completion of annual Catchment Credit Schedules and are tracking by local regulated agencies in the A&T Tool. Tracking involves the completion of maintenance on BMPs (BMP RAM), the tracking of Road condition (Road RAM) and the modeling of pollutant load reductions in the PLRM.

The BMP RAM requires that all structures, treatment devices, conveyance structures and treatment BMPs are inspected and maintained through local inspection processes that involve the identification of every treatment device requiring credits and an appropriation of those credits based on maintenance of the BMP. RAM scores are based on a 1-5 scale, with 1 being non-functional and 5 functioning at 100% treatment effectiveness. An inspector is anticipated to go out and inspect every device several times a year and bring back inspection data to warrant either maintenance or credits. It is assumed that average annual RAM scores will then be developed which track the condition over time and alert the Water Board that credits can be distributed.

Although this system appears to make sense from a water quality perspective, the cost of performing these detailed inspections, the amount of information that is needed to perform them and then enter into the database and the burdensome reporting requirements will require large funding levels. As mentioned, the County anticipates using its already functioning BMP/infrastructure maintenance tracking system; however the integration of this system into the TMDL tools has not been completed. The system as currently developed was created by the TMDL agency consultants and operates on a separate platform, most likely with a complex integration component. Because of this, the County will simply need more time to allow successful integration of existing County owned tracking tools into the TMDL management system.

The Road RAM is similar in that it is intended to understand the road condition and how this translates to washoff water quality and credit attainment. The study utilized a washoff simulator to understand this process and determined that washoff quality was based on how much available sediment was on the road surface. An assumption was made that the condition of the road could be modified via sweeping, thereby improving the RAM score and improving the washoff quality of the road. An inherent assumption is then made that sweeping can reduce the fine sediment available on the road and thereby improve water quality.

The County has fully explored this process through technical review of existing literature and development of County white papers and has determined that sweeping for water quality reasons requires responsible operator protocols and is not as easily attained as many in the regulatory community would like to believe. The County has found that no studies in existence have actually measured a benefit to water quality as a result of this practice, therefore models were developed based on what is called the build-up washoff process. So although intuitively it makes sense that sweeping can improve the runoff water quality by the elimination of sediment, no study has actually demonstrated this reduction via measurements of stormwater. The County has concerns about this tracking mechanism, the amount of staff and financial resources needed to implement it and the lack of scientific documentation to support it.

The removal of aggregates from the road is a complex process and involves the recovery of sediment via vacuum and mechanical techniques. Most brooms that operate on sweepers can actually pulverize the particles while in operation and leave a layer of fine particles on the road that is then immediately available for washoff. This is documented by a published document that measured the water quality and operation from varying sweeper types (Vaze 2002). This report detailed that there is a free and a fixed load on the road surface. The free load is available for washoff immediately and the fixed load (caked layer) is only available during storms based on varying rain intensities. What was determined was that sweepers are highly effective at picking up the free load on the road and that most vacuum sweepers cannot pick up the fixed load. Mechanical sweepers (broom type) are highly effective at picking up the free load and when operated can actually free the fixed load on the road surface making it available for washoff.

This lack of understanding of sediment transport based on varying rain intensities and management practices is something that the County wishes to understand prior to investing valuable County taxpayer dollars implementing. The current County program is developed to sweep the roads and this practice is routinely implemented to recover winter traction abrasives and remove sediments from the road. The Road RAM is mostly focused on recovering winter traction abrasives and aggregates from winter operations. This creates operational concerns relative to the timing of sweeping. For example, high efficiency sweepers need to be operated only when the roads are dry and are ineffective in icy or wet conditions. These are the times when the highest pollutant transport is occurring. By the time the sweeper actually gets into the field to recover material, most of the fine sediment pollutant load transport has already occurred. The County's routine is to then get out as soon as possible when conditions permit to sweep the road of remaining aggregate.

In Lake Tahoe we have winter operations which require the use of thousands of tons of abrasives to mitigate public safety concerns. The coefficient of friction between the car tire and the road is increased by adding particles to the road that are greater than 50 sieve. Particles less than 50 sieve size can actually be a detriment to traction. This means by removing a majority of the particles <50 sieve (300 micron) a benefit can be attained for both public safety and Tahoe water quality. This is a true source control practice and controls the application of pollutants directly to the road surface as opposed to attempting

to recover them once they have already detached (sweeping). Information exists on these sources; however the TMDL does not encourage or explore these concepts, which will have the greatest benefits.

The Road RAM as developed requires significant staff time, resources and includes public safety concerns for inspections. Each Road RAM test requires measuring volumes of sediment in high, medium and low accumulation areas, measuring dust cloud height and duration and includes a finger print test to determine if a finger print disappears. This test requires the road be shutdown for a period of time until the test is completed, which can be a major liability and safety concern for County staff implementing it. Other geographic areas are going away from time consuming and dangerous condition assessments and instead are tracking the sweeper via GPS to understand recovery amounts, speed, frequency and timing of operations. The Road RAM makes the assumption that the RAM score can then be improved by increased sweeping frequencies, which is counter to all research on the topic and existing measurement based studies. The County has completed multiple white papers to understand these processes, cost implications and potential benefits. Through existing research and ongoing studies, the County believes this Road RAM methodology is in need of more detailed testing on a jurisdictional basis before it is incorporated into any permit. Recommendations have been made and concerns have been documented, but the above mentioned program is still being required in the permit, which the County continues to have substantial concerns over.

Stormwater Monitoring

The Pollutant Load Reduction Monitoring requirements outlined in the permit include the use of the Lake Clarity Crediting Program (LCCP) and the development of Catchment Credit Schedules (CCS) and condition assessments. The Inspection requirements include Stormwater Inspections, Commercial, Industrial and Municipal Site Inspections and Traction Abrasive and Deicing Material tracking. Inspections have been and will continue to be conducted on all County infrastructure as required in the permit, however the newly created LCCP, CCS and condition assessments will require excessive staff time beyond what the County is capable of providing. As specified above, there are also concerns relative to the utility of these tools and concerns including safety issues with conducting them.

The Water Quality Monitoring requirements proposed in the permit are very stringent and include Catchment Scale monitoring and BMP Effectiveness monitoring. This requirement, including the extensive reporting of monitoring information and incorporation of the data into several databases including Tahoe RSWMP databases and the SWAMP database, is much stricter than any monitoring requirements to date. The County has concerns relative to the sampling frequencies desired and the expectations to annually validate tools developed by the Water Board. These tools or equivalents are being required by the Water Board yet the responsibility of demonstrating the tools utility is falling on the local jurisdictions shoulders.

The cost of the Water Quality Monitoring Program for El Dorado County alone is estimated to be in excess of $150,000 per year with full time staff needed to implement it. The total cost of the Monitoring and Reporting (M&R) program is estimated to be in excess of $300,000 annually. This will obviously require a significant County investment to implement. Once this data is collected, the County has concerns about the lack of feedback mechanisms where the gathered data is used to update models and methodologies to improve understanding of process, function and load estimation.

Currently, the County has an opportunity to have the USFS fund a portion of the water quality monitoring requirements in the permit, however this funding is not sustainable and based upon County estimates, will not cover all the water quality monitoring needs associated with the M&R program. The funding available is for Basin-wide programming and monitoring to collect data for the Tahoe Regional Stormwater Monitoring Program (RSWMP). There are questions that the County has with regard to Basin-wide monitoring efforts and if monitoring funded by California and taking place in Nevada can be credited in our permit reporting. The County has asked Water Board staff if regional monitoring efforts (monitoring in Nevada) can be used to satisfy California NPDES permit conditions and the County has received no response to date. This is an important question that the local jurisdictions need answered as currently the basin wide implementers are creating a cohesive effort and are moving forward in the hopes that a Regional Stormwater Monitoring Program (RSWMP) is being developed absent of State boundaries. To make this a comprehensive effort, the County needs clarification on this issue and the reporting requirements associated with it.

The condition assessments (BMP and Road RAM) are newly developed and have not been fully tested. The jurisdictions will be pioneering these tools and testing them to attempt to demonstrate credits. These tools (BMP and Road RAM) were created specifically for this program and have never been successfully implemented. It is uncertain if the result of these tools will yield measurable benefits and if the intensive staff time associated with them is a good use of government funds. Adaptive Management is a critical component of any successful program as Peer Reviewer *William M. Lewis* pointed out, "*It is critical that the true success of the projected methods of source control be assessed in a realistic way as time goes by. It is further necessary that any evidence of failure in a specific control strategy leads to the cessation and reformulation of the control strategy, rather than inertial continuation of expenditures on an ineffective strategy. Projects such as this often founder on the inflexibility of the action plan once implementation begins.*" With the untested nature of these tools and the huge cost associated with them that the County is expected to absorb, it is apparent that all activities with regard to this program be evaluated on an annual basis to demonstrate utility and endorse the perpetual continuation in order to support a successful TMDL program.

General Concerns

The current program is very focused on pollutant concentration reductions, which attempt to reduce the Event Mean Concentrations (EMC) to achieve a benefit to a receiving water

body. In the PLRM an EMC is adjusted to a Characteristic Runoff Concentration (CRC) based on estimated performance or increased maintenance practices. These include the use of advanced sweeping strategies and filtration of stormwater runoff. Some questions regarding these concepts are highlighted below.

Sweeping and Filtration:

Are EMC reductions achievable?

1.) Current hypothetical modeling (non-measured) results indicate that at best a 20-30% reduction is possible with advanced sweeping techniques (high cost). Again, these are not measured values and based on modeling of buildup and washoff processes.
2.) Most filters being installed in the Tahoe Basin are untested and many include pore spaces of 20 micron or greater. Being that the particle of concern for Lake Tahoe is <16 micron, these types of systems are impractical and require elevated levels of capital, operations, maintenance and replacement costs that do not directly address the pollutant of concern.

Are they sustainable?

3.) Sweeping requires a new sweeper every 5 years (~$300,000) and approximately $50,000 in maintenance and have local and global impacts from perpetual operations. They cannot be operated and are inefficient in freezing or wet conditions and require perpetual operation and if not operated, then no benefit exists to water quality.
4.) Filtration requires large capital, large annual maintenance expenditures, future replacement and most do not treat the small micron particulates needed to meet the TMDL.

Are they realistic?

5.) Microfiltration is used in the treatment of sewer water every day. The process behind microfiltration is very labor intensive and expensive. By even attempting to go this route we obligate ourselves to very high capital and maintenance costs, which are generally unfunded mandates and not an option most jurisdictions want to explore.

Do they deal with Stormwater volumes?

6.) No, the current methodologies are being targeted at changing reductions through increased maintenance via conditions assessments (Road RAM and BMP RAM). The current program is aimed at sweeping with some TMDL studies suggesting that the unit cost of sweeping is far superior to any other treatment methods. Since sweeping does not account for or change the volume of runoff generated from storm events, it then requires modifying pollutant concentrations to achieve a load reduction, which has yet to be measured.

Do they coincide with the Clarity Challenge and the Clarity Standard?

7.) Sweeping at best will achieve a modeled hypothetical maximum of 20-30% reduction if operated responsibly. The clarity challenge is a 20% reduction over the next 15 years. So in theory, if the sweeper modeling assumptions are correct and its implementation is flawless, we could possibly meet a clarity challenge through increased sweeping (although

this is not documented by science). The problem, however, is that the clarity standard is a 65% reduction over 65 years, which means that in order to meet these very large reductions we still need to practice volume reductions. Volume reduction through infiltration will achieve a higher standard in the long run and since stormwater needs to be infiltrated to meet clarity goals, the County believes we should practice infiltration and not rely so heavily on sweeping. Properly designed infiltration can virtually eliminate a pollutant load from receiving waters whereas with perpetual sweeping it *may* be possible to achieve a 20% reduction.

8.) The TMDL simply puts the emphasis on condition assessments and not on infiltration, which is contrary to the current low impact development requirements placed on most other highly regulated areas in the nation. Concentration reductions through sweeping and filtration are perhaps sending local agencies down an unsustainable road of scientific uncertainty.

The Draft Municipal National Pollutant Discharge Elimination System (NPDES) Permit (permit) has many strict requirements set forth for the local agencies required to implement it, however controlling the Forested Uplands pollutant source has not yet been established nor have there been an implementation timeline or requirements developed. Forest management agencies are often considered 'water quality agencies' and are not required to complete NPDES construction permits and are not regulated as tightly as the local jurisdictions. Does the Water Board have a plan in place to regulate all the activities in the Lake Tahoe Basin, including the Forested Uplands?

The County believes that the same standards and equitability should be held of all agencies required to implement the TMDL. To date, the County has yet to see a mechanism of how other sources will be regulated and how pollutant loads from other source categories will be tracked to demonstrate reductions in the lake. The TMDL is solely focused on municipal agency permits, which come with a high cost and a very cumbersome, somewhat uncertain process. The County believes that this permit should be delayed until there is a cohesive and coordinated plan for how load reductions will be targeted and tracked from all pollutant sources categories.

With the State of Nevada approximately one year behind the California jurisdictions, the implementation of this permit appears pre-mature. Many questions and concerns have yet to be addressed and a bi-State plan has not been adopted. To meet Lake clarity goals, a cohesive effort from both California and Nevada will be required. Moving forward without a cohesive plan and with varying implementation strategies is not in the best interest of the lake.

Peer Reviewer Comments

Peer Reviewer Comments are included below that addressed many of the County's concerns with regard to the TMDL and its incorporation into a Municipal NPDES Permit.

Patrick Brezonik

Is the goal really reasonable given climate change is occurring? Given the scenario painted on pages 12-7 and 8 of the TMDL, I wonder whether it is reasonable to have a clarity standard based on historical climatic conditions. Would it not be more realistic to accept that the described changes in climate—e.g., on the mix of snow/rain in precipitation, on increasing erosion from the greater proportion of precipitation falling as rainfall, and the other climate change impacts described in this section—would cause Lake Tahoe to have a different transparency even if there were no people living in the basin? I believe the TMDL should be written explicitly to account for this likelihood. Perhaps the initial target value does not need to be changed, but the documented climate changes in the region over the past 20-40 years (mentioned in the second paragraph on p. 12-8 of the TMDL) suggests that perhaps this should be considered. At the least the TMDL should acknowledge that the target should be a "climate-normalized" nondegradation standard.

Accuracy of predicted Secchi depth values and effects of stratification. I consider the difference between measured and simulated in 2000 in Table 8-X (TMDL, p. 8-4) to be quite large, in spite of the fact that the table heading states the numbers are in good agreement. Overall, comparing the differences as percentages of the measured values is not very useful because the measured values (the denominator term) are high, leading to seemingly small percentage differences that actually are large (> 1 m, on average) in an absolute sense. A more appropriate analysis would indicate that the simulated values consistently overestimate SD, and the average overestimation is 1.4 m over the five years. Giving a standard deviation for the difference also would be useful. This difference is fairly large relative to the overall change in SD over the period of record and even larger relative to the hoped-for improvement in transparency over the next 20 years.

Watershed modeling. Second, the EMC multiplying factor used to calibrate fine sediment loads (pages 4-62 and 63 of the TMDL-TR) seems rather arbitrary and empirical, and no explanation is provided for its basis (other than that it seemed to work). Some effort to explain the need for this empirical factor would seem to be appropriate. I note that the factor has a large range (> 6) and so it has a large effect on predicted loads. The same criticisms apply to the scaling factor based on quadrant. Third, I always find graphs like Figures 4-27 to 4-29 of the TMDL-TR troublesome, especially when they are presented to illustrate "how well" the simulations fit to measured data. It is difficult to tell from the figures, especially in any quantitative sense, how good or poor the fit actually is, but it appears that the fit is not good in terms of simulating either the timing of events or the variability in the data. This is especially the case for 2000-2001 for all three modeled constituents. About the best one can say from these figures is that the simulated values are in the "same ballpark" as the measured values. Perhaps that is sufficient for the purposes of the TMDL study, but if that is the case, I doubt that the time and effort that went into developing such a comprehensive and detailed modeling approach can be justified. Simpler approaches that didn't try to model and portray short-term variability would have been sufficient. If the authors want to show how well (or poorly) the model simulates reality, they should present plots of simulated versus measured concentrations (scatter plots) and show the statistics (r2 values) that quantify the degree to which the

simulations explain the variance in the measured data. I suspect such plots would show poor fit of individual simulated values to measured values. I accept the arguments made in various places in the TMDL-TR that the goal was not to simulate individual measurements and that it is very difficult to achieve that, but some larger-scale statistics could and should be produced to show whether the simulations capture key features of the measured values at the time scale of a year (e.g., annual means and ranges, and annual variance). Finally, the regressions of Rabidoux (2005), described on p. 5-5 of the TMDL-TR, to predict particle fluxes as a linear function of stream flow involve a self-correlation. Particle flux (P) is a product of particle concentration, CP, (in stream water) and stream flow, Q; i.e.: P = CP*Q (number/m3)*(m3/sec) = (number/sec)

The regressions thus implicitly are CP*Q versus Q, which is a correlation of a variable with a function of the same variable. Depending on the ranges of CP and Q this could lead to spurious self-correlations. The authors need to examine whether in fact this occurred in Rabidoux's analyses. There are straightforward statistical techniques for deciding whether this is a serious problem or not.

William M. Lewis, Jr.

Table 8-2 is given as proof of validation for the lake clarity model. The model predicts secchi depths within a very narrow range (23.1-23.9) whereas the observations fall in a considerably broader range (20.5-23.8). The model shows a consistent directional bias, which is problematic for any model. Furthermore, the observed and the modeled values are not significantly correlated with each other, i.e., the model is not capturing the causes of variation, which is its main purpose (Figure 1).

Figure 8.2 also poses some problems. Years 2000-2005 are reported to show good agreement, but there are some reasons to question this conclusion, as mentioned above. More troubling is the very wide variation of predicted secchi depths after 2005. The range of variation seen here for predictions is not found anywhere in the previous record of observed secchi depths. Certainly secchi depth observations must be available now for years 2006-2008. How do the predicted large variations over this span of years compare with the observations for these years?

Lake Tahoe Watershed Model

The LSPC model apparently was customized for the Lake Tahoe project because of the specific importance of particles less than 63 μm for Lake Tahoe. Apparently, as explained on page 4-25, the model is able to produce predictions of total suspended solids, and it was assumed that the observed fractionation of total suspended solids in the watershed, as shown by monitoring, could be applied to the predicted TSS. This seems reasonable, although it means that there are no mechanistic components of the model that specifically deal with fine particles. Similarly, nutrient species were not actually predicted by the model, but rather were assumed to reflect currently observed speciation in streams.

There was no allowance in the modeling for uptake or immobilization of nitrogen and phosphorus in transit. The modelers argue that the transit time and the velocity of flow indicate the insignificance of these processes. More secure would have been some empirical demonstration that this is a correct assumption, but it does seem reasonable.

Scaling factors (adjustment factors designed to correct erroneous predictions) are surprisingly large, as shown in Table 4-25. It would be reassuring have some explanation of these corrections based on monitoring.

The comparisons of modeled and observed concentrations show wild divergences on individual dates (often 1 order of magnitude). If hydrology is known, concentrations generally can be predicted fairly well for a given land use mixture. Perhaps the hydrologic modeling is introducing some unsuspected high degree of variation. *Although the model is adjusted to produce means that reflect reality, predictions for individual dates show that the model does not understand the processes that control concentrations*.

Pollutant load reduction opportunities.
Because the origin of fine particles in runoff is focused on urban uplands, it is unclear why it is cost effective to spend restoration dollars on forested upland or stream channels.

My overall concern about the implementation phase of source control is its enormous cost. Given the financial realities of the current economy, it might be good to have a companion document, of small size, outlining the results that could be obtained for expenditures of 50 percent or 25 percent of the proposed expenditure. Thus, in the event of a financial hardship, source control could proceed, and still could be meaningful.

My final point is to reiterate what is explained in VI c concerning adaptive management. It is critical that the true success of the projected methods of source control be assessed in a realistic way as time goes by. It is further necessary that any evidence of failure in a specific control strategy lead to the cessation and reformulation of the control strategy, rather than inertial continuation of expenditures on an ineffective strategy. Projects such as this often founder on the inflexibility of the action plan once implementation begins.

References

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California Department of Transportation, 2010, Particle Analysis of Abrasives Study

Road Management Journal, 1997. Using Salt and Sand for Winter Road Maintenance. [Information reproduced with permission from the Wisconsin Transportation Bulletin No. 6, March 1996.]

EDOT White Papers:

El Dorado County DOT, White paper EDOT 08-02, What is the Water Quality Benefit and TSS / PSD Removal Efficiency of the Sandfilter Located at the Apalachee Phase 1, Nottaway Basin?, October 2008

El Dorado County EDOT 09-01 Is sweeping an effective water quality BMP during a snow-melt condition in the Lake Tahoe Basin?, January 2009

El Dorado County EDOT 09-02, Is sweeping an effective water quality BMP during a winter rainstorm condition in the Lake Tahoe Basin?, January 2009

El Dorado County EDOT 09-04, How does street sweeping change the turbidity and sediment concentration of urban storm water in the Lake Tahoe Basin?, January 2009

El Dorado County EDOT 09-07, Different regional road management approaches and their range in stormwater turbidity during a winter rainstorm, January 2009

El Dorado County EDOT 09-10, Maximum hydrologic connectivity transmission distance envelope curve for South Lake Tahoe urban stormwater outfalls, May 2009

El Dorado County DOT, White paper EDOT 10-01, Development and Understanding of Current Abrasive Practices, Their Water Quality Impacts and Alternatives for Improved Source Control / Recovery, January 2010

El Dorado County DOT, White paper EDOT 10-03, Small Scale Evaluation and Testing of the Tenant Sentinel Heavy Duty Outdoor Sweeper and its Effects on Urban Road Water Quality and Surface Characteristics, June 2010

El Dorado County DOT, White paper EDOT 10-04, Small Scale Evaluation and Testing of the Schwarze A8000 Regenerative Air Sweeper and its Effects on Urban Road Water Quality and Surface Characteristics, June 2010

El Dorado County DOT, White paper EDOT 10-05, Small Scale Evaluation and Testing of the Tymco DST-6 Regenerative Air Sweeper and its Effects on Urban Road Water Quality and Surface Characteristics, June 2010

EDOT White Paper Synthesis

What is the Water Quality Benefit and TSS / PSD Removal Efficiency of the Sandfilter Located at the Apalachee Phase 1, Nottaway Basin?, 10/08/08, EDOT 08-02

- The sandfilter located at the end of Nottaway Street in the Apalachee Phase 1 project area is one of the few advanced filtration systems in the Tahoe basin for active stormwater treatment.
- The El Dorado County Engineering Division researched new specifications for the sand filter media for use in the sand filter by conducting in house tests to ensure proper drainage and treatment to maximize BMP efficiency and decrease the maintenance requirements of the system. By refining the media specifications, the Department intended to maximize pollutant load removal while decreasing the maintenance of the system that is currently required.
- After reconstruction of the sandfilter system it was then monitored for a single controlled event to measure the turbidity and fine sediment concentration of both the inflow and the outflow for pollutant load reduction analysis.

Is sweeping an effective water quality BMP during a snow-melt condition in the Lake Tahoe Basin?, 1/9/09, EDOT 09-01

- In order to evaluate sweeping as a water quality Best Management Practice (BMP) during the snowmelt condition, turbidity of snowmelt was measured at various roads within El Dorado County during a warming trend in January 2009. The water quality samples were collected along Pioneer Trail, North Upper Truckee (NUT), Montgomery Estates, Tahoe Hills and Woodland Subdivisions. This study attempts to add to the understanding of the water quality benefit of changing the sediment characteristics of road and impervious shoulder surface by sweeping during the snowmelt condition.

Is sweeping an effective water quality BMP during a winter rainstorm condition in the Lake Tahoe Basin?, 1/27/09, EDOT 09-02

- In order to evaluate sweeping as a water quality Best Management Practice (BMP) during the winter rainstorm condition, turbidity of runoff was measured at various roads within El Dorado County during a rainstorm in January 2009. The water quality samples were collected along Pioneer Trail, North Upper Truckee (NUT), Montgomery Estates, Tahoe Hills and Woodland Subdivisions. This study attempts to add to the understanding of the water quality benefit of changing the sediment characteristics of road and impervious shoulder surface by sweeping during the winter rainstorm condition.

How does street sweeping change the turbidity and sediment concentration of urban storm water in the Lake Tahoe Basin?, 1/29/09, EDOT 09-04

- The El Dorado County Department of Transportation (EDOT) regularly sweeps the County roads within the Lake Tahoe basin for a variety of reasons. One assumed benefit of the street sweeping program is the improvement in urban storm water quality exiting the EDOT right-of-way. The Center for Watershed Protection conducted a literature review in order to evaluate the benefits of sweeping and found that street sweeping does not guarantee water quality improvements (CPW, 2006). In order to establish the water quality benefits of the EDOT street sweeping program, a series of water quality sampling experiments were conducted during the fall of 2008 for storm water generated under real meteorological conditions.
- The premise for the experiments include sweeping portions of the Montgomery Estates subdivision within El Dorado County and comparing the characteristics of storm water within the swept regions and unswept regions. The hypothesis of these experiments was that the turbidity and the concentration of fine sediment would be higher in the control samples from unswept regions compared with the samples collected in the swept regions. A variety of measurement techniques were proposed to measure the benefit of sweeping. For these experiments it was assumed that sweeping did not change the volume of runoff, therefore the benefit of sweeping could be established simply by comparing the water quality of samples from swept and unswept regions.

Different regional road management approaches and their range in stormwater turbidity during a winter rainstorm, 1/26/09, EDOT 09-07

- In order to evaluate the impact of different regional road management approaches on the water quality of stormwater during a winter rainstorm, turbidity of runoff was measured at a variety of El Dorado County and Washoe County roads. An understanding of the water quality benefits of these two different approaches is critical in achieving the water quality effluent limits that include turbidity of less than 20 NTUs (SWQIC, 2004). The Washoe County road network was selected to represent a road management approach to water quality with a relatively high emphasis on road sweeping and the El Dorado County road network was selected to represent a lower emphasis on road sweeping. It is assumed that road sweeping does not change the volume of runoff from a road system. Therefore the measure of the water quality effectiveness of these different road management approaches is in the comparison of the concentration of fine sediment in runoff. For this study, the measurement of field turbidity of the stormwater was used as a surrogate for the concentration of fine sediment. On January 22nd and 23rd 2009, a rainstorm occurred in the Lake Tahoe basin allowing for the comparison of the water quality for these two approaches to road management.

Lake Tahoe clarity and hydrologic connectivity of urban stormwater outfalls, 2/5/09, EDOT 09-10

- Soil moisture is an important control for the hydrologic connectivity for a semi-arid snowmelt-driven catchment (McNamara et al, 2005) and in order for fine sediment suspended in urban stormwater to be a detriment to the clarity of Lake Tahoe there must be hydrologic connectivity between the stormwater outfall and Lake Tahoe. Hydrologic connectivity can include outfall discharge directly to Lake Tahoe, discharge to a perennial tributary to Lake Tahoe, discharge to an ephemeral tributary to Lake Tahoe, discharge to an intervening area, or stormwater infiltration into the soil thereby recharging groundwater. For this analysis infiltration of stormwater into the soil is assumed to eliminate the transport of fine sediment to Lake Tahoe since pollutant concentrations generally decrease rapidly beneath stormwater infiltration basins (Deshesne et al, 2005).
- This study is focused on measuring the maximum connectivity of urban stormwater for regions within El Dorado County with the greatest connectivity between the County right of way (ROW) and stormwater discharge outfall pipes. This study documents the relationship between the area of impervious surface within the County ROW, the rainfall intensity and the separation distance from the stormwater outfall to surface water for relatively high average annual rainfall intensity conditions.
- The direct hydrologic connectivity of urban stormwater outfalls to Lake Tahoe is a certain lake clarity problem as are stormwater discharges to perennial streams since suspended fine sediment is likely to remain in suspension in streams long enough to reach Lake Tahoe. Stormwater outfalls directly connected to ephemeral streams have a reduced impact on lake clarity since ephemeral streams are only connected to Lake Tahoe seasonally. However, the fraction of stormwater volume from outfalls that discharge to intervening areas or subwatersheds are only a detriment to lake clarity if

the stormwater eventually reaches Lake Tahoe. Therefore, in order for water quality improvement projects to benefit the quality of water within Lake Tahoe, the pollutant load estimates must address stormwater connectivity.

Development and Understanding of Current Abrasive Practices, Their Water Quality Impacts and Alternatives for Improved Source Control / Recovery, 1/28/10, EDOT 10-01

- Sweeping is known throughout the nation to be effective at removing mass of material; however it is not well understood as far as impacts to water quality or improvements. The cost implications of these practices are not well understood and may not meet objectives; therefore source control is needed to curtail the increased mass of material being applied to the road surface each year. This paper will identify potential benefits that can be attained by simple source control measures such as abrasive screening, washing and cleaning to prevent the bulk of mass fine material being applied to the road surface each year. Alternative native abrasive media will also be discussed with results of preliminary investigations into the feasibility and practicality of utilizing native materials for traction. These methods of source control may yet be another option to improve maintenance practices for public safety used by all jurisdictions lake wide, while keeping current sweeping practices at maintainable levels of operations and within available budgets.

Small Scale Evaluation and Testing of the Tenant Sentinel Heavy Duty Outdoor Sweeper and its Effects on Urban Road Water Quality and Surface Characteristics, *6/1/10, EDOT 10-03*

- In order to evaluate sweeping as an urban water quality Best Management Practice (BMP) tool, washoff simulation was conducted along with corresponding Rapid Assessment Methodology (RAM) estimates before and after sweeping. The goal of this test was to measure turbidity of runoff at high, moderate and low accumulation areas of a road segment before and after sweeping to determine water quality benefits in a simulated condition. The water quality samples were collected on a section of 14th Green Drive in Incline Village, CA (Figure 1). This study attempts to add to the understanding of the water quality benefit of changing the sediment characteristics of road and impervious shoulder surfaces via sweeping.

Small Scale Evaluation and Testing of the Schwarze A8000 Regenerative Air Sweeper and its Effects on Urban Road Water Quality and Surface Characteristics, 6/23/10, EDOT 10-04

- In order to evaluate sweeping as an urban water quality Best Management Practice (BMP) tool, washoff simulation was conducted along with corresponding Rapid Assessment Methodology (RAM) estimates before and after sweeping. The goal of this test was to measure turbidity of runoff at high, moderate and low accumulation areas of a road segment before and after sweeping to determine water quality benefits in a simulated condition. The water quality samples were collected in the Montgomery Estates subdivision on Sierra House Trail and Bonanza st., El Dorado County, CA (Figure 1). This study attempts to add to the understanding of the water quality benefit of changing the sediment characteristics of road and impervious shoulder surfaces via sweeping.

Small Scale Evaluation and Testing of the Tymco DST-6 Regenerative Air Sweeper and its Effects on Urban Road Water Quality and Surface Characteristics, 6/29/10, EDOT 10-05

- In order to evaluate sweeping as an urban water quality Best Management Practice (BMP) tool, washoff simulation was conducted along with corresponding Rapid Assessment Methodology (RAM) estimates before and after sweeping. The goal of this test was to measure turbidity of runoff at high, moderate and low accumulation areas of a road segment before and after sweeping to determine water quality benefits in a simulated condition. The water quality samples were collected in the Glorene and 8th subdivision on Clement st., El Dorado County, CA (Figure 1). This study attempts to add to the understanding of the water quality benefit of changing the sediment characteristics of road and impervious shoulder surfaces via sweeping.