

# San Joaquin River Dissolved Oxygen Total Maximum Daily Load

## Technical Working Group Meeting

November 20, 2007

9:00 a.m. – 12:30 p.m.

Port of Stockton, Portside Room

2201 W. Washington

Stockton, California

### Attendees

Name	Agency
Brown, Russ	Jones & Stokes
Brunell, Mark	University of the Pacific
Burks, Reggie	EERP/ University of the Pacific
Chen, Carl W.	Systech
Gowdy, Mark	Central Valley Regional Water Quality Control Board
Graham, Justin	University of the Pacific
Grimes, Russ	Jones & Stokes
Hanlon, Jeremy	University of the Pacific
Herrick, John	SDWA
Hsu, Claire	US Bureau of Reclamation
Hunt, Lisa	URS
Kruth, Maury	US Bureau of Reclamation
Lee, Gene	US Bureau of Reclamation
Lee, G. Fred	G. Fred Lee & Associates
Litton, Gary	University of the Pacific
Mao, Lee	US Bureau of Reclamation
McLaughlin, Bill	California Department of Water Resources
Menconi, Mary	California Department of Fish and Game
Niemi, Mike	Modesto Irrigation District
Ploss, Lowell	San Joaquin River Groundwater Authority
Seville, Steve	Jones & Stokes
Silva, Steven	US Geological Survey
Spear, Chelsea	University of the Pacific
Stringfellow, Will	University of the Pacific
Van Nievwenluyse, Erwin	US Bureau of Reclamation
Vargas, Al	California Department of Food and Agriculture
Wingfield, Mike	Jones & Stokes
Wilson, Danielle	Jones & Stokes (Facilitation)
Adams, Marissa	Jones & Stokes (Note-taker)

## **Introductions and Agenda Review**

Danielle Wilson convened the meeting at 9:00 AM, noting that this is the first meeting of the DO TMDL Technical Working Group in over a year. Danielle indicated the meeting would be followed by a presentation and tour of the Port of Stockton Aeration Facility at Rough & Ready Island Dock 20. Steve Seville with Jones & Stokes would provide a brief update. Danielle stated that the primary purpose of the November 2007 TWG meeting was to provide updates on on-going DO TMDL efforts, identify subject matter to be presented and discussed at future meetings, and agree on how often the DO Technical Working Group should meet.

## **UPDATES**

### **San Joaquin River Water Quality Management Group, Lowell Ploss**

Lowell Ploss noted that progress is being made on the west side, as farmers work to reduce their drainage through a \$25 million grant from the state of California. Lowell stated that the Vernalis Adaptive Management Program has begun its 2008 planning and is looking at water quality between Mossdale and Stockton to investigate whether the source of a fish loss was from predation or water quality. Lowell said they are currently discussing where, when, and how to sample, and are looking for participation in sampling activities.

Lowell reviewed a drainage project; an effort to reduce drainage through recapture and crop application that will eventually lead to desalting, including a collection system that re-circulates drainage before it is applied to salt tolerant crops. Lowell noted that the greatest associated cost is brine, which must be either evaporated in ponds or desalted mechanically, and that it is still to be determined what to do with the mountains of salt in the Delta.

Gene Lee stated that Reclamation is working with Regional Water Quality Control Board staff on development of a real time monitoring and management program and that work is ongoing to revitalize the San Joaquin River Water Quality Management Group such that the group can meet within the next year.

### **Central Valley Regional Water Quality Control Board, Mark Gowdy**

Mark Gowdy stated that his most recent efforts have been focused on working with the California Department of Fish and Game to get funding for the next round of DO studies. Mark noted the need for studies and fieldwork focused upstream of Vernalis to provide a complete picture of the DWSC and to improve modeling in this region. Mark said he is increasingly aware of how useful the upstream studies will be for DO, and is also looking at water quality as part of the VAMP program, and real-time salt management. Mark encouraged others to consider how their work may be of interest to other agencies.

Danielle Wilson suggested that the DO TMDL TWG consider presenting to a larger group of agencies and to the public regarding our status with upstream and WARMF studies in early-spring or late winter and how this work may be of interest to other agencies. Danielle noted that the initial efforts of the TWG in earlier years were focused on data collection, and that the data can now be presented and reviewed by others for purposes of draw some conclusions and directing next steps.

Lowell Ploss announced that the SWRCB will hold a workshop on San Joaquin River flows in 2008 that is focused on fisheries that may be a good opportunity for presenting the initial conclusions of the Working Group.

Mark Gowdy announced that he will be taking a job with the State Water Resources Control Board (SWRCB), Bay Delta Unit, in Water Rights. John noted that this will not affect his involvement with the Working Group, and that he will have a liaison role to Water Rights, and will assist Regional Water Quality Control Boards to coordinate their actions. Mark noted that flow is an obvious factor related to DO in the DWSC, and that the SWRCB is aware of the need to improve coordination between water rights and water quality.

Fred Lee stated that the SWRCB makes water rights decisions without looking at the impact of exports and flow changes pursuant to SWRCB Decision 1641.

Fred Lee indicated an upcoming Nutrient Water Quality Modeling Workshop sponsored by the California Water Modeling Forum would be held in early 2008. The workshop will be a one-day overview regarding the sources and impacts of nutrients and how to manage load response for DO in the DWSC and South Delta. Danielle Wilson noted that she will post this meeting announcement to the project web site.

## **PRESENTATIONS**

### **Upstream Studies Update — William Stringfellow**

Will Stingfellow presented an overview of the three-year upstream San Joaquin River DO TMDL project. Will noted that project collaborators will conclude data collection in November 2007, and that the project contract will end in June 2008. Will noted that agricultural agencies have been key collaborators, including the San Joaquin Drainage Authority and others.

Will noted that upstream project is focused on the watershed above Vernalis. Will reviewed the 2003 DO TMDL which sited channel geometry, insufficient flow, and loads of oxygen demanding substances from upstream of the DWSC, including suspended algae, municipal discharge, and other sources. Will specified that he upstream project is focused on suspended algae.

Will reviewed the following six project objectives:

1. Establish a comprehensive monitoring program to characterize the loading of algae, other oxygen-demanding materials, and nutrients from individual tributaries and sub-watersheds of the upstream SJR.
2. Characterize the transformation and fate of algae and other oxygen-demanding materials between their sources in the watershed and the DWSC.
3. Characterize the fate of nutrients and the impact of nutrients on algal growth between their sources in the watershed and the DWSC.
4. Characterize the temporal variability of water quality parameters on a daily and seasonal basis.
5. Provide input and calibration data for water quality modeling associated with the low DO problems in the SJR watershed, including modeling on the linkage among nutrients, algae, and low DO.
6. Provide stakeholder confidence in the information that will be used to support the DO TMDL allocation and implementation process.

Regarding project objectives #2, Will noted that the intent is not to characterize a direct impact from oxygen, but to characterize oxygen fate from upstream sources. Will noted that there has been ongoing outreach to agricultural, environmental, and other stakeholder groups to peer review the model and turn it from a scientific study into a usable tool

Will reviewed the following research questions:

- What are the sources of algal inoculum in the watershed?
- What are the sources of nutrients in the watershed?
- What is the relative importance of inoculant size and nutrient sources in determining the algal biomass load reaching Channel Point?
- What would be the impact of reducing either inoculum or nutrients or both on algal biomass loads at Channel Point?
- What other sources of BOD (besides algae) are in the San Joaquin River watershed and are these sources important to the SJR BOD load to the DWSC?

Will noted that the project looks at three separate areas of the San Joaquin River, the tidal reach, the main stem (Crows Landing to Vernalis) where there is a lot of rapid algae growth, and south of Crows Landing where there is slower moving water and a lot of nutrient build up.

Will then reviewed Project tasks, which fall into the following three categories:

- Monitoring and data gathering (including water quality and flow, QA, and data analysis) - Tasks 4, 5, 8, & 10
- Modeling (for nutrients and algae in the SJR) and data transfer - Tasks 6 & 11
- Directed Scientific Studies (to close data gaps) - Tasks 4, 7, 8, & 9

Will noted that a new monitoring station has been installed in the tidal reach between Vernalis and Mossdale as part of monitoring and data gathering activities (Task 10), and ecological studies between Mossdale and Channel Point that look at the impact of zooplankton on algal growth, in order to characterize zooplankton without having to look at microscopic work.

Will explained that adaptive management started with the DSM2 model, but was changed to the WARMF model, an EPA publicly available model more easily expanded to address land use impacts. Will noted that an important component of the WARMF model is a user interface that allows non-users to add and manipulate data and output. He further noted that efforts are currently underway with the Department of Water Resources to set up a more efficient process to transfer data from the ERP database.

Will noted completion of the following tasks:

- Task 2-CEQA
- Task 3-QAPP
- Task 5-Upgrading of monitoring stations
- Task 9-Zooplankton studies (Results included in Task 4 & 8 reports)
- Task 10-New station installation in tidal reach

Will then reviewed the Task 4 objectives and noted that as part of the grab sampling program, 113 locations in the San Joaquin River and tributaries were sampled, including all locations in proposal Table B-1, and all Dahlgren & USGS sites in previous study. Will noted that 1,907 samples had been collected as of October, and that sites on the core station list were sampled every two weeks.

Will then reviewed the status of the following task objectives:

- Review & compile historical data (Essentially complete – primarily completed as part of modeling program)
- Coordinate collection, compiling, QA review & dissemination of flow and WQ data (Will associate calibration data with flow data, and disseminate back to modeling group and other interested parties)
- Conduct studies of individual drainages
- Interpretation of results
- Training & outreach (CSU Fresno, California Water Institute)

Will then reviewed collection and processing of flow and water quality data, noting that all known pre-2005 data (historical data) have been compiled, and that a preliminary data set through the end of October will be published every fall and spring (final information will go into the IEP database).

Will then reviewed studies on individual drainages to examine water quality changes along the San Luis Drain, Salt Slough, and others.

Will noted that when the San Luis Drain was shut off for three days in the summer of 2007, this modified one of the major sources of algae and inoculums entering the San Joaquin River. Will referenced a graphic of Mud River Slough downstream of the San Luis Drain demonstrating how the load of chlorophyll was affected during this time. Will noted that the modeling group is currently working to see if the model could be useful for these types of predictive purposes, and that one management strategy may be taking algae out at the San Luis Drain.

Will then discussed the *Interpretation of results* task objective. Regarding the comparison of drainages, Will noted that a smaller sample size of representative drainages is necessary since it is not possible to sample all drainages in the Valley. Will noted that all of the models have been taking data from drainages that may not adequately represent the east and west. Will stated ranking and indexing is the next step so the process of setting management strategies can begin, and that this will be presented in a separate presentation. Longitudinal analysis will be conducted in direct response to peer review that recommended other kinds of analyses

In summary, Will stated that the WARMF model looks very promising, has a user-friendly interface, has been peer reviewed by the stakeholder group, and modified in response to stakeholder comments. Will noted that the model is posted on the Systech site and encouraged others to download and test the model so that any potential problems can be identified and addressed now. Will said that Chlorophyll seems to be highly variable but that is its nature (can vary 30-40% in a day). Will noted that final tasks will be completed by April with a final synthesis report completed by July.

### **Dissolved Oxygenation Data from DWR's Deepwater Ship Channel Monitoring Network — Russ Brown, Jones & Stokes**

Russ Brown provided an update on DO data from the DWR's continuous DWSC monitoring network in order to:

- Confirm RRI monitoring of background DO concentration patterns (without aeration) in the DWSC
- Measure tidal transport and mixing of DO additions (DO diffuser effects)

- Identify DO increments in the DWSC (where does added DO go, how long does it stay?).
- Estimate what DO concentrations without aeration would have been (during periods of aerator operation).

Russ stated a modeler needs to be able to live in two realities at once to determine what should be done when the oxygen machine is operating and how to know if it is working, despite not being able to observe the machine both on and off at the same time. This is necessary to connect measurement to management of the device, so that measurement, management, and the device are all working together. Russ noted that DWR both built the machine and did the monitoring.

Russ presented a graphic of measured DWSC flow and DO at Mossdale for 2004, and asked attendees to estimate DO at Rough & Ready Island (RRI). Russ noted that this calculation is necessary: 1) to confirm if the measurements at RRI are correct, and 2) to determine if these low DO numbers really represent a problem. Russ indicated there is a strong tidal movement between the diffuser and Channel Point and asked: 1) where should we be looking for improved DO?; 2) how can we tell the difference between aerated oxygen and existing oxygen in the SJR (i.e. How much of the increment that we see was actually caused by the aeration device)? Russ noted that all of these fluctuations were caused by the aeration machine and that; in general, he is confident that what was measured at RRI and what was measured in the San Joaquin River are the same. Russ noted that if these numbers did not jibe, it would be necessary to need to go back out and re-measure to identify what is wrong. Russ noted the importance of analyzing multiple DO probes in the DWSC at the same time, both upstream and downstream, in order to determine DO regardless of tidal excursion.

Russ stated all monitors must be placed 12 feet down because the diurnal (day-night) cycle can complicate the interpretation of results. Russ noted that the drop in temperature and drop in DO could have been caused by changes in flow, the point being that the cause of a DO decline is not always clear. Russ said that it is not clear why DO was above saturation in the April time period.

Russ elaborated on the diurnal tidal cycle, noting that artificial DO will stay in the water for a couple of days, further complicating data analysis. Russ further noted daily monitoring has resulted in an abundance of data, and that efforts to separate and track artificial DO will be difficult.

Russ stated that the hope is that aeration is increasing DO along a 1.5 mile stretch by 1.5 milligrams. Russ said that if the aeration machine is run for two consecutive days, DO should increase by 2-3 milligrams. Russ noted that this should be a detectable change distinguishable from natural noise. Russ stated that operating the machine for 4-5 consecutive days will put a pulse of DO into the DWSC that, after the aeration device is turned off, can be observed to

analyze the natural environment (low points) versus the impact of aeration (high points).

### **Questions, Comments, and Discussion**

- The difference could be a result of zero flow through the DWSC between July and September. Aeration under these circumstances will cause DO to increase and not subsequently decrease. There is also a lot of algae at Vernalis but none of it has entered the DWSC. Oxygen does not generally get super saturated without the presence of algae.
- It was noted that the Port of Stockton was operating the old US Army Corps of Engineers aerators and a bubbler over the summer, and this may have affected DO levels. It was also noted that the City of Stockton nitrification facilities that are intended to reduce ammonia levels to less than 1 mg are not working well because ammonia levels were near 10 mg. Zero flows may also have affected the ammonia load.
- It was noted that when there is no flow in the DWSC, there is no load; therefore there is no need for artificial aeration. However, when DO levels dropped below 5 mg in June, 10,000 lbs of aeration over a couple of days would have been necessary to increase DO levels to 5.5 mg.
- There is a lot happening in the 15 miles between Mossdale and Channel Point. Does the data off of Mossdale include data from the new monitor installed at Grant Bridge to measure algae? Grant Bridge is downstream of Mossdale, so should help in the analysis.
- Is the aeration device designed to operate automatically or does it require an operator? Artificial aeration could be operated on a thermostat. However, a better understanding is needed regarding the circumstances under which the device should be turned on, the amount of aeration necessary under different situations and conditions, etc. More experimentation when the device becomes operational is necessary.
- The Link Node model was modified to include the aeration device. The Link Node model should reflect a 25% nitrogenous BOD associated with upstream algae. The Link Node model should also simulate algal contribution from Turning Basin.

## **Aeration Device Update — Steve Seville, Jones & Stokes**

Steve Seville provided an overview of the aeration device, which is located at Port of Stockton Dock 20 at Rough and Ready Island and consists essentially of pumps, tanks, pipes, and wells. Steve presented to the group that the facility operates using two 25 cfs pumps each with their own fish screen. Steve said that the device intakes water, infuses it with oxygen, and pushes it down a U-shaped pipe (therefore “U-Tube technology”). Steve noted that the facility does work, will be tested over the next couple of months, and is expected to become operational in the spring when DO levels drop. Steve stated that Jones & Stokes is currently developing an operations and maintenance manual for operation and that the device could potentially be operated remotely in the future.

Following the meeting, attendees toured the aeration device at Dock 20/Rough & Ready Island and watched a demonstration.

### **NEXT STEPS**

#### **Topics for Future DO TMDL Working Group Meetings**

- Loss of phytoplankton between Vernalis and the DWSC
- Tidal area flow unit studies (Gary Litton)
  - New data from last 1.5 years
  - Progress with dye studies
  - Potentially presented as a series
- Stable isotope studies (Carole Kendall)
  - Longitudinal studies
  - Continuous monitoring
  - Differentiation between different sources of phosphate
- San Luis Drain studies (Will Stringfellow)
- Modeling studies (Russ Brown)
  - White paper follow-up
  - 3-D versus 2-D versus 1-D models
  - HydroQual model and final report
  - Stanford model and data from sampling and dye studies
  - Data gaps/DO TMDL contractual restrictions
- City of Stockton treatment plant and nitrification facility (Steve Giddings)
  - Enhanced nitrification in winter 2002/03
  - Compliance with permit conditions.
- Various ammonia topics including:

- VAMP fish tag studies and ammonia toxicity (Anke Mueller-Solger)
  - Analysis of plant and receiving water
  - Marine studies on inhibition of algae primary productivity in presence of low ammonia concentrations and algae taking-up ammonia in place of nitrate (Gary Litton & Mark Brunell)
  - Proposed revision to EPA harm threshold to make more stringent
  - Clarify what Link Node can do in terms of ammonia (Joel Herr)
  - Identify opportunities to assist one another.
- Funding
    - Fish Studies / California Department of Fish and Game funding
    - Fish kill study
    - Directed action projects
  - USGS studies on groundwater inputs to San Joaquin River
  - US Army Corps of Engineers studies on impact to DWSC
  - How to improve coordination with UC Davis?

#### **Dates for Future DO TMDL Working Group Meetings**

- **January 17, 2008 - Ammonia Meeting**
- **February 21, 2008 – Modeling Meeting**
- **March 2008 – Off to complete final reports**
- **April 17, 2008 – Status Reports**
- **May 15, 2008 – Review Meeting**

#### **WRAP-UP**

Danielle Wilson noted the following:

- Improvements have been made to the DO TMDL Technical Working Group distribution list
- Working group members should forward final reports for posting to the project Web site

*The meeting was adjourned at 12:30 pm.*