Memorandum

Date:	February 28, 2013
To:	Jeff Wingfield Environmental Manager Port of Stockton 2801 W. Washington Street Stockton, CA 95201
From:	Michael Wingfield Project Manager
Subject:	**2012 Port of Stockton Dock 20 Aerator Operations, Maintenance and Cost Summary**

Introduction

On May 7, 2012, the *Agreement for Funding & Operation of Dissolved Oxygen Aeration Facility* (the Agreement) was executed in which the Port of Stockton (Port) and other stakeholders in the San Joaquin River Dissolved Oxygen (DO) Control Program expressed their commitment to fund the operation and maintenance of the Stockton Deep Water Ship Channel (DWSC) Aeration Facility located at Dock 20 at the Port.

The agreement contains no prescription or specific requirements for when the Aeration Facility should be operated. Therefore, representatives of the Port met with Central Valley Regional Water Quality Control Board (CVRWQCB) staff on August 30, 2012, to discuss an appropriate trigger for operation of the Aeration Facility. Previous triggers for aeration by the Port included the use of daily averaged DO data from the Department of Water Resources' (DWR's) Rough and Ready Island (RRI) monitoring station. However, CVRWQCB stated their desire that the Aeration Facility be used for the intended purpose of meeting the Central Valley Basin Plan water quality objectives[1] for DO at all times. Since that time, the facility has been operated periodically on behalf of all parties to meet the water quality objective.

This report provides a summary of DO conditions in the DWSC, all operations and maintenance of the Aeration Facility that have occurred since September 1, 2012, and the estimated cost allocation for all parties signatory to the Agreement.

[1] 5.0 milligrams per liter (mg/L) December through August, 6.0 mg/L September through November

Maintenance and System Improvements

Before 2012 operations began, staff performed a general inspection of the facility and checked all system components for proper function. Lubricant levels and conditions were also checked. This and subsequent inspections revealed problems with the Oxyguard DO probes that monitor intake and discharge DO levels. Reconditioning and calibrating the probes onsite failed to remedy the problem, so the probes were removed and sent to the supplier for repair. At the time this report was written, the DO probes were still out for repair. No other problems have been identified, although the Port intends to have the system's oxygen flow meters recalibrated as they have been in use for several years.

Ambient Dissolved Oxygen Monitoring

DO is monitored daily using data provided by DWR. The data are collected at the RRI station and are published on the California Data Exchange Center (CDEC) website in 15-minute increments. Data collected at RRI can be viewed at http://cdec.water.ca.gov/cgi-progs/queryF?RRI. The DO sampling device is maintained and calibrated by DWR staff on a weekly basis. RRI DO data for September and October 2012 are shown in Figures 1 and 2 below, and they show that DO levels dropped below the objective on numerous occasions after September 1.

Facility Monitoring

During periods of operation, the facility is inspected daily during the work week to check for potential problems and ensure proper function. All gages and meters are checked to confirm proper function and normal readings. The systems are checked for any signs of wear or damage that could affect performance. Operational data are logged during all periods of operation including water flow and pressure, oxygen flow and pressure, and liquid oxygen tank level and pressure.

Facility Operations and Dissolved Oxygen Inputs

The facility was operated on an as-needed basis to meet the water quality objective. In order to operate as efficiently as possible, the facility was turned on and off, as conditions warranted, and the response in the DWSC was monitored. Though much was learned about the capacity and performance of the facility during DWR's demonstration project, forecasting the mass of the DO deficit in the DWSC is problematic, and a practical trial-and-error approach was implemented to determine appropriate oxygen inputs. For example, if during operation the daily minimum DO level increased to ≥7.0 mg/L the oxygen feed rate was decreased, and the response was monitored. Conversely, if daily minimum DO levels fell below 6.0 mg/L, the oxygen feed rate was increased. The water flow rate was also adjusted by operating one or both of the pumps. This process was repeated until water and oxygen flow rates were identified that would maintain the DO concentration at or above the objective. Due to variable conditions in the DWSC (water temperature and flow, chlorophyll concentration, etc.) the ideal water and oxygen flow rates needed to maintain DO above the water quality objective fluctuate. Therefore, the process of monitoring and adjusting oxygen

inputs is ongoing during periods of operation. Table 1 provides a summary of the periods of operation and the associated oxygen inputs. As described above, the DO probes were not functional; therefore, oxygen transfer efficiencies documented during testing of the facility were used to calculate the mass of oxygen inputs.

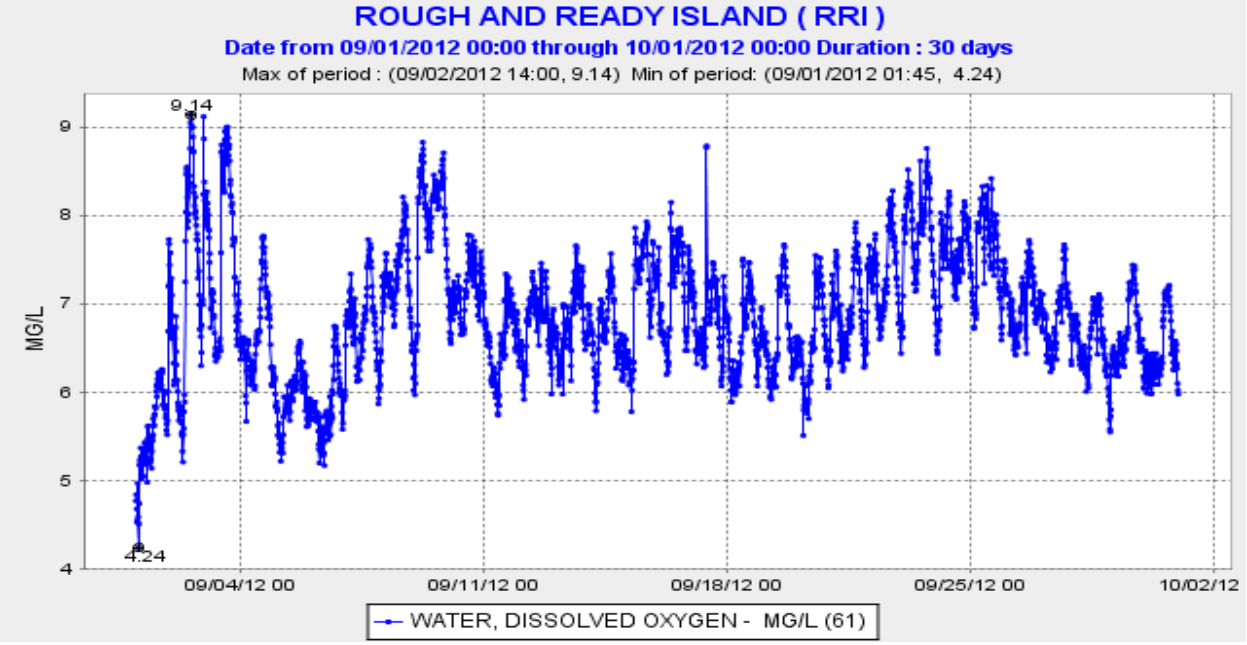

Figure 1. Rough and Ready Island 15-minute Dissolved Oxygen Data—September 2012

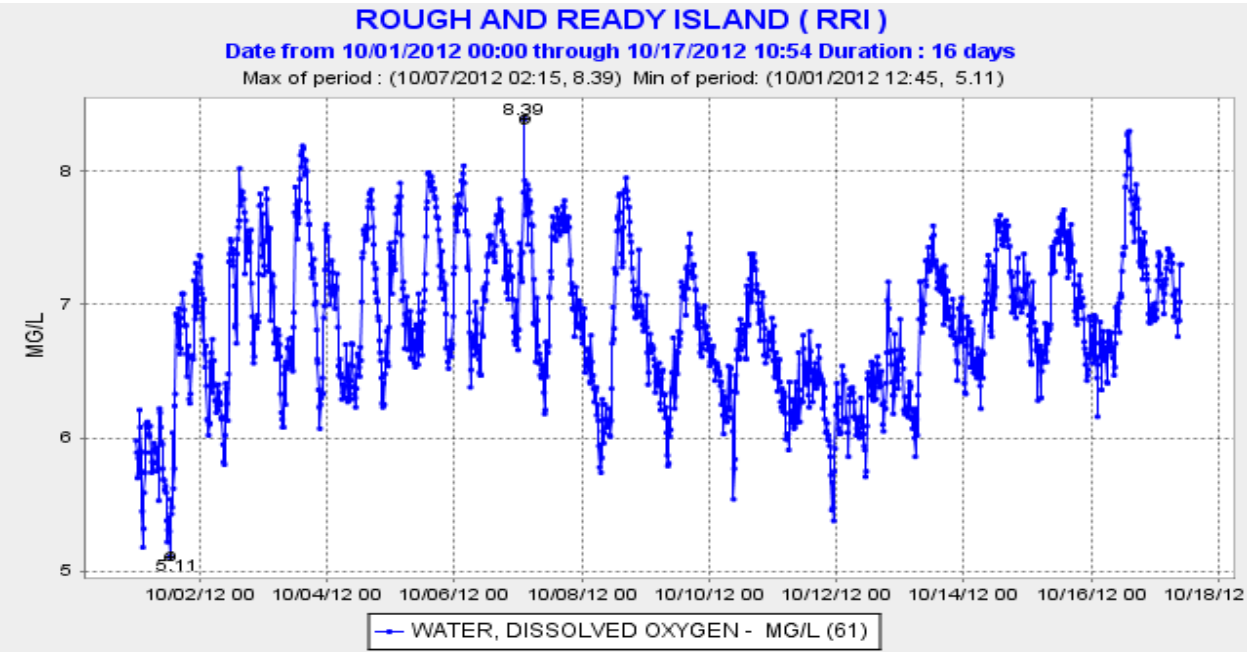

Figure 2. Rough and Ready Island 15-minute Dissolved Oxygen Data—October 2012

Table 1. Dock 20 Aerator Operations Data—2012

Date	Time	Duration (hours)	Water Flow (cfs)*	O_2 Flow (scfh)	Gas/Water Ratio (%)	Transfer Efficiency (%)	O_2 Input (lbs/day)
9/1	1115 (start)	12.75	45	6,500	4.0	0.58	3994
9/2		24	45	6,500	4.0	0.58	7519
9/3		24	45	6,500	4.0	0.58	7519
9/4	0830 (stop)	8.5	45	6,500	4.0	0.58	2663
9/6	0915 (start)	14.75	45	6,500	4.0	0.58	4621
9/7		24	45	6,500	4.0	0.58	7519
9/8		24	45	6,500	4.0	0.58	7519
9/9		24	45	6,500	4.0	0.58	7519
9/10		24	45	6,500	4.0	0.58	7519
9/11	1630 (stop)	16.5	45	6,500	4.0	0.58	5169
9/11	1631 (start)	7.5	25	4,000	4.4	0.56	1396
9/12		24	25	4,000	4.4	0.56	4467
9/13		24	25	4,000	4.4	0.56	4467
9/14		24	25	4,000	4.4	0.56	4467
9/15		24	25	4,000	4.4	0.56	4467
9/16		24	25	4,000	4.4	0.56	4467
9/17		24	25	4,000	4.4	0.56	4467
9/18		24	25	4,000	4.4	0.56	4467
9/19		24	25	4,000	4.4	0.56	4467
9/20	1030 (stop)	10.5	25	4,000	4.4	0.56	1955
9/20	1031 (start)	13.5	45	4,000	2.5	0.7	3141
9/21		24	45	4,000	2.5	0.7	5584
9/22		24	45	4,000	2.5	0.7	5584
9/23		24	45	4,000	2.5	0.7	5584
9/24	0915 (stop)	9.25	45	4,000	2.5	0.7	2152
10/1	1600 (start)	8	45	4,000	2.5	0.7	1861
10/2		24	45	4,000	2.5	0.7	5584
10/3		24	45	4,000	2.5	0.7	5584
10/4		24	45	4,000	2.5	0.7	5584
10/5		24	45	4,000	2.5	0.7	5584
10/6		24	45	4,000	2.5	0.7	5584
10/7		24	45	4,000	2.5	0.7	5584
10/8	1030 (stop)	10.5	45	4,000	2.5	0.7	2443
10/12	1415 (start)	9.75	25	3,500	3.9	0.59	1673
10/13		24	25	3,500	3.9	0.59	4118
10/14		24	25	3,500	3.9	0.59	4118
10/15	1300 (stop)	13	25	3,500	3.9	0.59	2231

cfs = cubic feet per second

Date	Time	Duration (hours)	Water Flow (cfs)*	O_2 Flow (scfh)	Gas/Water Ratio (%)	Transfer Efficiency (%)	O_2 Input (lbs/day)

scfh = standard cubic feet per hour
lbs = pounds
* 25 cfs = one pump in operation, 45 cfs = both pumps

Estimated Cost Allocation

Due to a recent change in accounting software at the Port, the financial data currently available is limited to the months of June through August 2012, during which time the facility was operated to meet Port mitigation requirements. Those operations (which occurred only in June) were funded solely by the Port. Operations on behalf of all parties signatory to the Agreement did not begin until September 2012. Therefore, the following accounting is an estimate of the costs incurred during operations in the September through December period.

The estimates were derived by dividing the total costs incurred during operations in June by the number of days of operation to determine a cost per day of operation. Because oxygen and water flow rates were adjusted numerous times during the September through December period, average oxygen and water flow rates were calculated and applied to the actual bulk liquid oxygen and electrical utility costs from June operations. During the September through December period the average oxygen flow rate was 35.5% higher than during June operations and the average water flow rate was 49.6% higher. The operations accounting for June through August is shown in Table 2. The third column shows the costs adjusted for the increased oxygen and water flow during the September through December period.

Table 2. Cost per Day for 2012 Operations

Operations Component	Actual Costs for June	Estimated Costs using Average O_2 and H_20 Flow Rates During Sep-Dec
Technical services, including daily DO monitoring and onsite maintenance and operation	$2,821.25	$2,821.25
Bulk liquid oxygen	$1,790.37	$2,425.95
Electric utility	$2,606.52	$3,883.71
Subtotal	$7,218.14	$9,146.55
Cost per day of operation	$1,535.77	$1,946.08

From September 1 to December 31 the facility operated a total of 30.6 days. At an estimated daily cost of $1,942.75 the total estimated cost of operations for the September through December period was $59,549.90. That total does not take into account repairs that were required for several of the DO probes at the facility. The Port has yet to receive an invoice for those repairs; however, it is expected to be approximately $2,000.00, resulting in an estimated grand total of $61, 549.90. The

funding allocations set forth in the Agreement are shown below with the corresponding estimated amounts that each stakeholder will contribute for 2012 operations.

Table 3. Operations Funding Allocations—2012

Stakeholder	Estimated Contribution
Port of Stockton—33.33%	$20,514.58
San Joaquin River Group—25.00%	$15,387.48
San Luis & Delta-Mendota Water Authority and San Joaquin Valley Drainage Authority—25.00%	$15,387.48
State Water Contractors—16.67%	$10,260.37
Total	$61,549.90