Need to Change the Operation Requirements of the COE Aerator Located at the Port of Stockton near Channel Point

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During the past four years, the SJR DO TMDL studies have shown that there is severe DO depletion in the Deep Water Ship Channel below the water quality objective. Further, it has been observed that the US Army Corps of Engineers' aerator located at the Port of Stockton near Channel Point is not operating during many of these severe DO depletion situations that have been observed.

Under a cover letter (US ACOE, 1990a) signed by Colonel Jack A. Le Cuyer, Sacramento District, the U.S. Army Corps of Engineers described a Dissolved Oxygen Mitigation Plan and Environmental Assessment associated with the deepening of the San Joaquin River Deep Water Ship Channel from 30 to 35 feet that took place in the late 1980s. The Dissolved Oxygen Mitigation Plan (US ACOE, 1990b) stated,

> *"The Corps issued a contract to the environmental modeling firm of Resource Management Associates (RMA) to model the DO in SJR. The RMA effort modeled both pre- and post-project conditions. The results indicate that the project deepening under a variety of hydrologic conditions would lower DO concentrations by about 0.2 mg/L. To mitigate for the project impact of 0.2 mg/L would require a mass input of 625 pounds (lbs.) oxygen/day under near-zero net flow conditions in the project area of SJR to 2,500 lbs. oxygen/day when the net downstream SJR flow in the project area approaches 2,000 cfs."*

This Mitigation Plan was based on an Environmental Assessment (EA) (US ACOE, 1990c), which stated,

> *"Because the ship channel dredging reduced DO levels in the channel by approximately 0.2 mg/L, the aeration facility will be operated when any of the DO level monitoring locations drops below 5.2 mg/L during the fall salmon run. DO levels below 5.0 mg/L adversely effect* [sic] *the fall salmon runs which typically occur during September, October or November."*

The Mitigation Plan further stated,

> *"The Corps proposes to construct one jet aeration facility. A schematic drawing of the system is shown in Figure 2. Under normal hydrodynamic conditions one site will aerate a 4 to 6 mile length of the channel because of the tidal excursion that occurs past the*

aeration site. The system will have an oxygenation capacity of 3,000 lbs oxygen/day, and will be operated during the fall salmon run period when DO falls below 5.2 mg/L (typically September, October and November). The aeration facility will be operated and maintained by the Port of Stockton.

This mitigation plan and an accompanying Environmental Assessment were circulated during February 1990 among the above listed agencies as well as the National Marine Fisheries Service, and the Environmental Protection Agency. No significant comments were received during the review period. Therefore a Finding of No Significant Impact (FONSI) has been prepared and the final siting and design of the aeration facility will commence."*

* Port of Stockton
City of Stockton
Central Valley Regional Water Quality Control Board
California Department of Water Resources
California Department of Fish and Game
U. S. Fish and Wildlife Service
U. S. Bureau of Reclamation

Studies by Brown, of Jones & Stokes (2003), conducted as part of the CALFED (now California Bay-Delta Authority) Low DO Directed Action project, found that the aerators were operating at less than the design capacity. According to Brown,

*"The south jet had the most turbulent bubble column "boil" that was surfacing just 10 feet in front of the jet. This indicates that the bubble column was immediately breaking away from the water jet and rising to the surface. The measured flow-away current was estimated to be 215 cfs. This suggests a water flow-to-air flow–ratio of about 50, assuming all the air was being supplied to the jets. Most of the flow was measured in the upper 2–3 feet, and the maximum velocity was about 2 ft/sec at a radius of 15 feet from the center of the upwelling bubbles. The DO concentration in this flow-away current was about 7.3 mg/l. The assumed background DO was 6.6 mg/l, as estimated from the deeper water in the vicinity of the jets. The jet entrains water from the entire water column as the bubble plume rises, so the average DO of the entrained water is difficult to estimate. The actual increment of DO that the bubbles are producing in the upwelling flow is therefore difficult to estimate. If the DO increment was 0.7 mg/l, and the flow away current was 198 cfs, then the flow-away current carried about 780 lb/day of oxygen (i.e., 5.4 * 198 * 0.7). This is about 62% of the design aeration capacity of 1,250 lb/day for each set of water jets.*

The north jet was also tested on September 26, 2001. Although the pressure of the air supply line for the north jet was about the same as the south jet (i.e., 7 psi), the air bubbles appeared to be smaller, and substantially less air was upwelling to the surface. The resulting flow-away current was measured to be only 40 cfs. The maximum water velocity at a radius of 15 feet was only 0.5 ft/sec and the depth of the flow-away current was less than 1 feet. The DO concentration in this smaller upwelling flow averaged

about 8.1 mg/l (increment of 1.5 mg/l), suggesting that the smaller bubbles were more effective in saturating the DO concentration in the upwelling flow. But the much smaller flow-away current from the north jet only carried an estimated 340 lb/day of oxygen. This is less than 30% of the design aeration capacity 1,250 lb/day."

It is now clear that the original Mitigation Plan for addressing the additional reduction in oxygen demand assimilative capacity was inadequate from several perspectives. This Mitigation Plan only addressed the DO depletion associated with the homing migration of Chinook salmon, and did not address the fact that DO depletion below the water quality objective of 5 mg/L is adverse to a variety of aquatic life (US EPA, 1987). Further, subsequently the State Water Resources Control Board concluded that, in order to protect the homing migration of Chinook salmon through the DWSC, it is necessary to have a DO in the Deep Water Ship Channel of no less than 6 mg/L.

Another major problem with the implementation of the Mitigation Plan is that the aerator is operating at far less than its design capacity, with the result that the US ACOE's Mitigation Plan is not being fulfilled. The Corps should immediately work with a consulting firm to improve the efficiency of the aerator so that it more properly complies with the Mitigation Plan that the Corps agreed to support.

During the past two years, I have been following the DWR RRI monitoring station DO data for the purpose of gaining a better understanding of the factors influencing DO depletion, and especially, when DO depletion occurs. As Lee and Jones-Lee (2003a,b) reported in the Synthesis Report and in subsequent reports, there are times, such as in February 2003 and again in July and August 2003, when DO in the near-surface waters at the DWR RRI monitoring station occurred at concentrations that were lethal to fish. The aerator, however, was not operating since the Corps is not required to operate it. It is inappropriate to have an aerator sitting idle in the Deep Water Ship Channel during times when the DO concentrations are severely depressed. It also appears that, contrary to the Mitigation Plan statement, the aerator has not been *"… operated and maintained by the Port of Stockton."*

According to Gowdy (pers. comm., 2003), discussions are currently underway for the Port of Stockton to take over the operation of the aerator, where it would be operated to provide 250,000 lbs of oxygen per year to the Deep Water Ship Channel. From the information available, it appears that, with the implementation of this approach, in some years there still will be a substantial period of time when the DO in the Deep Water Ship Channel is less than the water quality objective when the aerator will not be operating. There is need to have the Port and the US Army Corps of Engineers commit to operating this aerator any time the DO in the Deep Water Ship Channel, as measured by the DWR RRI monitoring station, drops to within 0.5 mg/L of the water quality objective. During the period of September 1 through November 30, any DO reading less than 6.5 mg/L, and from December 1 through August 31, any DO reading less than 5.5 mg/L, at any time during the day, should trigger the operation of the aerator.

The RRI monitoring station DO readings are available continuously online (http://cdec.water.ca.gov/cgi-progs/queryF?s=rri&d=now&span=12hours) and should be used to establish when the aerator should be operated. The scheduling of the operation should not be

restricted to September, October and November. Severe DO depletion problems occur at other times during the year. The Deep Water Ship Channel's original construction and subsequent deepening from 30 to 35 feet contributes to the low-DO problem in the DWSC, which should be mitigated by the Corps.

It is recommended that the Regional Board begin to work with the Corps of Engineers and the Port of Stockton to immediately revise the operating conditions for the COE aerator so that it is operated every time the DO falls within 0.5 mg/L of the WQO at any time during the day at the DWR RRI monitoring station.

References

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