SOUTH DELTA WATER AGENCY

4255 PACIFIC AVENUE, SUITE 2
STOCKTON, CALIFORNIA 95207
TELEPHONE (209) 956-0150
FAX (209) 956-0154
E-MAIL Jherrlaw@aol.com

Salinity-1/31/06
Workshop

Directors:
Jerry Robinson, Chairman
Robert K. Ferguson, Vice-Chairman
Natalino Bacchetti, Secretary
Jack Alvarez
Mary Hildebrand

Engineer:
Alex Hildebrand
Counsel & Manager:
John Herrick

January 20, 2006

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Selica Potter, Acting Clerk to the Board
State Water Board
P.O. Box 100
Sacramento, CA 95812-0100

We attach comments for the January 31 Workshop on Salinity Issues in the Central Valley. We are prepared to provide a summary of these comments and answer questions on January 31.

Alex Hildebrand
Engineer

Cc: Tom Howard
Al Brizard
Lester Snow
Tim Quinn
Kirk Rodgers

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Comments by Alex Hildebrand for SDWA Regarding the Workshop of the SWRCB On Salinity Issues in the Central Valley on January 31, 2006

INTRODUCTION

This is a very important workshop. Controlling salinity and avoiding the accumulation of salt is a problem that is often either ignored or misunderstood. As water is moved from north to south in the Central Valley salt is also moved from north to south. We then consume most of the transferred water that is delivered into the valley south of the Delta, and we reduce the available stream flow and dilution water by exporting pure mountain water from Friant to the south, and from Hetch Hetchy and the Mokelumne River to the Bay Area. We have therefore salted up the lower San Joaquin River and the south Delta, and we have largely destroyed our ability to get rid of the salt by natural processes.

Roughly forty million tons of salt have already accumulated in the soils and groundwaters of the San Joaquin watershed south of the Delta. In addition to the salt that is accumulated, several hundred thousand tons of imported salt is concentrated and then drains each year into the depleted San Joaquin River. This salts up the lower river and south Delta.

This document describes the conditions that existed prior to 1950, pre-CVP, and explains in greater detail how conditions have changed and continue to worsen. We then address what can be done in the short and long range, including measures to avoid zones of extra high salinity in channels of the lower San Joaquin River and south Delta. However, we will first review the difference between applied and consumed use of water and other basic considerations which influence what measures can solve the problem and which proposals merely shift the problem from one use or user to another.

BASIC CONSIDERATIONS

Consumptive versus non-consumptive use of water

The production of food consumes far more water than is needed to meet all other human needs. Researchers at U.C. Riverside have estimated that 0.75 acre feet of water must be consumed in order to grow a balanced diet of food for each member of the public.

In order for a given variety of crop plant to produce a pound of biomass in a given climate, the plant must take up a rather fixed amount of water through its osmotic root system and evaporate it through its leaves. There are scientific reasons why this is unlikely to change. The roots take up the water but reject the salt that was in the consumed water. The concentration (salinity) of the salt that is left in the remaining soil moisture is, therefore, several times as high as it was in the applied water. In order for the roots to continue to function, this concentrated salt must be flushed out of the soil root zone with water that is in excess of the plant's consumptive need. This excess water is called leach water. In the Central Valley leach water and other water, such as urban water that is applied but not consumed, is largely recovered and reused. However, when leach water with high salinity percolates to groundwater that is not also replenished with low salinity water, the salinity of the groundwater gradually rises to unusable salinity. If the leach water flows by gravity sub-surface into a stream or is conveyed to a stream by a sub-surface drainage system, the salinity of the stream is increased. It is impossible to grow food without concentrating whatever salt is in the portion of the applied water that is consumed. If the salinity of the applied water is low, such as in snow melt streams, the salinity of the leach water is still quite good, but a salinity standard of 0.7 EC leads to leach water of 2 to 3 EC.

At your November 18 hearing the DWR alleged that south Delta agriculture was "a source of salt". That is not true. The sources of the salt are the sources that put salt in the water that flows into south Delta channels. South Delta farmers merely concentrate that salt as a necessity of growing food. They add very little salt.

The previous discussion applies also to any consumptive use of water by plants, including wetlands, wildlife refuges, riparian vegetation, weeds, lawns, etc.

Stagnant water

If there is no net unidirectional flow in a reach of south Delta channel, there can be no control of either salinity for farmers or dissolved oxygen (DO) for fish. This lack of flow is therefore only tolerable if the stagnation is brief and the inflow to the stagnant reach has a salinity substantially below needed levels as was the case pre-CVP.

CONDITIONS PRE-CVP AND HOW THEY CHANGED

Prior to the CVP in about 1950 the salinity of the San Joaquin River that flowed into the south Delta was so low that salinity was not a problem. There was and still is a large indigenous salt load that is derived from the weathering of soils, but that salt enters the stream system largely during storm and snow melt runoff and is amply diluted. Furthermore, there was a net flow of water toward the Bay in all but dry years so that the salt flowed to the Bay. Even in extreme years, the volume of good water in Delta channels provided a tidal pool of water from which irrigators in the south Delta could divert water to supplement river inflow and they had the legal right to do so.

Tidal flows and the difference in density between salt and fresh water cause salty Bay water to move into the western Delta. The lower the net outflow to the Bay the further the salt goes into the Delta. When an island like Franks Tract is inundated, it increases the volume of the tidal flow, as does any other increase in the volume of tidal waters. When the CVP and later the SWP went into operation, they then drew Sacramento water to the south Delta. This north to south flow within the Delta entrains salty Bay water and also reduces net outflow to the Bay. The exported water therefore contains more salt than when that water flowed into the north Delta. The CVP water, delivered to its westside service area via the Delta Mendota Canal, consequently imports into the San Joaquin watershed as much as one million tons of salt in a single year, most of which came from the Bay. Part of this imported salt then drains to the south Delta via the river as previously described. A large portion of this salt that flows back to the south Delta is then drawn to the CVP pumps and is re-exported down the DMC. This salt only gets to the Bay when the San Joaquin inflow is significantly more than is exported by the CVP and SWP combined. Most of the time that river inflow, after depletion by local diversions, is substantially less than CVP export rates even exclusive of SWP exports.

When New Melones was built it was required by the SWRCB to provide dilution water to meet the Vernalis salinity standard. However, that standard is far above the recorded pre-CVP salinity, and dilution does not remove salt. Furthermore, the Board did not establish the year-around minimum Vernalis flow requirement that is needed to restore the channel depth from Vernalis to Mossdale when water depth is reduced by export pumping. The inflow of the river sometimes falls below what is needed to meet south Delta's need for local agricultural diversions. The diverters must then draw water from the Delta pool. This is increasingly true as exports to the Bay Area from Hetch Hetchy increase; as summer flows are reduced in order to increase spring and fall fish flows or to provide EWA flows; and as water is exported out of the Stanislaus watershed; and as upstream water sales take place; and as consumptive use of water in the watershed increases. When Vernalis flow is less than about 1000 cfs there is not now enough depth for local diversions. Salinity standards in internal south Delta channels have not yet been enforced, and the lower the river flow the more those standards are violated.

Another effect of the CVP and the SWP is to reduce water levels and depths in south Delta channels. The higher the combined export rate the more the CVP and SWP have to draw down water levels in the south Delta in order to induce the flow of water

across the Delta to the pumps. The operation of the SWP also reduces the duration of the high tides. There is then less time for high tide water to flow into shallow channels, particularly into Tom Paine Slough. In order to maintain adequate water levels for agricultural diversions and local boating in Middle River, Grantline Canal and Old River within the south Delta, the DWR has installed each year three temporary tidal rock barriers. These do fairly well in restoring water levels in those channels, but can only be installed during part of the year due to flood risks. Furthermore, the barriers do not restore water quality and do not restore water depth upstream of the head of Old River. A fourth barrier is installed at the head of Old River during spring and fall to keep more water flowing toward the Ship Channel and thereby help reduce DO problems in the Ship Channel for fish and to keep salmon smolts from the CVP pumps.

The DWR now proposes a South Delta Improvement Plan (SDIP) ostensibly to protect three of the four south Delta channels from export operations while increasing export rates. However, the SDIP does not even pretend to protect the channel from Vernalis to Stockton in either depth or salinity. The SDIP exacerbates problems in that channel. The SDIP proposes permanent operable barriers on Middle River, Grantline Canal, and Old River within the south Delta. These barriers are necessary but are not sufficient to protect either water levels or salinity without other measures that are not included in the SDIP. The drawdown of high tide levels by export pumping renders the barriers incapable of capturing enough water to supply local diversions during several days of neap tides in each summer month. If that deficit is not met, the water depth can not be maintained. The SDIP proposes to meet that deficit by taking a large flow of water into the head of Old River from the San Joaquin during neap tides. But that large inflow to Old River will often not be available while also maintaining an adequate downstream flow past Brandt Bridge toward the Ship Channel. Furthermore, the drawdown of water level at the head of Old River which results from that inflow would exacerbate the problem of inadequate depth in the San Joaquin channel during low flows.

There are substantial local diversions from Tom Paine Slough which connects to Old River. The SDIP has not determined how to get enough water into that slough under SDIP conditions. Water flows into the Slough through locally constructed tide gates that were installed long before the export projects at a time when Old River salinity and tide levels had not been impacted. In recent years the flow into the slough has been inadequate and DWR has installed rented pumps to augment flow into the slough. The SDIP proposes to operate with water levels in Old River substantially lower than levels provided by the temporary barriers. This must be assumed to exacerbate the problem of Tom Paine Slough inflow.

SOLUTIONS

Solutions to these salinity problems are discussed below. The proposals are divided among measures that can be implemented prior to installation of permanent operable barriers and increases in export rates, then measures to be implemented after the operable barriers are installed, and finally measures to avoid the long term consequences of salt accumulation.

Solutions to be implemented prior to the permanent barriers

1) Recirculate Delta water in July, August, and September from the Delta down the DMC, then through existing Wasteways to the river, and back down the river to the Delta. The recirculation would have four objectives:

- Substitute for New Melones releases required to meet the Vernalis salinity standard as necessary to meet requirements of HR2828, PL106-361, pending the greater reduction that will result from reducing drainage from the CVP westside service area,
- Maintain a minimum Vernalis flow of 1000 cfs,
- Reduce salinity at Vernalis sufficiently below the 0.7 EC standard so that salinity does not rise above 0.7 EC before the flow reaches Brandt Bridge, and
- Supply enough flow into the head of Old River so that local agricultural diversion needs upstream of the barriers are met at all times while maintaining adequate water depth and a net daily downstream flow through all of the south Delta's main channels, except as proposed in item 4 below.

A test of recirculation was made in August 2004 when the base Vernalis flow was about 1000 cfs. This demonstrated that a 250 cfs recirculation reduced the Vernalis salinity by about 0.1 EC and increased Vernalis water depth about half a foot. We are not aware of any significant adverse impact. It has been assumed in discussion of recirculation that export operations could incur a water loss of as much as 10% of recirculation flows, but this has not been determined. In any event there would be no consumptive loss of water on a valleywide basis.

2) After the VAMP flow and prior to July 1 fishery concerns are assumed to preclude recirculation. During that period supply of the above Vernalis flow and salinity needs would be provided by borrowing water from San Luis Dam for release to the river or from flows otherwise exported to storage at that time and then replacing that water after July 1 at times that do not affect south Delta beneficial uses. Alternatively, purchase upstream water or retime EWA or other water transfers to provide flow and quality.

3) Force central Delta quality water from the Middle River barrier upstream and into Old River in sufficient quantity to keep salinity in Old River and Grantline Canal from rising above 0.7 EC from April 1 through September (During the VAMP flows this would not be necessary).

This can be done by appropriately raising the Middle River barrier and adding culverts to improve water capture, particularly during neap tides. Then provide low-lift pumps to augment reverse flow in Middle river when and in the amount needed.

4) Make any needed design improvements and operate culverts, if necessary, to assure the downstream flow into Old River and Grantline Canal is distributed so as to

maintain a net daily unidirectional downstream flow through each channel at all times. Add new flow meters and/or salinity meters that are located to verify the optimum use and split of water.

5) Continue to study and implement all reasonable means to adjust the time of drainage to the river from wetlands and farm lands in the CVP service area to coincide with VAMP flows, spring storm runoff and other times when the river has assimilative capacity for salt at concentrations below the salinity standard. Reduction of salt concentrations in the river is particularly important in March and early April to comply with HR2828.

6) During months when flood risks preclude the use of rock barriers, water levels for boaters and diverters can be assisted by dredging the channels between Old River and Grantline Canal.

Solutions to be implemented with permanent barriers

a) After installation of permanent barriers the New Melones releases for salinity control must continue to be reduced per HR2828. However, the water required to meet this obligation will be substantially reduced as drainage from westside wetlands is retained for timely release, and drainage from westside farm lands is kept out of the river.

b) The recirculation and other measures in (2) and (3) above will still be required to provide a minimum 1000 cfs Vernalis flow and to provide 0.7 EC salinity at Brandt Bridge. However, the base flow south of Vernalis will decline and thereby increase this burden. Furthermore, the base flow is already less than during the conditions reflected when CALSIM II was calibrated, and the base salinity is higher than indicated by CALSIM II (refer to the Peer Review Report).

c) The flow required into the head of Old River will change from pre-permanent barrier conditions. The Old River barrier will bring export quality water into Old River which will help with salinity control. However, as export rates increase the Old River barrier will not be able to capture enough water to meet local diversions in that reach primarily during neap tides. If the deficit in inflow at the barrier is provided by drawing water through the head of Old River, there will be a stagnant reach upstream of the Old River barrier where salinity and DO can not be controlled. The flow must therefore be reversed from the barrier eastward into Grantline Canal. This can be done by providing the deficit in inflow at the barriers with fish-friendly low-lift pumps. There is no water cost and only a low power cost to do this. This would be done with the same type of pump that has been provided by fish agencies at the Banta Carbona intake and in the Sacramento Valley. By taking care of Old River diversion and salinity needs in this way, the recirculation and other measures to provide flow into the head of Old River will be reduced. Recirculation requires considerably more power than low-lift pumps.

d) The SDIP proposes to do substantial dredging in the upper portion of Middle River. This and item (c) will facilitate and reduce the need for low-lift pumping at the

Middle River barrier. However, it may still be cost effective to substitute low-lift pumping at that barrier in order to reduce the recirculation required and particularly to reduce the other measures described in item (3) above.

e) Provide permanent low-lift pumps to provide adequate inflow to Tom Paine Slough unless the problem can be and is resolved by dredging followed by a maintenance dredging program.

f) Proceed with all necessary measures to keep agricultural drainage from the CVP service area out of the river.

g) Add new flow and/or salinity meters to assure that there is adequate net reverse flow from the Old River barrier eastward into Grantline Canal to meet the 0.7/1.0 EC salinity standard throughout that reach.

h) The permanent barriers will be operated in any month of the year when low river flows would otherwise cause either loss of depth or lack of circulation to maintain water quality for agricultural diversions, local boating and DO control.

It is illogical to contend that farmers diverting from internal south Delta channels do not need the same salinity protection as farmers at Vernalis. It is also disingenuous to pretend that south Delta farmers must suffer salinity impacts because full protection would involve a high water cost. This is clearly not true. Furthermore, the Projects have a responsibility to see that there are no adverse impacts of depth and salinity in Delta channels per the Delta Protection Act, Area of Origin Statutes, and D-1641 and its predecessor decisions.

PROBLEMS OF SALT ACCUMULATION IN SOILS AND GROUNDWATERS

None of the above solutions will avoid the long term consequences of continuing to accumulate salt in soils and groundwaters. The massive accumulation of salt in the soils and groundwaters of the CVP westside service area will continue unless that salt is either removed from the river and kept out of the groundwater and stored as a solid, or concentrated to a salinity approaching sea water and piped to the ocean for dispersal in the Japanese current. This should be done within five years and can not be afforded by the water users who receive that salt in their water supply. With the population growing as it is, the state can not afford in the long run to lose the production of food on fertile soils or to destroy the ability to use the groundwater that is being salinated. We have overcommitted the water yield of the San Joaquin watershed and lost the ability to get the salt to the ocean by natural processes.

We are also accumulating salt on a smaller scale in many scattered locations. Urban use of water adds salt to the water that is applied but not consumed. Cities can not therefore use river water and then return the unconsumed water as treated waste water to the river system at the same salinity as the river water they diverted. Waste water treatment does not remove salt. Consequently if the waste discharge can not be flushed

to the ocean, it salts up the stream system. If the city switches to land disposal, the salt percolates to groundwater with serious long range consequences of salt accumulation. Dairies are not allowed to dispose of waste except by percolation. Their problem is complicated by nutrients but they also are forced to salt up groundwater.

Perhaps we need a master salt disposal system into which these entities can discharge. This would be complicated and expensive, but can we afford not to preserve the usable salinity of our groundwaters? Basically this is a cost of population growth. That growth over commits our stream systems so that we have to substitute artificial means for natural processes.