

**San Joaquin River Dissolved Oxygen Total Maximum Daily Load
Technical Working Group Meeting
March 21, 2006
9:00 a.m.–1:00 p.m.**

**Jones & Stokes Boardroom
2600 V Street, Sacramento**

Attendees

Name	Agency
Brown, Russ	Jones & Stokes
Chen, Carl	Systech
Dahlgren, Randy	University of California, Davis
Dempsey, Mike	California Department of Water Resources
De Rosa, Laurie	HydroQual (via phone)
DiPalermo, Laura	University of California, Davis
Edmunds, Jody	URS Corporation
Finney, Vern	U.S. Department of Agriculture
Fleenor, Bill	University of California, C Davis
Gowdy, Mark	Central Valley Regional Water Quality Control Board
Grimes, Russ	Jones & Stokes
Hagman, Michael	Friant Water Authority
Headlee, John	U.S. Army Corps of Engineers
Heyd, Jennifer	Regional Water Quality Control Board
Hsu, Claire	Bureau of Reclamation
Lee, Gene	Bureau of Reclamation
Lehman, Peggy	California Department of Water Resources
Kendall, Carol	U.S.G.S
Mao, Lee	Bureau of Reclamation
Marcotte, Barbara	California Bay-Delta Authority
McGahan, Joe	Summers Engineering
Pedlar, Bob	California Department of Water Resources
Ploss, Lowell	San Joaquin River Groundwater Authority
Quinn, Nigel	Lawrence Berkeley National Laboratory
Rajbhandari, Hari	California Department of Water Resources
Seville, Steve	Jones & Stokes
Stevens, Craig	Stevens Consulting
Stringfellow, Will	Lawrence Berkeley National Laboratory
Taylor, Ernie	California Department of Water Resources
Topla, Joe	California Department of Water Resources
Volkmar, Emily	University of California, Davis
Wilson, Danielle (Facilitation)	Jones & Stokes
Hicks, Carol-Anne (Note-taker)	Jones & Stokes

Welcome and Introductions

Addition to the Agenda: Barbara Marcotte will give an update on CBDA.

Updates

San Joaquin River Water Quality Management Group Plan

Lowell Ploss (SJRGA)—The San Joaquin River Group Authority Water Quality Management Plan that was developed by stakeholders has been implemented. The State and Regional Water Quality Control Boards have recognized that the Plan is out there to assist with salt, boron, dissolved oxygen, and TMDL water quality issues. State and federal agencies have signed on. There is an implementation group, which will have an organizational meeting on April 6th, 2006. We are keeping track of the implementation of activities, the grassland farmers project on the west side, Bureau of Reclamation studies, etc. Use the San Joaquin River Water Quality Management Plan as a public outreach tool to keep the public informed of implementation efforts. For projects on the west side, there is an effort to reduce return flows and discharges. We're relying on bond measures to get money for those folks.

Danielle Wilson (J&S)—Is there a website for public involvement?

Lowell— No, we don't have a website out. We will be putting activities on the San Joaquin River Management Program (SJRMP) website. When it's up and running, we will send Danielle the link and she'll get it on SJR DO TWG website.

Central Valley Regional Water Quality Control Board Action on DO

Mark Gowdy (RQWCB)—Not a lot has changed since the last meeting. There's pressure from the State Water Board, which has adopted the Regional Board's DO TMDL. It's now gone to OAL. We're working through that process—it's not quite an official regulation yet. We haven't heard from the State Water Board what the schedule is. For DO, it will be a couple more months before it's official. Within the Regional Board office, the only activity of note was that we submitted our comment letter to the DWR on the Draft EIS/EIR for the South Delta Improvements Program. We circulated our comments by email, and will email them to anyone who wants them—contact me if you're interested.

Russ B. (J&S)—Have you made any progress on the Basin Plan, it's sort of an unenforceable level, whether it's 5mg or 6mg or something like that? What is the Regional Board's opinion? How can you tell whether the standards are being violated or not? Are you working on a day-to-day strategy? Who puts in the report? If I'm a discharger, do I send you a report saying what I discharge? How do you enforce compliance?

Mark—We're making progress toward fulfilling the information requirements. We're going to calculate specific discharge limits, but we need more information before we come up with that in the final TMDL. Compliance with the TMDL is loose at the

moment. We want studies to be happening—as long as we're getting information, we're happy. If not, we'll resort to actions needed to get information that's needed later.

Russ B.—What's the level of effort, the tech thing, what daily average, daily anything, anytime?

Mark—That's a sub-issue related to the interpretation of the Basin Plan objective for in-channel DO. It's recognized that an objective is written in all times and places with no averaging, that it's ambitious, select an adjective. Regional Board staff are open to suggestions—the staff can't initiate a change to the Basin Plan in the current environment. We don't have the resources to take on a change like that. To the stakeholder community, say the aerator is going to be very effective, but not at oxygenating the whole channel, only at oxygenating half of the channel, it's creating passage for salmon. The folks operating the aerator may choose to petition the Regional Board for an objective change, and we are open to that. We can't initiate the amendment process. We were surprised at the tri-annual review of the Bay-Delta WQCP. There were no comments received by the State Water Board from anyone on the DO objective. We look to the stakeholder watershed to step up and take action.

Lowell—The dates in the TMDL for when studies had to be completed were just extended.

Mark—I think the date for studies to be finished is June 2008. I think that so far we've done a good job of moving this thing forward, except for a few technical glitches on different tasks.

Upstream Studies Contract

Joe McGahan (Summer Engineering)—Things are moving along significantly. The first summer of monitoring was completed last summer. The project got a late start—we intended to have three summers of monitoring, but missed 2004 summer monitoring. There was an extension, mentioned by Lowell, to get the third year in 2007. Interim reports are due at end of this month on 2005 collections. We will monitor again this and next summer. There are different aspects and components to this project. We're about a third done, have spent about a third of money, and one set of interim reports were submitted in fall 2005. Those reports will be on the website soon. The next reports should come in March. We submitted a request for additional money to continue linkage studies in the San Joaquin River. The original project had three years of work, but we're cut back to one year. We asked to continue that study and some significant algae diurnal studies and are incorporating that into the modeling that's being done. It won't be approved until May.

Russ B.—What's the linkage study? Is part of peer reviewing to look at zooplankton grazing?

Joe—We brought in a UOP professor. The first results that have come in look like zooplankton are important. We want continued funding to keep the professor on the project.

Russ B.—Linkages, what are the conditions that are assumed to be understood? Is linkage the idea of how river conditions become ship channel conditions and what goes on between Vernalis, Mossdale, etc.?

Joe—Yes.

Danielle—Mark, we're going to give a presentation at the May TWG meeting on results, right?

Mark—Basically, it'll be a presentation on the annual report.

Lowell—I don't think the upstream study group is in that. Have we found a database to put all the data into? There are a few options. The idea right now is that we're compiling all data in excel format. We want to post it on the website and use the website to transfer data. DWR is under contract to incorporate the data into the IEP database. We would like to set up a website for posting the data so that people can download excel format packets of data. Separate data will be sent to DWR for their IEP database. The question to you all is how open should that website be? Should it be password protected or open to everybody? We've been given information, but it's not clear that people who gave the information understand the distribution. We need everyone on the same page and need a record of who's collecting information.

Is it more efficient to go straight to the IEP database?

Yes, it will be there if that's where you're more comfortable getting the information. We've made some effort to rearrange the website, but haven't finalized what we're doing on that yet. Kyle Jacobs is under contract. Another option, as part of the contract, is that we can set up local databases as needed, but most of it already up there.

CBDA Governance, Structure, Contract, TWG, Where We're Going, Update

Barbara Marcotte (CBDA)—As many of you know, in November, the Little Hoover commission convened to audit and evaluate the Bay-Delta Program. They came out with recommendations in November, and a ten-year action plan was developed responding to those recommendations. Lots of changes were proposed, things are to be very different. One of the options is to dissolve the Authority. Another option is to transform the Authority into less of an oversight function and more of a support, tracking, and strategic planning entity. If you're interested in more details, you can check the website for the commission report and the ten-year action plan. The action plan is not final. It's in the governor's office right now. There may be some changes, but it should be finalized in a matter of weeks. So, what does that mean to this project? We're not completely sure yet—I'll have better information at the next meeting. One of the recommendations in the plan is for the Ecosystem Restoration Program to be transferred to DFG. DO has been a bit of an odd project because of its two main components: the water quality component and also its ecological component for ERP. It's always been in the ERP, so tentatively its slated to be transferred to DFG sometime

after June 30. The decision resides with DWR because the funds that support this program were appropriated to DWR. So, there's a lot of ongoing discussion with DWR. We've started a dialog with Kathy Kelly, who's particularly connected to this project, and the group that's taken on the construction of the aeration system. In the next few months, we'll try to make sure that the contractual obligations and the functions that we are doing now, particularly those that are successful like this one, can continue; and that there won't be a lot of disruption. I will be going into the Science Program, which is an aspect of the Authority that will remain. I expect the science program to have continued interest in this project and close coordination and connection to longer-term efforts. We will know more specifics at the next meeting. This is a prime opportunity for dialog and coordination, website maintenance, conceptual model work, standards, and if you think TWG is an important project.

Craig—The status of the Jones & Stokes contract, which supports this effort, is proposed to terminate June 15th. We are submitting for a one-year extension of that contract. We're not sure what the chances are for that to happen.

Why so low? Can we give a support letter?

Barbara—It has more to do with contractual legal aspects of the contracting process that we use. If I think that could play a role, I'll let you know. At this point, the Department of General Services has to make the call.

Would it be possible to submit an amendment to this contract to continue the coordination function of this project?

Barbara—Possibly, to support or augment just the meeting coordination aspect of the contract. If you wanted to broaden the scope of the contract for just technical coordination, which might involve supporting these meetings, it wouldn't be able to cover the other things that we want to do. It's not a complete solution, but it's important for this group to keep these meetings going. There may be some other contracting options. We will look into that over next couple of months and try to keep continuity.

Lowell—Will our contract stay with the authority or will they all be transferred to DFG for administration.

Barbara—The upstream studies contract? We're not sure. The upstream studies fall under GCAP, which is a contracting agent handling a whole lot of projects. This is one among many. It may be contractually very difficult and burdensome. There's a proposal right now for all projects under GCAP to go to DFG. If DFG really wants to step up and take this on, and assert the leadership necessary to continue coordination, then that's fine, it should be there. There are a lot of different things to consider and discuss with DFG. We have a year to get some things in place, but not quite as long for upstream studies. Email me if you have particular thoughts.

Danielle—I'd like to encourage all of you to think about what presentations you want to see at the next few meetings. Should the J&S contract end, there needs to be another vehicle to keep the TWG moving. Working under the assumption that the contract

would end, we have the May meeting and a June meeting. That's two meetings left, so think about things that you'd want to see: updates, presentations, models, and email them to me. We want to make sure we get in as much as we can while contract is still on.

Presentations

Current Status and Next Steps of Aeration Demonstration Project—Steve Seville, J&S

See meeting materials for a copy of the Power Point presentation.

The contractor may have enough efficiency to get the device running by the end of July. USFWS has to make the determination of when construction can happen. DWR will make the request. They've already talked to USFWS, and they're talking August.

—How are the two ends of the U-Tube connected mechanically at depth?

—The discharge line will be hung above water. It'll have a plumbing connection, two elbows. At the bottom, the U-tube itself has an outer and inner casing. Water is pumped down the inner casing and comes up outer casing.

—On the U-tube itself, air is pumped air, and goes into solution because of the pressure. Coming back up it, doesn't it come out of solution?

—No, it chemically becomes part of the water. Within a confined system, it stays under 1 atm of pressure until it comes out of the system. There will be a port window where you will be able to visually take pictures and inspect the bubble dynamics. What does oxygen look like when it goes into solution? It works in fishery farms, but has not been studied. This will be the first time to study the process.

—For long-term evaluation of it, what monitoring of DO will happen at what locations?

—Russ B. will present about monitoring of the device.

—There's the possibility of a tour, maybe around end of April, when U-tube drilling is going on. Is there interest in coordinating and announcing a tour?

—Yes!

—Danielle will coordinate getting a page on the website to talk about the device, how it's functioning, what the testing results are, etc. That's going on now.

Monitoring DO in the DWSC with the O2 Injection Device: How will we know if its really working?—Russ Brown, J&S

See meeting materials for a copy of the Power Point presentation.

Nigel Quinn (LBNC)—Sensors on the market are for measuring much smaller levels of DO. With regard to the levels of oxygen being put into the channel, what type of sensor will be used to monitor/measure this?

Russ B.—Your worry is noted. No one else in the world cares about measuring these relatively high oxygen concentrations. Manufacturers assure us that the new technology will work well. We can take samples and chemically test concentrations. There's also the possibility of laser technology. DWR has four in operation and it's been proven that they're good at low DO values.

Carl Chen (Systech)—What about demonstrated oxygen toxicity in Missouri dams?

Russ B.—In that study, the input was described as total gas. It's really the nitrogen that's causing the trouble for the fish. It would be a problem if we were raising total gas concentration above equilibrium. We're going to make sure we're not killing all the fish swimming past the diffuser. USFWS does not share our confidence that fish will be fine. They would like us to directly cage some fish within the blast of oxygen to test for physiological issues.

Craig—What's the rate at which concentrations will decrease over distance?

Russ B.—As water goes out 6 feet, 10 diameters, it will be mixing to 1/10 of the original concentration. Within 6 feet will be a 6 cfs plume moving at about 0.6 fps—that's real rapid mixing. There's some concern that a fish might swim through this jet and experience 10 or 20 fps. We want to make sure these fish are not impacted.

—In the study for the City of Anderson, we injected dye at 4,000 mg/l. The highest detectable concentration was less than 1/10 of the injected concentration, right at the source, and was very small, barely detectable.

Craig—Is that written up somewhere?
—Yes.

—Send the information to Danielle.

Craig—I think we're more worried about getting enough oxygen in the water to oxygenate the channel than worried about the concentrations being too high.

Craig—Have you thought about operating the device in such a way as to send a patterned signal into the channel, on for a few days, off for a few days, to see if the pattern is demonstrable in the results?

Russ B.—You read my mind! We will never know what the DO would have been without the device. We can calculate that it should have gone up by 1.5 mg/l, but DO naturally fluctuates by 0.5 mg/L. How can we tell if what we're injecting is working?

—What will pressurized oxygen do to living organisms when it comes to the surface?

Russ B.—We're assuming that there won't be a pressure change felt by the fish, no bubble membrane, the oxygen is chemically in the water. Initially we'll be putting fish right into the diffuser to make sure these concerns are unfounded.

Carl—For the problem of Nitrogen, when you use compressed air, not compressed pure oxygen, you have a problem. We did pure oxygen compression for Comanche Reservoir for Ebud. The initial mixing can get to 80 mg/l, then introduce it with a jet, the initial dilution out of jet is about 1. Ebud spent all the money on equipment and left none for monitoring, so we don't have a good monitoring program; but we know DO never went to 0 because the fish survived. There were no fish kills.

Russ B.—That's the nearest previous installation of an oxygen device. That one's much deeper in the Comanche Reservoir. We don't know whether there's toxicity at that depth because it wasn't monitored at that depth. We also don't know how efficient it is. It did raise DO concentrations deep in reservoir, but metals that were killing fish are no longer present with the introduction of pure oxygen. By operating the device in the DWSC on a pulsating operation we can do testing more easily.

Carl—We suggest monitor net flow very carefully; it will affect loading, to find out how much oxygen-consuming material will go into the ship channel.

Russ B.—We're relying on the USGS meter at the treatment plant, 0.5 mile upstream, to tell us what the net flow through the channel is.

Lowell—When will the four stations be installed?

Russ B.—Relatively soon.

Lowell—I think we need to collect that data for a period of time before operating the aerator. Introducing a new dynamic by measuring elsewhere... we need a baseline.

Russ B.—Right, we need period of watching all five monitors in relation to Rough & Ready Island in a period when we're not operating.

Lowell—What triggers the operation of the aeration device?

Russ B.—The Rough & Ready Island DO. The only thing missing is what the DO would have been without the operation. That's the unknown.

Nigel—Are the set targets at 5.5 and 6.5?

Russ B.—Whenever DO gets within 0.5 ml of standard, that's when we begin operating.

Lowell—When calculating the load on the aerator, are you going to subtract what's being injected by Corps?

Russ B.—That's another factor, there's another aerator being operated upstream by Corps.

Nigel—How many months will it take to get the Corps aerator turned off? Can we turn it off without permission?

Russ B.—We'll have to see if we can coordinate with them.

Mark—How many times would you have to cycle it on and off before statistical random function of background would be that you're turning to? How long are you going to do that before you think you have a statistically significant understanding?

Russ B.—I don't know. What is the DO that we should use? What is the DO that the fish care about? We're going to invoke scientific method of trial and error.

—Are you going to measure ammonia and BOD while doing this?

Russ B.—Yeah, that sounds good. We'll be collecting chemical data.

Russ B. showed HydrolQual model demos.

Russ B.—These models are based on a continuous injection, dye injected for four days. There was no decay in tracers. We don't know what the rate of decay in the system would be.

—Will there be any advantage of injecting oxygen prior to having a deficit?

Russ B.—Yeah, the more oxygen the better is all I know about fish. Our testing will not depend on whether we're at the standard or not, just based on if we're below 8 mg/l. We ought to be able to move the oxygen with the oxygen device as long as it's below saturation.

—What are the projected operation costs per day?

Russ B.—Pure oxygen is 10 cents a pound, that's \$1,000 per day, \$200k per year for oxygen cost. AS to the total operating costs, people, monitoring, electricity... anyone?

—Is the operational cost a consideration? Is it more efficient when the tide going in or out? Is the cost cheap enough so that you're not worried about the efficiency of when you inject?

Russ B.—If we inject all oxygen just on the flood tide, it will affect a mile and a half upstream, but there's trade off. Oxygen would gradually move downstream with flow.

—Instead of running one 24 hours a day, run two during flood-tide?

Russ B.—if 5,000 goes where I need it, that might help efficiency. We haven't got to the testing of the tubes yet. If they are twice the distance with half the flow, will that give better transfer? Trying just on flood tide, or injecting the entire time even if DO is above standard.

Craig—For efficiency, will we try operate different ways to see where higher efficiency is? Like heating a room, maintain constant temperature or up and down?

—Is there a way to enhance mixing?

—I don't think we're inducing mixing, but rather living off of tidal mixing. We're not messing with the fabric of stratification and algal zones. That will still form each afternoon like it does now. There will be some phytoplankton or chlorophyll analysis during pulse and decay.

Break: 15 min.

Progress with Tracing Organic Matter and Nitrate Sources to the San Joaquin River using Isotope Techniques—Carol Kendall, USGS

See meeting materials for a copy of the Power Point presentation.

—Does this identify areas where there's a lot of growth versus areas where there's little growth – see the algal bloom slide?

Carol—Yes.

—Does the change in numbers indicate a change in source?

Carol—Yes.

—There's no tidal sloshing at Crow's Landing. It's more complicated downstream where there is tidal sloshing.

—About 5% of the decrease is due to herbivory, zooplankton grazing. We're not sure if we're knocking down the standing stock of algae by a whole lot.

—What time of was that year?

Carol—August.

—In the longitudinal transect from mud slough on down, there's a sharp decrease in N15 between Vernalis and the ship channel. Would we assume that the wastewater treatment would have a higher N15? Why the decrease?

—It's ammonium.

—Jump in ion red, do you think ammonia is coming out of wastewater treatment plant causes that in particular?

—Yes. As you nitrify ammonium, you fructify the N-pool. Stuff left behind has a higher N15, when algae forms it's picking up that N15.

—Phytoplankton prefer ammonia, that makes good sense.

—Which point is the top end of the ship channel?

—So by Mossdale the N15 had already dropped. There's really no significant other water sources between Vernalis and Mossdale to account for the drop. There's a small sewage discharge from Manteca at Mossdale, that's pouring out high ammonia.

—Isn't their outfall several miles downstream?

—No. It's right near the Mossdale landing. There's still tidal excursion at Mossdale. Stockton waste can get up to near Mossdale, too.

—Is there some way to irradiate or bombard the tank of oxygen, change it all to O¹⁸ and trace it?

—O¹⁸ is very expensive. Such a nice pulse in the 15–16 range already, that maybe uses the natural signal where the analytical precision is 0.2. Question is whether pure oxygen is 18. To use those same tanks in the lab as a standard, that would be expensive.

Influence of Riverine Phytoplankton on Primary Productivity in the San Joaquin River—Peggy Lehman, DWR

See meeting materials for a copy of the Power Point presentation.

—Did these samples have the same turbidity level?

—They were incubated together, all conditions the same.

—What's the species composition data?

—It was done by mass instead of density, this is phytoplankton species carbon.

—If you go down to Channel Point, upstream to right before channel gets deep, it's dominated by diatom population. Then go deeper and you'll get flagellate-dominated population.

—Does your data indicate that there's a second bloom, another process in the channel?

—Don't know if the shift is a second bloom, there's just a shift in species composition because diatoms are dropping out. They disappear. There's no good reason except that once you have a river system hit a deep system, diatoms bottom out. Flux studies were done in 2001, it drops out very fast.

—The raw mass of flagellates, is it a lot higher in the channel, or is it the same?

—The mass is significantly higher in the deepwater channel upstream. That doesn't mean there's growth, it means there's mass.

—Why are growth rates slower because bigger upstream?

—Diatoms are known to grow really slowly. That's just the way they are. It's all about the light, diatoms grow faster than other organisms at low light and low temp; as long as there's a high residence time, they'll do well.

—Say that species composition from upstream to downstream is associated with environmental factors changing. Do you have a hypothesis for what's causing the change in composition?

—There's a strong association with light, that's characteristic of how diatoms function. Turbid environment, shallow, where there's a lot of turnover, those are perfect conditions for them. Flagellates occur in deep water habitats because they can move. Ammonia might be good for them, but didn't get a lot out of that.

—There are changes in environmental factors causing different parts of the population to grow at different rates as you move downstream as opposed to other sources.

—Right, there's growth along the river. It's possible, with our given understanding of composition of species at some point to model based on our understanding of growth of these things with variables of the environmental to predict. It's been done in the literature: just give diatoms slower growth rates in the model. We've worked with HydroQual on that before, with one species growing fast and one growing slow.

Laurie De Rosa (HydroQual)—We can run two separate species. We're not doing that at this point, but we can.

—What are the growth rates in terms of doubling rates?

—Upstream, like 1:2. The way we model is specific to species. Blue-green is three. When we run the model from upstream to downstream, we will grow more diatoms upstream, then they'll settle out. When we go to the DWSC, flagellates will grow better for that reason. The model should do that. We have not proven that yet. We are working on downstream settling, but in principle, empirically, it should work.

—Is that the way that you are going to do the modeling?

—No, we're still going to specify specific growth rates, etc.; but the environmental conditions of upstream are such that diatoms will be favored. One of things, the way this whole project got set up, is that we're trying to integrate upstream and downstream. With the contract it got split. We're talking about creating plan to bring them back together. For upstream modeling, we don't need a two-component model because it's diatoms. There is a possibility of doing a two-component model.

—We could try to simulate three species. Will that add clarity or confusion?

—In the plot of growth rate vs light, where was the light value?

—The light is in incubation, it simulates a light gradient.

—So, the ones with fast growth rates, they're under low light conditions?

—That would be the overall light through the day, daily average intensity.

—From the correlations you've looked at, what environmental factors upstream would affect what happens downstream?

—Depends what you want. I want diatoms in the system to feed the pelagic food web. But that doesn't help with carbon load.

Identify Next Steps

If you have presentations that you want to see between now and June, email Danielle.

—Has anyone worked up the DO data from last year?

Russ B.—It's on my plate, but I haven't got to it yet.

Danielle—At the next meeting, we will hear on monitoring efforts and some other things. Any thoughts, wishes?

Next meetings

April 18, 2006

May 16th, 2006, tentative if need this date

June 13th, 2006, final meeting, should contract end.

Russ B.—Is Laurie intending to come and give a final demo of the two linked models?

Laurie—Yes.

—With regard to the DO situation from last year, were we in violation a lot?

Russ B.—Generally it was a high DO year because it was a high flow year.

—On top of Russ trying to figure out how much oxygen to add, the City of Stockton is finally bringing their nitrification facility on line. Ammonia discharge is going from 25mg to 2mg. Could we hear from CH2MHill or someone on how that works? That will happen right on top of building the oxygen machine.

—Will there be anything besides ammonia?

—No, straight nitrification.

—What about BOD?

—BOD loads are aside from the ammonia portion of it, the CBOD will not be affected.

—What about all the development in Lathrop? That will have an effect with increased storm discharges, etc. There will be a fair bit of change given all the development occurring there. Is that stuff being piped to an existing treatment plant?

—Manteca is expanding theirs. They're also having to do nitrification.

End: 12:35.