Public Trust and Delta Resources

The Public Trust Doctrine requires that the sovereign, king, or the duly constituted government is entrusted with the duty of protecting public trust resources. The doctrine is age old and is ensconced in our own State Constitution. What are these public trust resources? Mainly they are the air we breathe, the water we drink, and ultimately all the habitats that sustain all life. Generally, these same resources are also required in our industries and commerce and often lead to conflicts of how the resource is to be allocated, keeping in mind the public trust. This is where we find ourselves in our present Delta conflict. **How much water can be safely allocated to export while still maintaining the environmental health of the Delta? We are asking the State Water Resources Control Board to balance these two objectives**.

The Bay Delta Conservation Plan (BDCP) has taken as its mission the twin objectives of improving the reliability of export deliveries and restoration of the Delta. The CalFix/Twin Tunnels project has grown out of the BDCP studies and we presume the same objectives prevail for it. To meet these objectives there is a presumed need to capture and control a greater fraction of run-off which can then be timely allocated to Delta restoration and more reliable exports.

The California Fix/Twin Tunnels assumes that the allocation of run-off is okay, but that our problem with Delta restoration is simply a hydraulic problem in getting water across the Delta without killing fish and doing damage to the habitat. The Twin Tunnels is an attempt to fix the hydraulic problem but even with the tunnels the project still calls for some cross-delta transport through surface sloughs and canals. A review of Sacramento River and San Joaquin hydrologies informs us that the first assumption is problematic and an analysis of cross-delta transport of Sacramento River water shows that the hydraulic problem is more difficult than the tunneling project suggests.

Sacramento and San Joaquin River Hydrologies

Sacramento Side

In previous testimony presented by C-WIN in phase I of the CalFix/Twin Tunnels hearing on the request to change the diversion point, information was presented on the Sacramento hydrologic record that showed certain characteristics of Sacramento River run-off that raise serious questions about the Twin Tunnels to improve on the reliability of delivery. According to that testimony, the 100-year run-off record shows quite well that the water years divide into two well defined groups, which are labeled “dry” and “wet”, with very few of the years near the grand average. The testimony further showed that if run-off (as measured by the 4-river index) was less than 3.9 million acre feet (MAF) by the end of January there was only a 5% chance that the water year would turn out wet. It was further noted that a prudent operations plan would curtail winter export pumping until that criterion had been met. That same prudence should be observed for any operational plan for the Twin Tunnels. If winter pumping is limited to serving urban demands (There is virtually no agricultural demand during this period.) most of that 3.9 MAF or less contributes to outflow. **To allow winter pumping in the face of indications that the year will be dry prevents a careful, objective balancing between allocation objectives, water for export and water for Delta health, that the public trust demands, and presents significant risks to the Delta habitat**

for the remainder of the year. Depending on the degree of winter pumping under dry conditions also risks Delta health during the winter. The present operations plan for the Delta is to pump vigorously during the winter to fill San Luis Reservoir. This could be pumping up to 2 MAF, the capacity of San Luis, which would leave little winter outflow. That level of pumping in the face of a coming dry year would severely limit the ability of the SWRCB to allocate water releases for Delta health.

The dry year group of run-off years comprises 56 % of the record and has an average of about 12.2 MAF in terms of the 4-river index (this equates to about 14.5 to 15 MAF in unimpaired flow for the entire watershed). About 20% of the run-off's 100-year record show unimpaired flows of 10 MAF or less. At that level of run-off there will be little opportunity for winter pumping if we consider Sacramento Valley average annual demands plus those for the Delta farmers. Any significant level of winter pumping, say to attempt to fill San Luis, will leave virtually no flexibility to provide Delta outflow in behalf of the public trust. The driest of those 20% of years, 8 MAF of unimpaired run-off, approximately 10% of the record, will have difficulty providing expected agricultural demands even with no provision for outflow. These findings are at a variance with current operations which show that in most years, significant winter pumping to fill San Luis occurs. These findings are true for both cross-delta transfer and the Twin Tunnels since they go to the question of how much water will really be available for pumping.

Sacramento and San Joaquin River Hydrologies
San Joaquin Side

The patterns of unimpaired run-off for the San Joaquin River mirror those found for the Sacramento River. Dry winters presage a dry year and indicators can readily be found to be used as operational criteria. However, the San Joaquin River varies in a very significant way. Very little of the unimpaired flows reach the Delta. Because of the large dams on the main tributaries, the San Joaquin proper, the Merced, the Tuolumne, and the Stanislaus, only about 5% of the unimpaired flow reaches the Delta (more accurately the Vernalis checkpoint). The total unimpaired flow of the San Joaquin River at Vernalis averages about 8 MAF so 5% represents less than 0.5 MAF. Thus the San Joaquin contributes little to export pumping.

One of the more vexing problems in export pumping operations is the creation of reverse flows in Old River leading in to the export pumps. Reverse flows are the most immediate cause of concern because of their effect on Delta salinity and their associated fish kills by entrainment in the pumps. This occurs primarily because the entire burden is in a practical sense left to the Sacramento River to provide the water to the export pumps. There is no direct path across the Delta from the Sacramento River to the export pumps so the Sacramento river water must migrate across the Delta in a way that causes that water to enter the south Delta downstream of the export pumps and then move in a counter-flow fashion up to the pumps, hence the reverse flows. If there were significantly more flow entering the Delta from the San Joaquin River this could offset a large fraction of the reverse flows.

Table 1 is a data set showing the averages of flows in the San Joaquin at Vernalis, the export flows, the reverse flows, and the Sacramento flows from 1981 to 2006 for the combined months of December, January, February, and March. An additional column is provided in the table to list the calculated excess flows of Vernalis over export. Since Vernalis flows are generally less than export, the entry in the table is negative. The data comes from USGS measurements of flows for the Sacramento, San Joaquin and Old River and DWR reports on export pumping.

Table 1:
Flows In-to and Out of the Delta, Plus Old River Flows
Winter Averages over period, Dec., Jan., Feb., Mar. for years 1981-2006

Year	Old River	Export	Vernalis	Excess (Ver-Exp)	Sacramento
1981	-4.5	6.6	2.6	-4.0	23
1982	-4.5	7.5	5.3	-2.2	63
1983	0.3	8.3	27.0	18.7	66
1984	4.5	4.0	15.5	11.5	49
1985	-5.7	7.5	3.8	-3.7	20
1986	-0.8	7.0	9.8	2.8	45
1987	-4.0	6.4	3.0	-3.4	16
1988	-7.5	9.3	1.6	-7.7	16
1989	-6.6	8.7	1.5	-7.2	20
1990	-8.2	10.4	1.2	-9.2	15
1991	-4.6	6.0	1.0	-5.0	13
1992	-5.0	6.3	1.2	-5.1	17
1993	-5.5	7.6	2.8	-4.8	40
1994	-4.5	6.5	2.0	-4.5	17
1995	-3.0	7.6	6.7	-0.9	52
1996	-1.0	6.0	8.0	2.0	47
1997	10.5	4.8	22.7	17.9	57
1998	2.7	6.0	14.0	8.0	55
1999	-0.6	4.7	7.5	2.8	51
2000	-5.3	9.3	5.7	-3.6	41
2001	-5.8	7.8	2.8	-5.0	19
2002	-7.6	9.4	2.3	-7.1	26
2003	-8.3	9.6	2.2	-7.4	35
2004	-8.2	10.2	2.3	-7.9	39
2005	-6.0	9.0	5.0	-4.0	27
2006	-3.0	8.2	9.0	0.8	55

Regression analyses were run on this data set to find the best explanatory variables to predict reverse flows (Old River in the table). Figure 1 is a presentation of the best fit that could be found. It shows that Old River reverse flows are very accurately predicted by the variable “Excess”, the variable which shows how much export pumping exceeds the Vernalis flows. All flows are in kfcs (thousands of cubic feet per second) as the average over the winter months. No effect could be found for the Sacramento flows in explaining Old River flows.

One data point 1983 has been deleted in this regression analysis. 1983 was an extremely wet year, in fact a record El Nino year. Why it appears as an outlier needs further investigation. It is possible for instance in such a year that the hydraulic gradients throughout the Delta are changed dramatically during such an event. Opening the Yolo Bypass as is done for extreme events may help explain the departure.

The result shown in Figure 1 is unequivocal. The strong dependence of Old River flows on the Excess (Vernalis -Export) flows shows the importance of Vernalis flows and reduced exports if reverse flows in Old River are to be avoided. No dependence of Old River reverse flows on the magnitude of Sacramento River flows could be discovered. This result should not be surprising given the close proximity of the San Joaquin River, the export pumps, and Old River. The Vernalis flows in the San Joaquin are the first to scavenged by the Export pumps and given that they are insufficient to support the level of export flows gives rise to the induced reverse flows in Old River.

Concluding Observations

The Public Trust is the most important duty in the allocation of water and water rights. Rights mean nothing if there is not water to back them up. But it is incumbent on the Government, the SWRCB in this case, that sufficient water is allocated to protect public trust resources balanced against the demands of water users. In the Delta this comes down to the competition for water to support Delta health against the demands of the projects for export water.

Delta health is somewhat difficult to define. So far our purview has been limited to tracking a few significant species, most notably those on the ESA, and monitoring the encroachment of salinity in to the fresh water regimes of the Delta. Salinity is a problem both because of what it augurs for the change in habitat and for the problem of entrainment in export water. This is a rather limited purview; there are many species in the Delta whose health should be of concern and the ESA can in no way be an indicator for the good health of those species so listed. We have yet to develop a more comprehensive set of indicators for Delta health to guide the decisions of the SWRCB. However, there are some conclusions that can be made based on the testimony delivered here.

First, we have found a very sound statistical predictor for designating a dry group year (56% of the record). Its implications are very strong that no significant winter export pumping should be undertaken before the end of January in a water year. This predictor was first presented in testimony of part one of these hearings (C-WIN-2) and elaborated on here. Further statistical analysis of a more detailed data base may be able to develop a better algorithm to guide winter pumping. **The immediate consequence of this limitation on winter pumping is the difficulty of filling San Luis Reservoir before summer demands must be met. These findings prevail for either present operations or those anticipated for the Twin Tunnel. They go to the fundamental fact that in many years, natural run-off is insufficient to serve the projects in the way hoped for. Simply stated, the water is not there**.

Second, we have shown that without significantly increased releases from the San Joaquin

River tributaries in the winter there is virtually no chance of eliminating reverse flows in Old River when cross-delta transfers are used to deliver water to the export pumps. Only some combination of reduced exports and increased San Joaquin releases can promise to reduce or eliminate reverse flows. The Twin Tunnels can eliminate reverse flows only if it is the only means used to transport water across the Delta. However, as presently contemplated, the Twin Tunnels has less than the permitted export pumping capacity. Increased releases to the San Joaquin River will necessarily cause significant decreases in annual deliveries to many of the San Joaquin irrigators. It should be noted here that sufficient San Joaquin releases combined with reduced exports to eliminate reverse flows would make the Twin Tunnels project completely unnecessary and salinity control in the rest of the Delta would be made much easier.

Reliability of delivery of exports will only be improved by dealing with the problems the dry years present. It is possible that if exports are systematically reduced the operations of the large dams, above and below the Delta, can be shifted to provide year-to-year carryover. Thus the year-to-year deliveries would show much less variance and as a consequence better reliability. This should be explored.

Figure 1
Regression Line for Old River vs. Excess Flows
(1981 - 2006) (All flows in kcfs)