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July 2, 2009

Bay-Delta Conservation Plan Steering Committee
c/o Honorable Karen Scarborough, Undersecretary of Resources
Resources Agency
1416 Ninth Street, Ste 1311
Sacramento, CA 95814

Subject: December 17, 2008 Draft of "An Overview of the Draft Conservation Strategy for the Bay-Delta Conservation Plan"

Dear Members of the Steering Committee:

Contra Costa Water District (CCWD) appreciates the opportunity to comment on the Working Draft of "Conservation Strategy, 3.1 and 3.2" dated June 25, 2009. The current draft is much improved over previous versions, and has addressed a large number of the comments from all parties, including CCWD.

Attached are CCWD's comments on this document. The following issues are a reiteration of my comments at the June 30, 2009 Steering Committee meeting:

1) The Conservation Strategy seems stuck in time (last fall) and since then, everything has changed. The Operations Criteria and Plan (OCAP) Biological Opinions (BiOps) were issued by the U.S. Fish and Wildlife Service and National Marine Fisheries Service (NMFS) on December 15, 2008 and June 4, 2009 (respectively). The number of lawsuits filed on Delta matters seems to be rising exponentially. The current situation is not sustainable and CCWD remains extremely concerned that it will take 15 years or longer to implement this Conservation Strategy *if there is no significant opposition.* The existing crisis that cannot wait for that.

   Now is the time to begin action on positive-barrier fish screens, the 2-Gates Project, and tidal marsh habitat restoration.

2) The current focus of the work for the Conservation Strategy should be to optimize the facilities in terms of cost, performance and constructability (including likely schedule). CCWD has already demonstrated that conveyance facilities of a far smaller size (2,000 to 4,000 cfs) can produce the same level of water supply benefits. The most recent Bay-Delta Conservation Plan (BDCP) studies show that the capacity of a large facility

(15,000 cfs) is rarely used (50% of the time the flow is *less* than 4,000 cfs) and that a 5,000 cfs facility will provide almost the same water supply for about $1 billion less in cost.

CCWD estimates that a below ground tunnel of 2,000 to 4,000 cfs will cost less than the large canal, provide better reliability after a seismic event, eliminate land use and terrestrial habitat conflicts, be completed five years sooner than a large canal and has a much higher probability of being built at all. CCWD understands that other experts have independently reached similar conclusions.

Since the current BiOps provide a water supply to exporters of about 4.5 million acre-feet, it makes no sense putting the focus on the largest possible facility to gain an additional 1.5 million acre-feet when a much smaller facility will do the job cheaper and faster. Rather than continuing with "the biggest facility must be the best facility" assumption, the BDCP focus should change to using the current BiOps for south Delta operations and designing the optimal facility that will do the job.

Now is time for the BDCP to re-examine and adjust its basic assumptions to the changed situation, or it will end up as a bad plan that cannot be implemented.

3) The BDCP studies to date show 2 to 2.5 million acre-feet annually diverted through the south Delta with the Conservation Strategy (an average of about 2,500 to 3,000 cfs); in critically dry years about 75% of the exports will be made in the south Delta. The current BiOps limit exports to less than about 3,000 cfs when fish are present during the winter and spring. At these low export rates, positive barrier fish screens will work well because the tidal flows (+/- 20,000 cfs) are so much larger. The single most effective action that can be taken now and will still be useful in the future is installation of positive barrier fish screens for the existing pumps with a capacity of 1,500 cfs to 3,000 cfs. Bond funding is still available for this project.

   Now is the time to build positive-barrier fish screens that should have been built years ago under the CALFED program and now is the time to include them in the Conservation Strategy.

4) The NMFS BiOp has upstream obligations that affect the operations in the Delta. This is another changed condition and the BDCP must re-examine its basic assumptions and change accordingly. CCWD has from the beginning of this process stated that the Conservation Plan will be flawed if it fails to include upstream operations. It now appears that this will be a *fatal* flaw as the BiOp already includes upstream operations. The San Joaquin River

system needs particular attention, because one effect of the Conservation Strategy will be to exacerbate the existing "reverse salinity gradient" responsible for fish confusion in the south Delta (see attachment 2). Salinity and flows in the San Joaquin River should be included in the Conservation Strategy.

Now is the time for the BDCP to re-examine and change its policy regarding upstream flows and operations.

5) The California Department of Water Resources (DWR) has a contractual obligation with East Contra Costa Irrigation District (ECCID) to meet certain water quality targets near ECCID's intake. CCWD, by virtue of a three-party contract among DWR, CCWD and ECCID, is a third-party beneficiary of the water right settlement contract between DWR and ECCID. The Steering Committee agreed that, for the purpose of the effects analysis, water quality would be "assessed" to determine if the Conservation Strategy would affect the water quality DWR is obliged to meet under its contract with ECCID. Regardless of the outcome of that assessment, DWR must meet its contractual obligations with respect to that contract.

CCWD looks forward to working with the Steering Committee to incorporate these issues into the Conservation Strategy and to continuing a constructive dialogue.

Sincerely,

Greg Gartrell
Assistant General Manager

GG:mc

Attachments: 1) Detailed comments on 3.1 and 3.2
2) Gartrell and Herbold (2009) "Flow, Salinity and Migration of Salmon"

cc: Pat Corey (ECCID)
Phil Harrington (City of Antioch)

Attachment 1

Bay Delta Conservation Plan
Review Document Comment Form

Document:
<u>WORKING DRAFT CONSERVATION STRATEGY 3.1 AND 3.2 DATED JUNE 25, 2009</u>

Name: Greg Gartrell **Affiliation:** CCWD

Date: 2 July 2009

Please use this form to document your comments to the above document. Please number your comments in the first column and indicate the page, section, and line number (if provided) that reference the comment's location in the review document in the next three columns. **Return completed comment forms to Rick Wilder (wilderrm@saic.com).**

To be of the greatest value to the document development process, please make your comments as specific as possible (e.g., rather than stating that more current information is available regarding a topic, provide the additional information [or indicate where it may be acquired]; rather than indicating that you disagree with a statement, indicate why you disagree with the statement and recommend alternative text for the statement). Do not enter information in the **Disposition** column. This column will be used by SAIC to record how each comment was addressed during the document revision process.

No.	Page #	Section #	Line #	Comment	Disposition
1				General Comments: The Conservation Strategy seems stuck in time (last fall) and since then, everything has changed. The Operations Criteria and Plan (OCAP) Biological Opinions (BiOps) were issued by the U.S. Fish and Wildlife Service and National Marine Fisheries Service (NMFS) on December 15, 2008 and June 4, 2009 (respectively). The number of lawsuits filed on Delta matters seems to be rising exponentially. The current situation is not sustainable and CCWD remains extremely concerned that it will take 15 years or longer to implement this Conservation Strategy *if there is no significant opposition.* The existing crisis that cannot wait for that. Now is the time to begin action on positive-barrier fish screens, the 2-Gates Project, and tidal marsh habitat restoration. The current focus of the work for the Conservation Strategy should be to optimize the facilities in terms of cost, performance and constructability (including likely schedule). CCWD has already demonstrated that conveyance facilities of a far smaller size (2,000 to 4,000 cfs) can produce the same level of water supply benefits. The most recent BDCP studies show that the capacity of a large facility (15,000 cfs) is rarely used (50% of the time the flow is *less* than 4,000 cfs), that a 10,000 cfs or 5,000 cfs facility will provide the same water supply. CCWD estimates that a pipeline of 2,000 to 4,000 cfs will cost less than the large canal, provide better reliability after a	

seismic event, eliminate land use and terrestrial habitat conflicts, be completed 5 years sooner than a large canal and has a much higher probability of being built at all. CCWD understands that other experts have independently reached similar conclusions.

Since the current BiOps provide a water supply to exporters of about 4.5 million acre-feet, it makes no sense putting the focus on the largest possible facility to gain an additional 1.5 million acre-feet when a much smaller facility will do the job cheaper and faster. Rather than continuing with "the biggest facility must be the best facility" assumption, the BDCP focus should change to using the current BiOps for south Delta operations and designing the optimal facility that will do the job.

Now is time for the BDCP to re-examine and adjust its basic assumptions to the changed situation, or it will end up as a bad plan that cannot be implemented.

The BDCP studies to date show 2 to 2.5 million acre-feet annually diverted through the south Delta with the Conservation Strategy (an average of about 2,500 to 3,000 cfs); in critically dry years about 75% of the exports will be made in the south Delta. The current BiOps limit exports to less than about 3,000 cfs when fish are present during the winter and spring. At these low export rates, positive barrier fish screens will work well because the tidal flows (+/- 20,000 cfs) are so much larger. The single most effective action that can be taken now and will still be useful in the future is installation of positive barrier fish screens for the existing pumps with a capacity of 1,500 cfs to 3,000 cfs. Bond funding is still available for this project.

Now is the time to build positive-barrier fish screens that should have been built years ago under the CALFED program and now is the time to include them in the Conservation Strategy.

The NMFS BiOp has upstream obligations that affect the operations in the Delta. This is another changed condition and the BDCP must re-examine its basic assumptions and change accordingly. CCWD has from the beginning of this process stated that the Conservation Plan will be flawed if it fails to include upstream operations. It now appears that this will be a *fatal* flaw as the BiOp already includes upstream operations. The San Joaquin River system needs particular attention, because one effect of the Conservation Strategy will be to exacerbate the existing "reverse salinity gradient" responsible for fish confusion in the south Delta (see attachment 2). Salinity and flows in the San Joaquin River should be included in the Conservation Strategy.

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The California Department of Water Resources (DWR) has a

				contractual obligation with East Contra Costa Irrigation District (ECCID) to meet certain water quality targets near ECCID's intake. CCWD, by virtue of a three-party contract among DWR, CCWD and ECCID, is a third-party beneficiary of the water right settlement contract between DWR and ECCID. The Steering Committee agreed that, for the purpose of the effects analysis, water quality would be "assessed" to determine if the Conservation Strategy would affect the water quality DWR is obliged to meet under its contract with ECCID. Regardless of the outcome of that assessment, DWR must meet its contractual obligations with respect to that contract. Text is completely devoid of near-term actions ~ these must be added. Adaptive management will allow CMs to be modified, discontinued or the new ones added. This process needs to be really well defined ~ who is doing it, when will we see it? The document suggests Goals and Objectives have been decided when they are still being worked on. When will this be completed? How can the analysis proceed without them? S. Delta screens and separated corridors concepts should be included in the Strategy	
2	1	3.1	18	Many of the waterways are not constructed/dredged ~ this reads as if the entire delta is artificial. Ship passage is also a function of the channels.	
3	2	3.1	14	What PPIC reports? Reference gives one, text says several. Are they peer-reviewed?	
4	2	3.1	10	Goal to use hydrodynamics to support movement of adult fish. Why just adults? Adults and juveniles swim ~ what kind of hydro matters here? Salinity gradients affect fish behavior, it is more than just hydrodynamics.	
5	4	3.1	16	Why does monitoring and research only guide long-term (post canal) decisions? Certainly there are near-term decisions that would benefit from monitoring/research.	
6	1	3.2	13-38	Recommendations came from experts - please cite.	
7	1	3.2	20-23	Recommendation could be addressed by reconnecting the SJR (highly productive) to Suisun Bay	
8	1	3.2	24-28	Need to consider salinity gradient ~ unnatural reverse salinity gradient in central-south could be addressed by reconnecting the SJR to Suisun Bay and improving San Joaquin water quality and flows.	
9	1	3.2	40-41	Existing water conveyance system is not fundamentally flawed, but existing method of diversion (no screens) and operations is impacting ecosystem	
10	3	3.2	9-11	Salvage is the real issue here. Tides can affect OMR flows without any exports and there is no salvage. The relationships are really with exports, SJR flows (independent variables) and salvage. OMR is a result, not a cause. Should relate to biology, not just flows in OMR. There are other ways to address salvage (screens) which need to be included.	
11	3	3.2	36-40	How does diverting more water benefit species?	

12	4	3.2	1	Presumption of five intakes: studies by several groups including the BDCP are now showing the Strategy of a 15000 cfs facility is oversized, not economical and unnecessary.	
13	4	3.2	27-31	Water operations measures are supposed to minimize entrainment at the south Delta facilities. Screens are the logical measure to accomplish this.	
14	4	3.2	39-41	What seismic standard is being used for canal levee design? Will the canal levees be above sea level?	
15	5	3.2	9-16	Again, why not consider screens?	
16	5	3.2	15	Ops approved by SC last week do not include year-round OMR restrictions.	
17	5	3.2	17-28	Fall salinity should be included as well (line 25), given the new fall x2 experiment and the relationship with Corbula.	
18	6	3.2	35	Intertidal habitat may lead to more methylation, what CMs are reducing this?	
19		3.2.3		Not restoring habitat. Either creating, enhancing, or preserving. But not restoring.	

Flow, Salinity and Migration of Salmon

Greg Gartrell[1] and Bruce Herbold[2]

This is a brief discussion of how flow and salinity likely affect salmon outmigration. The first section discusses the difference between average flow and tidal flow, and how the "net flow model" leads to incorrect conclusions. The second section applies a tidal view to salinity gradients to provide an alternative explanation of observations.

1) Net flow models versus a tidal view of the Delta

Net flow (whether QWEST or OMR net flow or any other net flow) in channels influenced by tides is a mathematical construct, not a physical factor felt by fish. QWEST was first used in an old "Carriage Water model" that attempted to describe how the outflow required to meet a given salinity level in the Delta increased with increasing exports. That model failed miserably: the hydrodynamics were wrong, the outflow levels the model predicted were wrong and the shape of the curve relating exports and outflow was backwards (predicting a monotonically increasing curve when the actual curve has a minimum value before increasing).

Net flows are averages of flows measured at a point (an Eulerian view), effectively the view of water movement from the river bank. This is not something that fish experience. This mathematical construct simplifies a complex flow field, and in the case of fish movement, confuses the picture just as the old Carriage Water Model confused the understanding of salinity in the Delta. Fish experience local velocity[3] as they move around (the fish-eye or Lagrangian view). Of course, to the extent that fish move with the flow, they experience no change in velocities any more than we sense the movement of the Earth through space, except that they feel accelerations due to factors like turbulence, fish body motion or changes in channel shape. However, the movement of water and fish with flow is very different when viewed without the averaging needed to calculate net flows. To give an idea of how badly a model based on average flows (Eulerian or Lagrangian average) in a tidal environment can be, consider the following:

a) Tagged salmon released north of Rio Vista have been caught after just a few days at Chipps Island where tidal flows are very high but net flows are very small. If the fish moved with the average flow, it would take them one to two months to arrive.
b) A salmon could start the day in Old River, travel with the instantaneous local flow down the river on the flood tide towards the export pumps, move across Woodward Cut and travel up Middle River on the ebb tide. The daily average flow (in this case Lagrangian average) would be pointing from Old River to Middle River, leading to the false conclusion that the salmon walked across the island. All information about the intermediate movement of the salmon is

[1] Contra Costa Water District
[2] U.S. Environmental Protection Agency
[3] Flow in a channel is the average velocity times the cross-section. The velocity in a channel varies across the width and depth of the channel. Fish will experience the local velocity (in space and time), not the cross-sectionally averaged velocity, nor the overall flow in the channel.

lost in the averaging. On the other hand, using the (Eulerian) average of the measured water velocity at one location in the channel (the USGS velocity meter for example) could give an average velocity of a few millimeters per second (or about 300 meters per day), an equally false conclusion.

Two problems with net flows prevent them from reflecting conditions that directly affect fish: they throw out important information in the process of averaging and they are derived variables (not independent variables) both mathematically and physically.

The following graphs illustrate these problems. The graphs show instantaneous flows.

Figure 1 shows Delta flows with the ebb and flood flows generally of the same magnitude in opposite directions. The average net flow is much smaller than any flow affecting the fish at a given moment.

Figure 1. Flow with flood and ebb nearly balanced, 1 = 10,000 cubic feet per second

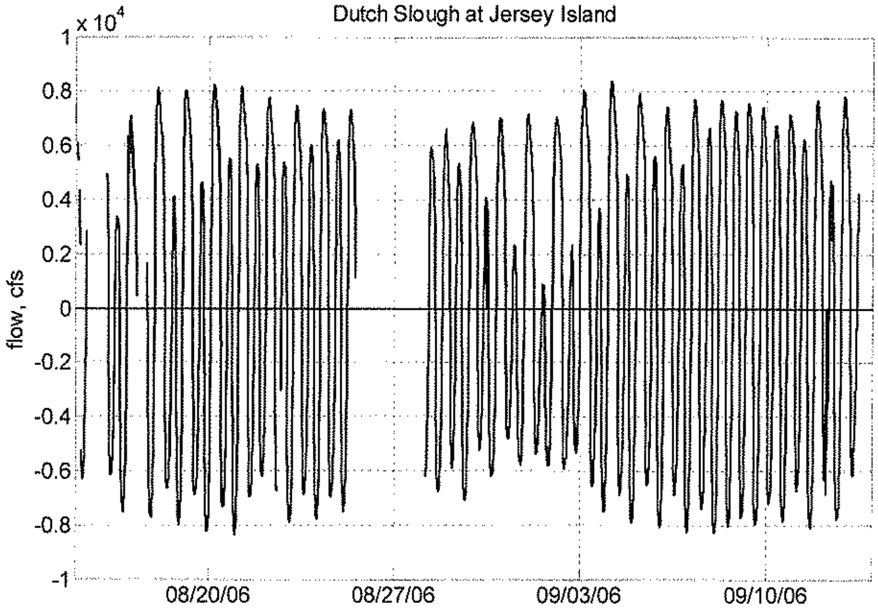
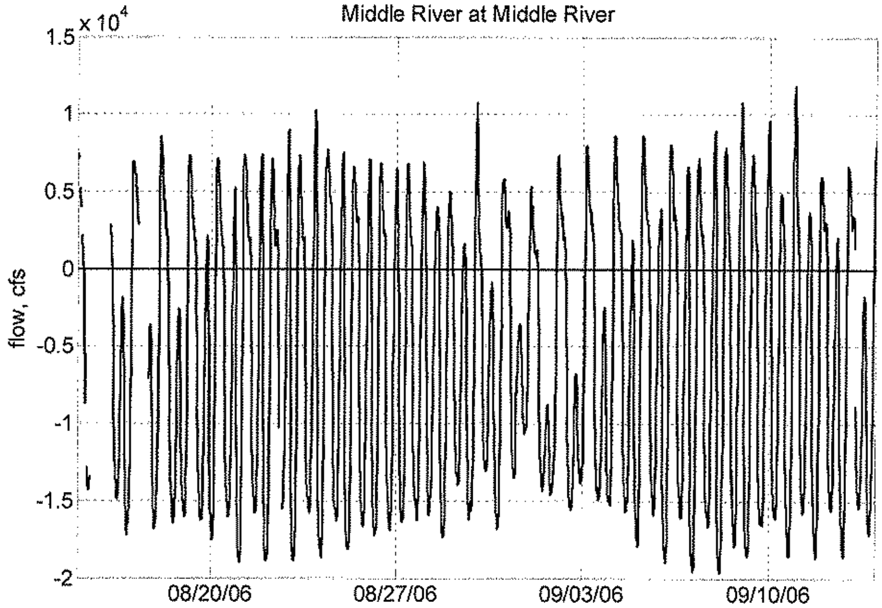


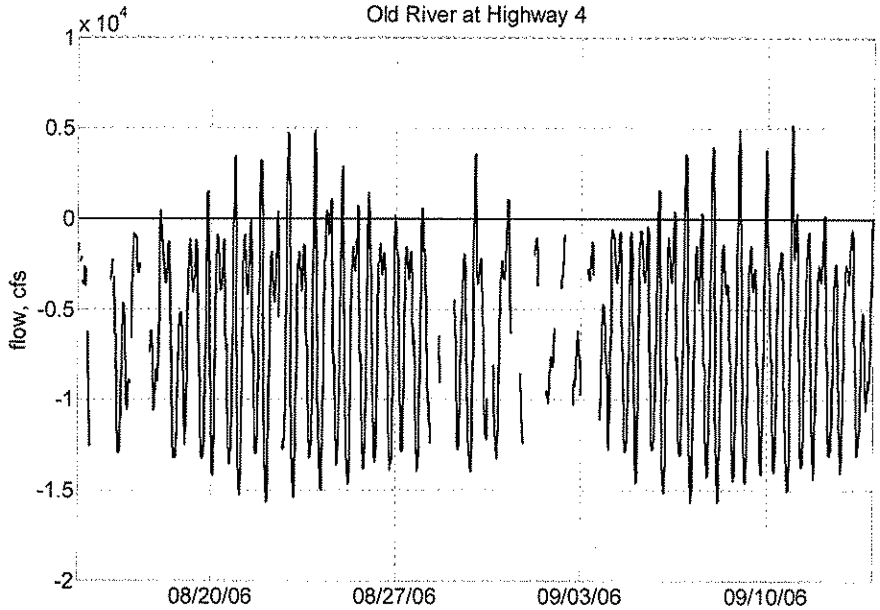
Figure 2 shows tidal flows with a stronger flood than ebb. While the direction of the average is obvious, the magnitude of the average is not. A fish experiencing this still has a chance to move in the opposite direction from the average if it uses the tides correctly (i.e., if it gets into the high velocity part of the channel on the ebb, and stays near the channel sides on the flood). Salmon clearly have the ability to pick the right tide based on cues, or they could not get from north of Rio Vista to Chipps Island in a few days.

Figure 2. Flow with strong flood tide compared to ebb, 1 = 10,000 cubic feet per second



Finally, Figure 3 shows a tidal flow where, at times, the ebb and flood are both less than zero. In this case, a salmon trying to surf the ebb will have a rough time of it. In fact, one can find no ebb tide at all for days at a time. This is a not a good situation if, in one flood tide, the salmon can end up in Clifton Court Forebay.

Figure 3. Flow in Old River at Highway 4, 1 = 10,000 cubic feet per second



Clearly, the situation in Figure 3 is going to result in high entrainment of fish: the export flows are so big that the ebb tide is lost and it is a one-way trip south, with tidal excursions double the normal 4 or 5 miles. When does this situation occur? It starts when exports are 5000 cfs to 7000 cfs. The Bay Institute argued in the OCAP lawsuit that high entrainment of salmon occurs when exports are over 7000 cfs: that is when the ebb tide is lost. That level of exports is also when delta smelt entrainment is high in January and February.[4] An examination of Figures 1 through 3 tells the story very quickly: this is about tides and export levels, not net flows. It is not the "net flow"; it's the "no ebb flow".

What about entrainment that occurs when net flows are small (or even positive)? The net flow view of the world fails completely (just like the old Carriage Water model) in this situation. When viewed with the tides in mind, the picture becomes clear, as the examples in the next section illustrate.

2) Salmon movement in a tidal environment

Consider salmon moving down the Sacramento River into the Delta. Some will make it to Chipps Island and beyond, but some will end up in the Lower San Joaquin River, via Georgiana Slough, through Three-Mile Slough or around Sherman Island. In this central delta area their advective (i.e. non-swimming) movement would be governed by tidal flows. Some will, even when export pumping is low and net flows are positive, go through False River into Franks Tract, where they (the survivors, anyway) have a good chance of being discharged out into Old River. Others can get sloshed into Middle River. This is their starting point for the scenarios that are described below.

For San Joaquin Salmon, the starting point for the scenarios below will be the San Joaquin River at the Head of Old River.

Scenario 1: High exports, typical San Joaquin River flow and salinity (i.e., low flow, high salinity).
In this case, exports are high and the ebb tide is very small or non-existent. It is a short trip down the river (the salmon simply cannot swim against 1 to 2 fps currents for long) to the export pumps for Sacramento salmon. San Joaquin salmon have two likely fates: those entering Old River have a quick trip to the export pumps; those moving down the San Joaquin River get to the Lower San Joaquin River and then some will make it to Chipps Island and some will move into Old and Middle Rivers and thence to the export pumps. In all cases salmon entrainment will be high.

Scenario 2: Low exports, typical San Joaquin River flow and salinity (i.e., low flow, high salinity).

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[4] Pete Smith used OMR net flow to show this, but OMR net flow is a dependent, not independent variable. Exports and San Joaquin inflow are independent variables, and the correlation between delta smelt entrainment and exports/San Joaquin flows is better than the correlation between entrainment and OMR flows for the same time period.

Sacramento salmon coming from the north experience substantial ebb and flood tides. However, one thing is peculiar in the central and south Delta compared to what should be found in an estuary: San Joaquin River salinity (generally as much as 1 mS/cm, with chloride levels over 150 mg/l) is much higher than Sacramento River salinity (about 0.15 mS/cm with chloride levels around 10 mg/l).[5] An obvious cue in a tidal system for the ocean is salinity (electrical conductivity or specific ions; two obvious ions would be sodium and chloride). What salmon in the central and south Delta see is a reverse salinity gradient because of high San Joaquin salinity and saline discharges (ag and urban) within the Delta. Salmon attempting to follow the salinity gradient to the ocean would jump into the high velocity zone on the flood, rather than ebb. That takes them the wrong way, and exposes them to entrainment at the export pumps. (Even if export rates are very low, there is a good chance to get into the pumps).

The situation for San Joaquin salmon is probably very much worse: arriving in a low flow with high salinity and entering a reverse salinity gradient, the chances of a bad ending would lead one to wonder how any salmon at all find their way out. This is consistent with the extremely low survival rates reported by USFWS under all but flood conditions in the delta

In this case it is neither the "net reverse flow", nor the "no ebb tide"; it is the "reverse salinity gradient".

Scenario 3: Low exports, typical San Joaquin River flow and salinity (i.e., low flow, high salinity) with an Isolated Facility.
This case is little different from Scenario 2, except that the exports are liable to be less and the water quality situation could easily be worse. With apologies to our friends who authored the PPIC reports, it is likely to create an "Arkansas cesspool" from the "Arkansas Lake". With drainage (from the San Joaquin River and in-Delta ag) and urban discharges ringing the area (clockwise: Sacramento Regional, Stockton, Tracy, Discovery Bay, Ironhouse SD, Delta Diablo SD, Central Contra Costa SD), and little inflow, the central and south Delta are likely to become (with apologies to Thomas Friedman) "Hot (warm SJR water), Flat (gradients) and Crowded (with non-natives)". Entrainment, in the absence of screens will be high at both export pumps and ag intakes (you only have to see the vortex spinning above a siphon to realize just how fast the velocity is in the siphon), and confusion will be high. The number of fish orienting correctly to the ocean would be very small and even for them the very long transit time would probably subject them to extremely high mortality rates within the delta.

Scenario 4: Good flows and high quality on the San Joaquin River. Salinity gradients are not reversed and fish orient correctly to the tidal salinity gradient and tidal flows. This is totally different from Scenario 1, 2 or 3. The key is improved San Joaquin River flow and salinity.

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[5] As an example, with flows increasing during the VAMP period, SJR salinity is currently about 0.4 mS/cm today (April 20, 2009). That level is also found near Collinsville today, but in between it is as low as 0.2 mS/cm (Jersey Point area).