DRAFT FINAL
Meeting Summary

Santa Margarita River
Watershed Nutrient Initiative Group Meeting
Wednesday, December 9, 2015
9:30 am – 4:30 pm

Location:
Murrieta City Hall
1 Town Square
Murrieta, CA 92562

Attendee List:

Name	Organization	E-mail
Amber Rogers	County of San Diego	amber.rogers@sdcounty.ca.gov
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Pei-Fang Wang	US Navy (SPAWAR)	pfwang@spawar.navy.mil
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Stuart McKibbin	Riverside County Flood Control & Water Conservation District	smckibbi@rcflood.org
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Hilary Potter	Michael Baker International (Secretary)	hpotter@mbakerintl.com

Meeting Materials:

1. Meeting Agenda

Meeting Goals:

1. Provide SMR Group policy and technical updates.
2. Ensure common understanding by all SMR stakeholders about regulatory expectations and requirements
3. Update the stakeholders on the status and the next steps of technical activities and products

Action Items:

1. Dave Ceppos (CCP) will re-circulate the Charter, Project Process Plan, and Memorandum of Understanding to all participants by Friday, December 18.

2. SPAWAR will check past field data for reporting of phosphorus levels and relay any found data to Martha by Friday, December 18.

3. Tetra Tech will include in the calibration report for the estuary model, clear statements of whether the model under-predicts or over-predicts.

4. Ashli Desai will incorporate feedback from the group on the Wet Weather/Winter Dry Nutrient Regulatory Approaches White Paper and distribute it to the group for review.

5. Tetra Tech will include the following in partitioning for the watershed model application report:

    a. Summer dry, winter dry, and wet weather

    b. Having nurseries separate from orchard and vineyard land use

    c. Permit boundaries

    d. Jurisdictional areas (counties, cities, Caltrans, DoD, tribal)

    e. Types of agriculture

6. Clint Boschen (Tetra Tech) will check if they received the San Diego County land use analysis map which included a land use analysis based on satellite or aerial photos.

7. Riverside County Flood Control & Water Conservation District (District) will coordinate with Rancho California Water District (RCWD) regarding groundwater upstream of the gorge and use of their model.

8. Martha Sutula (SCCWRP) will develop several strawman scenarios for the January meeting to support nutrient management discussions.

SMR Group Decisions

There were no decisions during the December 9, 2015 SMR Nutrient Initiative Group Meeting.

Introduction

Dave Ceppos (Facilitator, Center for Collaborative Policy) welcomed everyone, thanked the City of Murrieta for hosting the meeting, and reviewed the agenda.

JoAnn Weber (County of San Diego) welcomed everyone. This is an exciting time in the project. Great modeling work is happening, which the group will get to see some results from today and use in the general strategies moving forward. JoAnn thanked the Regional Board for their patience as the group works to accomplish tasks in an appropriate and even process. JoAnn also thanked the stakeholders for hanging in this whole time.

Dave reviewed the action items from the previous meeting and the previous meeting summary.

Review of Previous Meeting Action Items

Dave reviewed the action items from the previous meeting. Some of his assigned tasks were not completed due to a lapse in contract execution and associated unavailable funding. The outstanding items are as follows:

4. Dave will re-circulate the Charter, Project Process Plan, and Memorandum of Understanding to all participants.

5. Amber and Dave will work to update the website. They will remind all participants of the procedure for accessing the website.

   A meeting on this was held. Dave has subsequent work on this item. Project Clean Water will be used as a repository for the project.

11. Martha will do a WebEx recording of significant material and post it on the website to prevent having to reiterate the same information at future meetings.

    Some post processing remains to be done, after which Martha's recording and the recording of Monday's webinar will be posted on the project website.

Previous Meeting Summary

Dave will send out the meeting summaries from October 13 and today for stakeholders' review. Generally, the meeting summaries will be sent out a week in advance of the next meeting. The meeting summary is revisited at the beginning of the next meeting, then ratified as final, and then put into the project record.

General Updates:

Hiram Sarabia (Regional Board) thanked the County of Riverside for securing a location for the upcoming CEQA scoping meeting on January 14 at Temecula City Hall. Hiram relayed that Regional Board management continues to emphasize the importance of adhering to the project schedule. He had a brief discussion with Regional Board management about potentially providing a support letter to Camp Pendleton for their funding request, including funding for the estuary model report, if Camp Pendleton believes that would be helpful. Hiram will discuss that with Kyle Cook (Camp Pendleton) in more detail. Hiram also mentioned the validation of the estuary model needs to be addressed.

JoAnn shared that IRWM finished the final Proposition 84 round last spring, in which no funds were awarded to this project. IRWM was looking for implementation grants. In the future, IRWM will go towards Proposition 1, which is very implementation oriented. It is unclear when that will occur as some guidelines are delayed, and it is unclear if they will fund studies.

Presentation and Discussion of Estuary Model Calibration

Martha Sutula (SCCWRP) explained that the estuary model calibration is the culmination of a long effort by SPAWAR and others. A preliminary presentation was provided in October, and a few remaining issues were identified.

Pei-Fang Wang (SPAWAR) presented on the estuary model calibration, including the conceptual model, model input datasets, water quality model calibration results, uncertainties in the model, and a summary.

The estuary model studies the process of eutrophication. A healthy water body is characterized by several phenomena, including low nutrient load or content in the water, sufficient light penetration to the water bottom, and sufficient dissolved oxygen for aquatic organisms to live. The addition of external nutrients causes a chain of reactions. Plant growth is enhanced, including phytoplankton and macroalgae. As plants grow, turbidity increases and shading from plants prevents light penetration. Plants also deplete dissolved oxygen from the water column, which will result in fish kill and death of the water body.

The modeling study includes several components. First, the watershed loads must be defined, characterized, and quantified. Presumably, the watershed load is one of the driving loads for the estuary. This quantification can be done using the HSPF model or by field study.

There are two parts to the lagoon model: hydrodynamic and water quality components. The EFDC hydrodynamic model has been validated and calibrated using the 2008-09 data. The EFDC hydrodynamic output is linked to the WASP water quality model.

The EFDC model calibration was completed in March 2014. The model describes how the water flows during wet season, dry season, and from the changing berm height near the mouth. The model successfully simulated currents, water surface elevation, temperature, and salinity. The team calibrated groundwater flow from the Stetson groundwater model to balance salinity in the lagoon and successfully modified EFDC and calibrated it against the seasonally varying sand berm height at the mouth. The eutrophication model has several inputs, including the agriculture field, water body eutrophication, and benthic sediment flux.

Pei-Fang described the approach to calibration of the water quality model. First, a conceptual model of transport, fate, and nutrient processes was developed to assess eutrophication symptoms, which are primarily dissolved oxygen, macroalgae, and ambient nutrients (Total Nitrogen and Total Phosphorus). Then, the model results were compared with field data for those key index parameters and the external loading was assessed. Not all the field data were appropriate for direct use in the model; therefore, the field data was adjusted and the appropriate portion for the model was selected. Model runs were conducted, and the model results and field data were compared. If the results matched or did not match, the team worked to understand why. Results and responses were assessed, model parameters were adjusted accordingly, and the iterative process continued until the data and model results matched in an understandable and expected way.

The model inputs, from all loading source (upstream, agriculture field, groundwater, and ocean), included key parameters of nitrogen (ammonia, nitrate, dissolved organic nitrogen, detrital nitrogen), phosphorus (orthophosphate, dissolved organic phosphorus, detrital phosphorus), carbonaceous biochemical oxygen demand (CBOD), silica (inorganic silica, detrital silica), dissolved oxygen, phytoplankton, and macroalgae.

Upstream sources include watershed loading to the lagoon via surface water flow and groundwater flow, loading from the agriculture field, and the ocean boundary through the sand berm. The team used the following data sources for the upstream loads:

- Bathymetry from the most updated survey by SPAWAR, February 2013
- Watershed surface water flow from the USGS gage at Ysidora
- Surface water nutrient loads from the mass emission station
- Surface water dissolved oxygen loads from the model calibration
- Watershed groundwater flow from the Stetson groundwater model
- Agriculture field nitrogen load as measured by SPAWAR in 2010, with the final load obtained from model calibration
- Ocean boundary condition from Scripps data as measured at Del Mar

The 2008-2009 field data included four index periods with water column nutrient data, about 10 months of data for water column dissolved oxygen, discrete 100-m transects collected at 3 intertidal locations on the northern shoreline every two months by SCCWRP for macroalgae, and four index periods at two locations for sediment flux (data for index periods 3 and 4 were used for model comparison).

The calibrated results include nutrients, macroalgae, dissolved oxygen, and benthic flux.

Nutrients

The model successfully simulated estuary nitrogen and phosphorus within 10 percent mean errors for all locations and time periods, except for the Segment 1 shoreline location. The discrepancy in the concentration at the Segment 1 site is attributed to the unknown source strength of the groundwater from the adjacent agriculture field and a differential in the spatial

representation of the site (approximately 30 square meters) by the model grid size (approximately 2700 square meters). The benthic nitrogen and phosphorus fluxes were successfully simulated by the model, generally within one order of magnitude of measured values during the critical period.

Pei-Fang presented model-data correlation charts for nitrates, total nitrogen, orthophosphate, and total phosphorus. All charts showed good correlation between the model and the field data. The largest difference between the model and the field data for the total numbers was with total phosphorus where the model under-predicted by about 25 percent.

Pei-Fang presented the model/data time series for phosphorus and for inorganic nitrogen. The model was run for three years (January 2007 to December 2009) and compared against the field data that was available (2008). The time series shows good agreement between the model and the field data with the exception of Segment 1. The mismatch at Segment 1 is likely due to resolution.

Macroalgae

The model successfully simulated the macroalgae biomass for Segment 1 (within 12 to 41 percent) and Segment 2 (around 39 percent). The discrepancy at Segment 1 is, again, attributed to resolution. The model did successfully capture the seasonality as well as the spatial patterns and timing of algal blooms.

Pei-Fang presented three plots of the macroalgae at Segment 1:

1) Model-simulated macroalgae biomass for two years of simulation (bottom green line)
2) Temperature of the water (upper green line) to demonstrate the correlation between macroalgae biomass and water temperature
3) Mean value and standard deviation of field data for 2008-2009, showing the mean values are in the same range as the model but the field data shows a slight shift of peak later than that predicted by the model

The same chart at Segment 2 shows the same results with the mean values again in the same range as the model with large standard deviation.

Pei-Fang demonstrated the spatial discrepancy for macroalgae by showing the model grid around the Highway 5 bridge. The model result reflects the entire segment while the two blue sections are the shallow portions of the subtidal/intertidal area where the biomass field data were collected. The ratio between the model area and the two small sections is about 90:1; therefore, the macroalgae transect area represents only about 1 percent of the grid size of the model.

Dissolved Oxygen

The model successfully simulated the dissolved oxygen concentration within 6 percent when compared with the field data at Segment 1 for mid-April through mid-November 2009 (7 months). The discrepancy in the winter is attributed to not implementing a baseline phytoplankton or benthic algae production in the model. The benthic algae was not simulated.

Despite the discrepancy, the model did successfully capture the seasonality as well as the spatial patterns and timing.

Pei-Fang presented the model/data cumulative probability for dissolved oxygen. The field data started in January 2009, stopped March 8, and then re-started mid-April. The model result and the field data are compared starting from the re-activation in mid-April 2009. It is for the first field data period that the model does not match the field data due to lack of benthic algae in the model. The cumulative probability analysis showed that 26.5 percent of the time series from the model are below 5 mg/L dissolved oxygen compared to 24.3 percent of the field data.

Benthic Flux

The model successfully simulated the flux of nitrogen, phosphorus, and oxygen into and out of the sediments. The field data is associated with a large standard deviation, demonstrating a large variability within the dataset. When the field data with the standard deviation is compared to the model results, the model results correlate with the field data. If only the mean of the field data is compared to the model results, there is a 5 to 45 percent difference for nitrogen, 49 to 51 percent difference for phosphorus, and 0.5/g sq. m-day for dissolved oxygen flux.

The nitrogen flux changes with the seasons and shows similar patterns for Segment 1 and Segment 2. The fluxes peak in February to April and stay low during November to January.

The phosphorus flux at Segment 1 and Segment 2 peaks in May to July and stays low November to January. There is a one to two month lag between the peaks of nitrogen and phosphorus.

For dissolved oxygen, the model is over-predicting compared with field data.

Model Uncertainties

There are three categories of uncertainties:

- External loads (upstream groundwater for nitrogen and phosphorus, agriculture field groundwater for phosphorus)
- Estuarine water quality parameters (location and resolution of measurements, high variability of sediment flux)
- Numerical models (model resolution, model sensitivity analysis)

For the external loads, there are no exact numbers for upstream groundwater loads and although SPAWAR has done studies since 2010, there is no data for 2008 and 2009 for load from the agriculture field. As evidenced by Segment 1, resolution may be an issue for the estuarine water quality parameters. In addition, the sediment flux has a high level of variability which increases uncertainty levels and even puts a question on the mean values. Numeric models always have uncertainty with model resolution and sensitivity analysis; however, the team believes the model resolution has been controlled pretty well in this case and several rounds of sensitivity analysis have been conducted.

Model Sensitivity

Overall, the hydrodynamic output is the most important parameter as it determines 90 percent of the transport in the lagoon. Next most significant is model grid resolution. Pei-Fang expressed confidence in how this model addresses those two issues.

Specific to nutrients, model grid resolution, then macroalgae uptake, and then seasonal sediment flux are the important parameters. For dissolved oxygen, the macroalgae biomass is the most important parameter since the more biomass that is in the water column, the higher the consumption of dissolved oxygen. For macroalgae, the most important parameter is the nutrient concentrations, followed by the uptake/growth/death rates, and then self shading. Self shading diminishes the light available for macroalgae growth. For sediment flux, the detrital/particulate deposition is most important, then the overlying concentration.

Relative Importance of Nutrient Sources and Sinks to the Estuary

The estuary has watershed surface water and groundwater inputs, agriculture field groundwater input, and benthic flux. Pei-Fang showed the major loading of nitrogen sources to the lagoon for each source as modeled for four index periods in 2008. During the early dry season, the watershed surface water and groundwater nitrogen is four times the magnitude of the local groundwater inputs. During the first three weather seasons, the dominant source is watershed surface water; however, during the last weather season, the dominant flux is from the agriculture field groundwater and benthic flux. Pei-Fang noted that the agriculture field load has been reduced since 2008 measurements and the numbers shown are from 2008. The agriculture field load was reduced by a factor of 10 between 2010 and 2014 due to a reduction in watering of the field, not a reduction in nutrient source concentration.

The group discussed the source of nutrients for the benthic flux. Pei-Fang explained that sediment is a reservoir for organics. The model is run for several years, starting with zero organics in the sediment, nutrient deposits are allowed to settle in the sediment, and a steady state is reached. The steady state remains when the model is set up again. Martha mentioned the nutrients in the benthic flux come from two sources: particulate deposition during wet weather and production of organic matter in the estuary that settles back into the bed. The team is working on identifying the difference between the two, but they were not differentiated in the current model.

Pei-Fang showed the major loading of phosphorus sources to the lagoon for each source as modeled for four index periods in 2008. The watershed sources dominate the first two seasons, and the benthic flux dominates the last two seasons. In the last season, another dominant source is the watershed groundwater. Martha noted that the relative contribution of groundwater fluxes from the agriculture field and the watershed are not known. They did not analyze any phosphorus data from the watershed groundwater or agriculture field sources. SPAWAR believes there is some phosphorus data available and will provide Martha with any found data.

Summary

Pei-Fang summarized findings of the estuary model calibration. The EFDC and WASP models were linked, and the model was calibrated against field data for 2008-2009. The existing field

data was evaluated and processed for model input. Comparing the model and field data showed agreement for nutrients, similar trends and magnitude for macroalgae biomass, agreement for dissolved oxygen for April to November with a mis-match during January to March due to no simulation of benthic algae, agreement in trends for sediment flux, and mis-match of model/data at Segment 1 due to resolution. The uncertainties were identified and sensitivity analyses were conducted to characterize the accuracy requirements for model input data and model output.

Group Discussion

JoAnn thanked SPAWAR and Camp Pendleton for their efforts, as well as the technical team in general. She recognized this was difficult to complete, especially with macroalgae. Pei-Fang took initiative in acquiring a special module for the macroalgae.

Pei-Fang acknowledged those who contributed to the estuary model calibration, including Kyle Cook, Martha Sutula, James Martin (Mississippi State University), Tim Wool (U.S. EPA Region 4), and Jim Fitzpatrick (HDR).

Jim stated that the model, with the identified uncertainties, can be used to provide initial insights. He discussed that there is quite a bit of variability when comparing the sediment flux model to the data. It is important to recognize how the sediment flux data was collected and how it is different from what the model is computing. For collection, domes are placed over sediment to trap biomass. Measurements are taken of the production of oxygen and utilization of nutrients to see the apparent flux rate. The sediment flux model calculates the sediment-water interface, which is not the same what is measured in the field.

Jim also noted that if groundwater flow from the agriculture field has been reduced by a factor of ten, then it would be interesting to go back and sample the estuary to see its response to that change and how the load reduction may have influenced biomass. Chuck Katz (SPAWAR) indicated that sampling has been done and will be reported out in the near term.

Jim has completed a quality assurance review of the estuary model calibration and did not find fatal flaws. He believes the model can provide some preliminary guidance to the management strategy for the estuary.

Martha cautioned that the estuary model calibration has identified a number of issues with uncertainty. These issues cannot be fixed in the short-term period with available resources but could be fixed in the future with more resources and more data. She is not comfortable with using the estuary model for specific numeric load or waste load allocation development at this time. She does support using the model to have discussions about nutrient management.

Hiram Sarabia (Regional Board) thanked all involved for their support and efforts on this task. He asked for the calibration report to clearly indicate whether the model is over or under predicting.

Wet Weather Nutrient Regulatory Approaches

Ashli Desai (LWA) discussed the policy decision making concept of wet weather nutrient regulatory approaches. When talking about addressing impairments, seasonal components must be considered.

The regulatory and scientific background framework for this analysis and statewide policy has been based on the dry weather paradigm. Typically, algae grows more during dry weather, especially during the summer. The Statewide Nutrient Policy focuses on summer dry weather. In the Santa Margarita River Watershed Nutrient Initiative Process Plan, this issue was identified as something to be addressed. A draft white paper has been developed. Ashli presented the approach of the white paper for group discussion. The draft white paper will be distributed for review.

In developing the draft white paper, a literature review was completed to identify what approaches have been taken for other TMDLs, for other areas in California, and other areas in the United States. Options were identified based on things commonly seen in the literature review and based on factors from personal experiences of the group. The draft white paper will have citations that identify where different options have been adopted. A flowchart was created to identify the situations where different options would apply.

The literature review found that most times there is not a clear distinction between wet weather and winter dry weather. It is important to make that distinction because there may be different conclusions for different conditions. When considering wet weather and winter dry weather, there are three key categories to think about:

- Are beneficial use impacts occurring? If yes, then targets are needed. If not, then targets are probably not needed because no problems are identified.
- Where do impacts occur? This is a key piece to influence the discussion. There could be no observable impact in the river but an impact in the estuary during a certain condition. The relation of discharges to river and estuary need to be considered.
- Other considerations? There may be management scenarios necessary to address discharges that occur in one season that impact another season. Other reasons for targets must also be considered, such as anti-degradation or uncertainty.

Ashli presented the evaluation framework flowchart. If there is a beneficial use impact during the condition of concern, then the right side of the flowchart is followed, including establishing applicable targets for winter dry or wet weather, if there is an impact during summer dry weather, then summer dry weather targets need to be established. Lastly, the need for management actions during wet or winter dry weather that may affect dry weather are evaluated. If there is no beneficial use impact during the condition of concern, then no targets specific to winter dry or wet weather are needed, but summery dry weather still needs to be evaluated. If there are impacts during summer dry weather, then targets need to be established. Finally, the impact of discharges during winter dry and wet weather on meeting the summer dry weather targets needs to be evaluated.

A key question that came from the literature review was “is the downstream water body retentive?” That is, will the downstream water body capture wet weather or winter dry weather load that would contribute to impairment during dry weather. If the water body is not retentive, then there would be no need for winter dry or wet weather targets. If the water body is retentive, then a model analysis would be needed to determine the impacts of winter dry and wet weather on summer dry impacts. The draft white paper will include clearly defined terms.

In concept, a retentive water body would be one with sediment deposition that could contribute or with groundwater recharge. A closed estuary is an example of a retentive water body. Ashli assured the group that the retentive issue will be assessed for the estuary.

Hiram asked if it is possible today to determine how much is deposited when the mouth of the estuary is open. Martha explained that can be done in two ways: using the radio isotope measurements from the initial set of studies or using the model to estimate the wet weather depositional effect on dry weather benthic nutrient flux in the estuary.

Ashli explained the color coding on the flowchart identifies options available for different situations. The different scenarios are presented in table format. The framework is the combination of the flowchart and the tables. Just because the flowchart leads to one box, it does not dictate a singular option.

Hiram questioned how it is determined whether or not there are beneficial use impacts. Ashli explained that for direct effects, it is a direct comparison to the basin plan objectives. For indirect effects, it will be based on response targets that the group determines are appropriate for deciding if there is a beneficial use impact in the watershed. The group will need to consider water quality objectives and the NNE alternatives.

Since this is ultimately a regulatory action, Dave posed the question back to the Regional Board on what they do to assess whether or not beneficial use impacts are occurring. Cynthia Gorham (Regional Board) shared they have been following the document Martha developed for the NNE framework. Hiram suggested that when assessing impact by looking at macroalgae biomass, it would also be useful to examine the nutrient concentrations at that time.

Martha raised the issue of the two tracks for this project: the estuary and the river. They are on separate timelines, but it is one watershed. From Ashli's perspective, she assumes the estuary evaluation would have to be done ahead of the river evaluation. Once the estuary evaluation is done, there will be a pathway with identified options. The flowchart and tables do not indicate an extraordinary amount of options would be identified on any pathway. Cynthia expected the estuary would be the driver for nutrients for this watershed. The estuary data is available now; the river data is not yet available. As the river data comes in, the group will develop targets for the river. The wet weather may not have as much of an important role in the river as it may have for the estuary.

Kyle asked if it there is a potential there would be a different approach for wet weather or winter dry weather depending on the conditions or if there would be one approach that addresses both seasons. Ashli explained that determination of the beneficial use impacts will lead to the plan. She does not anticipate having a target that changes depending on the condition; however, there may be different management actions to meet that target depending on the condition. The first step is to determine if there is a problem, then identify the actions to address the problem and how to evaluate the impact of the actions.

Hiram asked what data would be used to assess whether there is a beneficial use impact. Ashli indicated that is a discussion point for the group. Hiram suggested it would be important to have data that represents "normal" conditions, not only drought conditions. Chuck also suggested the group needs to discuss how to determine the correct benchmark such that the impairment is based on science.

SPAWAR/Camp Pendleton will present their latest monitoring results at the next group meeting.

Model Application to Support Nutrient Management Discussions

Martha explained that there have been four technical elements to this work: collect data, summarize available science and select response targets, calibrate models, and use the models. The watershed loading model and estuary model have been calibrated. The next step would be to use these models for three purposes:

1) In the estuary, define the range of allowable loads (loads coming in, the estuary's response, and the level for the estuary to sustain uses and continue human use)
2) From the watershed loading model, identify the range of nutrient loads and sources
3) Combine the models to discuss, in the policy realm, the need for and range of loads and waste load allocations

To start using the models, there are preliminary decisions or considerations necessary on how to begin to interpret the estuary numeric targets in order to make the calculation of allowable loads. Decisions also need to be made on the categories of interest for partitioning the nutrient sources. That partitioning is necessary to produce a preliminary estimate.

Martha cautioned that discussions today are not producing anything actionable; this is the start of the conversation.

Watershed Loading Model: Application of HSPF Model for Allocations

Clint reviewed the status of the watershed loading model. The HSPF model developed by the U.S. Army Corps of Engineers and USGS has been calibrated. It is a standard platform to look at modeling hydrology and water quality, but it is not a receiving water model that would be used for an estuary. The HSPF model includes continuous simulation of flow, sediment erosion and transport, nutrient loading and dynamics. A 20-year timeframe was modeled (1990 through the end of 2010), so it includes different weather conditions and years and the range of loading over time. The watershed loading model provides a long-term perspective with a dual focus: estimating loads to the estuary and simulating ambient conditions within the stream network.

Clint discussed the challenges with the watershed loading model, including the sparse rainfall data on highly variable terrain, intermittent water quality observations often limited in number at key locations, and the characteristics of a highly managed system with reservoirs and dams, groundwater pumping, and irrigation.

Within the HSPF model, the larger watershed is segregated into smaller subwatersheds or subbasins since there are different tributaries, hydrologic patterns, and land use information. The goal is to end up with a good mix of subwatersheds that represent a homogenous area within the watershed. The Santa Margarita River Watershed was split into 77 subbasins. The discharge records from the three reservoirs were used as point source boundary conditions. Clint cautioned that the group needs to consider how to handle reservoirs and downstream imported water.

Clint presented the model's limitations and possible future enhancements:

- The hydrologic fit is limited by the sparse rainfall data. A substantial improvement would be achieved through the use of PRISM data.
- The water quality fit is constrained by hydrology and potential data quality issues. There are relatively large discrepancies between individual observations and the model output. It is expected in any watershed model that competing issues can be adjusted to fit conditions in one part of a watershed that will not relate to other parts of the watershed. There is a balance to calibrating and parameterizing the model to have it fit as much of the entire watershed as possible. There will still be site-specific differences.
- The model is based on static existing land use coverage (2005 for Riverside County; 2009 for San Diego County). The land use could be varied over time or zoned land use could be considered.
- The model was developed for a 20-year time period that ended 2010; therefore, more recent data cannot be used. Additional years could be added to the model.
- There are complex interactions with the groundwater system. Having the more detailed groundwater modeling data would improve the watershed model.

To use the model, the uncertainties need to be documented and quantified. The uncertainty in seasonal and annual loads is most important for allocations relative to the estuary. Temporal scales and spatial scales will help qualify the confidence of the model. The model's sensitivity to assumptions also needs to be evaluated, especially relative to load allocations. Clint explained they have a limited mandate for improvements to the model which includes incorporating the groundwater model information and re-evaluating the calibration to nutrients based on the previous, coarse groundwater representation. At this time, there is no scope for improving the hydrology or extending the model past 2010 within the next six months. If that is of interest to the group, Tetra Tech can explore it.

Clint presented the predicted loads by land use. The predicted loads presented are based on the current watershed model, for the entire watershed, and averaged across the entire 20-year time period. If a particular year or particular area is isolated, the results would be different. The loads presented are the edge of field loads and do not consider downstream delivery or instream dynamics.

The group suggested that wet weather, summer dry weather, and winter dry weather should be presented separately.

For nitrogen, the longest bar on the chart is for the orchard/vineyard/nursery land use type. Scott Thomas (Stetson) asked if the loads from nurseries were based on literature values or if they considered active TMDLs. Because of the timeframe of the model, the loads are prior to full implementation of the Rainbow Creek TMDL. That will need to be considered when discussing management activities.

Cynthia suggested separating nurseries from orchards and vineyards, if possible. JoAnn suggested Tetra Tech should use the San Diego County land use analysis map which included a land use analysis based on satellite or aerial photos.

Clint presented the predicted loads by land use for phosphorus. Again, the orchard/vineyard/nursery land use type stands out. The chaparral/scrub land use also shows a high percentage, which is probably reflective of the amount of chaparral/scrub area in the watershed as that is not expected to be a high loading category for phosphorus.

Scott expressed concern about how much change there has been in land cover, land use, and how the river system is managed. The recent years where sewage has not been released into the river in a couple places are more important than the prior years when planning for the future. There is no farming next to the estuary anymore. Scott questioned how this could be partitioned or considered to strategically utilize the model best. Clint acknowledged the concern and explained that a higher resolution for the model could be achieved by further splitting out subbasins, especially those areas with unique changes or management practices.

Clint explained the loads by subbasin summarize the edge of field loads, not the downstream delivery amounts. The model does not track loads from their specific land use origin, through the watershed, to the estuary. Discount factors, such as seepage from the river to groundwater and other variables, impact the delivery of the load from the land surface to the estuary.

Tetra Tech is calculating the throughput for each stream reach. This can be done for long-term annual timeframes or on a seasonal basis. If it is supposed a load from a source area must proceed through reaches 1 through “i” to reach the estuary, the upstream input, local input, and output of each reach can be examined to determine the throughput of each reach. The annual and seasonal model results can be examined on input, output, and diversions for each reach to determine the percentage throughput. The delivered load would be equal to the local load as processed through each intervening reach (i=1 to n). The stream reach characteristics and soil type and imperviousness for overland flow are considered in determining what percentage of the source load reaches the edge of field.

Tetra Tech presented maps showing loading rates by subbasin for total nitrogen and total phosphorus. The maps show the total loading rate on a pounds per acre basis by subbasin as a function of hydrology and land use.

Other load sources to consider include Rancho California Water District discharge that have changed over time and discharges from upstream reservoirs which largely consist of water from the Colorado River project that is released to meet the water rights requirements of the natural flows. These load sources may be small relative to nonpoint source loads in wet years but significant in dry years.

Uncertainty in the model arises from interaction of a large number of factors, some of which can be quantified and some which cannot. It is best to evaluate the uncertainty based on discrepancies between model simulations and observations, although there is uncertainty in observations, too.

The uncertainty in concentrations is due in large part to discrepancies in the magnitude and timing of runoff events. Optimally, there would be a lack of bias in the model relative to season and flow. Plots show there is not a strong bias relative to flow. The model is relatively unbiased, but there is not a high level of precision relative to individual concentrations.

The main objective is load delivery to the estuary; however, loading is not measured. Concentration is measured at points in time and flows. The concentration data has to be converted into loads. Tetra Tech has been working on this recently using the USACE FLUX program which uses a rating curve approach where the relationship between flow and concentration is factored together with observed concentration. That conversion has been done for places with flow gages and good data, including the Santa Margarita main stem at Temecula and at Fallbrook PUD. There is not enough data at Ysidora for the conversion at this time. The FLUX estimates of annual load have 95 percent confidence intervals on the order of about 20 to 40 percent, but they can be used to compare with the model results.

With the current model, looking at loads, the TKN and total phosphorus tend to be over-estimated at Temecula (11 to 60 percent). This is not unexpected due to the uncertainty in hydrology. At Fallbrook PUD, the total phosphorus load is slightly over estimated but NO_X and TKN appear to be under estimated. Tetra Tech is still investigating these issues but expects the discrepancies are mostly due to high flow years. The model may need further adjustment but is sufficient now to establish the first cut of relative allocations.

The scheduled work includes sensitivity analyses to determine how the results are responsive to parameter uncertainty. The proposal is to move forward with the initial allocations in the model that can be improved later.

The groundwater models can be incorporated given more time and resources. With the limited time and resources, the output from the Camp Pendleton Salt/Nutrient Management Plan and the Lower Santa Margarita River groundwater model can be used, and the relative contribution from Camp Pendleton versus upstream sources on net nutrient loads to the estuary can be summarized.

The loading rates are currently summarized by land use category and subbasin. The individual subbasins (hydrologic response units [HRU]) can be assigned to jurisdictions by location and land use. Transport factors could be applied to estimate the fraction of a load reaching the estuary on an annual or seasonal basis from a jurisdiction or type of land use within a jurisdiction.

Tetra Tech presented an example of a completed allocation process done for Jordan Lake in North Carolina. Jordan Lake was a nutrient-sensitive water. There were 46 different jurisdictional entities subject to MS4 permits and a special State law for nutrient-sensitive waters that required tabulation under a variety of timeframes. Source loads by land cover for nitrogen and phosphorus were simulated for baseline and existing conditions. The delivery rates from sources to the lake were mapped. The delivery rates were affected by instream processes and upstream reservoirs. Total nitrogen and total phosphorus land load estimates for Lake Jordan were developed for 46 jurisdictions. A model was used to apportion percentages of the regulatory baseline load.

For the Santa Margarita River Watershed, the source categories of interest need to be identified for partitioning the loads. After receiving group input, Tetra Tech will put together a technical approach to ultimately get at balancing expectations from different stakeholders in terms of categories, levels of uncertainty, and where it makes sense to partition loads and look at delivery downstream to the estuary. Then, analyses can be conducted in accordance with that approach and the overall model application report can be completed. Tetra Tech hopes to

have the technical approach completed in January and the overall model application report done in March.

Martha suggested that the first cut at partitioning be done at a more detailed level than the ultimate load allocation goals and the discussion be centered around how the group wants to see the nutrient sources instead of the end result of load allocations. The group recommended partitioning be done by permit, by jurisdiction (county, city, Caltrans, DoD, tribal), and different types of agriculture (grow crops, horse ranches, etc.). For tribal areas, the loads will not be shown unless requested by the tribes since they are sovereign nations and not under regulation of the Regional Board.

JoAnn suggested more understanding of the river is needed before assuming the delivered load to the estuary is coming from specific watershed sources. The river work is about two and a half years out. Cynthia stated the Regional Board has been working on this TMDL for ten years. Regional Board management and the EPA want the TMDL completed. JoAnn asked if there would be a way to make the TMDL preliminary such that it could be revised when the river work is ready. Cynthia indicated there are multiple options that require discussion with management.

Ashli suggested a process that would begin with assessing the estuary impairment, determining the loads and magnitude, and identifying if watershed loads are contributing to the impairment. If watershed loads are contributing to the impairment, then different ways to allocate the watershed loads would be investigated to provide flexibility if the river TMDL is different. One option may be to do a nutrient management plan to reduce loads by a certain percentage but not assign loads until after the river monitoring is done.

The group discussed that the river monitoring and further SPAWAR monitoring would aid in reducing the uncertainty in the watershed model. Cynthia reaffirmed that the TMDL needs to be developed but could include a statement that it would be re-visited once more data is collected. This is one of the reasons the Regional Board is trying to develop this as a non-traditional TMDL, to allow flexibility with the collection of more data.

Ashli asked how industrial sources or other sources subject to other permits are being handled. Clint explained that land use categories would have to be aggregated to create the single industrial category subject to the Industrial General Permit.

With regard to groundwater upstream of the gorge, Geosciences and RCWD would have to provide permission to use their model. RCFCD will coordinate with RCWD.

Chuck questioned how open space is handled, whether it is subtracted out. Ashli explained that separating out background reference values is not always beneficial as it can result in higher reductions necessary from other places.

Estuary Receiving Water Model

With the estuary receiving water model now calibrated, it can be used to summarize the nutrient loads the estuary can sustainably assimilate. Martha explained that numeric targets are not just numbers. Numeric targets have a suite of conditions that represent the extent, frequency, and duration, in addition to magnitude. The estuary model can be used to help understand how decisions on expressing numeric targets influence the calculation of allowable

loads, which can then be joined with the work from Tetra Tech to show how that impacts the calculation of load/waste load allocations. Detailed discussion on this will be at the January 12 meeting. In preparation for that meeting, Martha needs to know which scenarios the group wants presented.

The Basin Plan includes objectives for Total Nitrogen, Total Phosphorus, and dissolved oxygen. The NNE approach considers macroalgae biomass and percent cover. The group has previously agreed to evaluate these indicators using the estuary water quality model. Pei-Fang presented earlier how the model performed with respect to Total Nitrogen, Total Phosphorus, dissolved oxygen, and macroalgae.

For each numeric target, there are four basic issues:

- What is the numeric target?
- How should extent be considered? (horizontal across a channel cross section, vertical in the water column, or along a longitudinal axis of the estuary from the ocean to the top)
- How should frequency/duration be handled?
- Is there a critical period?

<u>Total Nitrogen and Total Phosphorus</u>

For the numeric target, there is a narrative objective in the Basin Plan that provides different numbers for different types of water bodies. For Total Phosphorus, it is 0.05 mg/L entering a standing body of water, 0.025 mg/L in a standing body of water, and 0.1 mg/L in flowing waters. The group discussed that the estuary is open during the entire simulation period, so the flowing waters value is applicable.

For the extent, the model output demonstrates the influence. When two years of data for Total Phosphorus and Total Nitrogen is shown from left to right bank, neither the model nor the field data shows any gradients across the cross section. The model also does not show variability in the vertical water column. Along the longitudinal axis of the estuary, there are strong gradients shown. Therefore, the extent should consider the gradient along the longitudinal axis of the estuary and can take the average of both the cross-section and the vertical water column.

The group discussed splitting the estuary into multiple segments along the longitudinal axis to evaluate numeric targets for Total Phosphorus and Total Nitrogen. Possible reasons for using multiple segments could be potential delisting of certain segments or recognition of different water body characteristics. The area of the estuary below Interstate 5 is under ocean tidal influence; the area above Stuart Mesa is freshwater. From a hydrographic viewpoint, there are three segments (saltwater, freshwater, mixing). There is different vegetation to consider as well. The upper two areas are fluvial and the bottom area is depositional. For the January meeting, Martha will show results for one, two, and three segments.

For frequency/duration, the group discussed the concern of meeting future monitoring requirements. Stuart mentioned consideration needed to be made for the tide, wind storms, and Camp Pendleton diversion to Lake O'Neal. Martha mentioned the diurnal, seasonal, and wet versus dry effects may caution against doing a grab on the first of each month. For the January meeting, Martha will provide the running average and do the first day of the month versus the average of the month. To evaluate for a critical period, Martha will present wet

versus dry weather. Cynthia confirmed the Regional Board is willing to look at numeric targets separately for wet versus dry weather. Cynthia also confirmed a 10 percent exceedance frequency would most likely be acceptable.

Dissolved Oxygen

The Basin Plan objective for dissolved oxygen is 5.0 mg/L applied instantaneously with a 10 percent frequency of noncompliance allowed. Previous studies have investigated this value and found it to be generally well supported for chronic effects. The group agreed that 5.0 mg/L is reasonable.

For the extent, the model shows no difference in the vertical column and no gradient over the cross-section. There is strong variability along the longitudinal axis which reflects the increase in mixing that occurs at the ocean and land ends of the estuary. For the January meeting, Martha will show results for one, two, and three segments. For frequency/duration, Pei-Fang previously presented the model does not perform well in winter wet weather, so the model output can only be used for April through November. This limitation and how it affects the TMDL will need to be discussed with the Regional Board. For the January meeting, Martha will use hourly average data.

Macroalgae Biomass

Martha reminded the group of the source of information on numeric targets for macroalgae. There is information about the levels of macroalgae that are natural and the levels where water quality starts deteriorating. Macroalgae biomass effects are also related to percent cover, which is not predicted by the model. Martha suggested the group select multiple values to evaluate. The Regional Board would like to see an outcome for this estuary that is better than what was established for the Loma Alta TMDL. Martha has done caging experiments that showed significant effects after three to four weeks at 110 g dw/sq meter. However, it is quite possible effects started below 110 that were not measurable in the caging experiments. The suggested thresholds from European studies correlate well to Martha's work. For the January meeting, Martha will use values of 50, 75, 100, 125, and 150.

For the extent, macroalgae is evaluated on an aerial basis, so there is no vertical extent to consider. The model did show cross-sectional differences with the north side highest and the mid-bank lower than the south bank. There was no field data collected for the north side. Scott suggested the model may not be showing realistic results. Chuck suggested the model output is affected by the potential agriculture field source which does not appear to exist now. For the January meeting, Martha will show the average and maximum over the cross-section and one, two, and three segments across the longitudinal axis.

For the duration/frequency, the group discussed how to catch the peaks and whether sampling would be based on a set schedule or visual analysis. Ashli suggested using monthly peak and seasonal peak. Hiram suggested starting with the monthly peak. Martha explained that one number is needed. Martha will consider the group's discussion and bring two options to the January meeting.

Next Meeting: January 12, 2016