Sediment Deposition Rates and Associated Oxygen Demands in the Deep Water Ship Channel of the San Joaquin River. Stockton, California July-November, 2000 (DRAFT)

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DRAFT

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July-November, 2000

Prepared for:

San Joaquin River Dissolved Oxygen TMDL Technical Committee

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I. Introduction

The study was conducted for the San Joaquin River TMDL technical committee as part of the CALFED 2000 investigations. Water and suspended sediments in the San Joaquin River and Stockton Deep Water Ship Channel (DWSC) were studied during the summer and fall of 2000 to elucidate settling and resuspension mechanisms that influence dissolved oxygen (DO) concentrations. The width and depth of the San Joaquin River increases significantly upon entering the DWSC resulting in reduced flow velocities and turbulence that allows greater settling of particulate matter. Of the suspended solids entering the DWSC from the San Joaquin River, algae have been estimated to be a dominant source of the biochemical oxygen demand (BOD) load (Jones and Stokes, 1998). This work was performed to quantify the setting fluxes and velocities of particulate matter and oxygen demand associated with these suspended sediments. It is anticipated that deposition rates and settling velocity data will be used to calibrate a water quality model of the DWSC.

Sediment deposition rates were measured with a series of traps placed in the DWSC. Water samples from the DWSC and the San Joaquin River upstream of the DWSC were collected to estimate settling velocities from the deposition rates. Algae concentrations of both the water column and the trapped sediments were quantified with chlorophyll *a* measurements. Laboratory biochemical oxygen demand (BOD) tests were performed with the trapped sediment to estimate the oxygen demand of the trapped matter. In combination these measurements provide evidence supporting significant settling and resuspension rates. These data also yield water and sediment quality constituent correlations that may be used for other San Joaquin River TMDL investigations or analyses.

II. Water Quality Measurements, Sediment Deposition Fluxes and Settling Velocities

Sediment traps were used to estimate sediment deposition rates in the Stockton Deep Water Ship Channel (DWSC). Settling velocities (m/hr) were calculated from the sediment deposition flux (mg m^{-2} hr^{-1}) and the composite water concentration collected at each trap station and depth. During the collection of water samples at each trap, field measurements of water temperature, electrical conductivity, pH, dissolved oxygen, turbidity, and secchi depth were recorded.

<u>Methods and Materials</u>

Three sediment frame systems, each with four traps, were placed at Light 48 (Channel Point), near Light 43 (directly offshore from the continuous monitoring station on Rough and Ready Island), and at Light 38 in the San Joaquin River. Navigation light locations are shown in Figure II-1. A schematic diagram of the trap apparatus is shown in Figure II-2. The traps were left to collect sediment for 24-25 hours or only during ebb and flood tides lasting approximately 6 hours. The dates and times that the sediment traps were deployed are listed in Table II-1.

Water samples were also collected at a station upstream of the DWSC in the San Joaquin River. Water samples were collected at depths of 4, 8, 12, 16 feet in the center of the San Joaquin River near the UVM Station above the Stockton RWCF discharge outfall shown in Figure II-1. This location is referenced in this report as the San Joaquin River. All other station are referred to being as in the DWSC, also part of San Joaquin River.

The sediment traps were constructed of 2-inch diameter PVC pipe, 20 inches long. Traps were located at four depths: 2.5 m (8.2 ft), 5.0 m(16.4 ft), and 7.5 m (24.6 ft) below the water surface and at 0.5 m (20 inches) above the sediment surface. The trap near the sediment water interface was secured to a weighted PVC frame with a 3 by 3-ft square footprint. Traps at 2.5, 5 and 7.5 meters were attached to a nylon line anchored to the sediment trap frame and supported by a buoy. The aspect ratio of sediment traps can influence the trapping efficiency. Traps six inches long were also used with the 20-inch traps on two monitoring days. Deposition rates measured with both trap sizes were found to be similar. Therefore, use of the 6-inch traps was discontinued.

Water samples and sediment samples were transferred from the traps to 1-L polypropylene bottles, immediately iced and transferred to a 4°C refrigerator within 2 hours of collection. Volatile and total suspended solids of the water samples and sediment slurry were determined by filtration, drying at 103°C, and ignition at 550°C (APHA, AWWA, and WEF, 1998). Quantification of chlorophyll *a* and pheophytin *a* were also performed in accordance with Standard Methods (APHA, AWWA, and WEF, 1998).

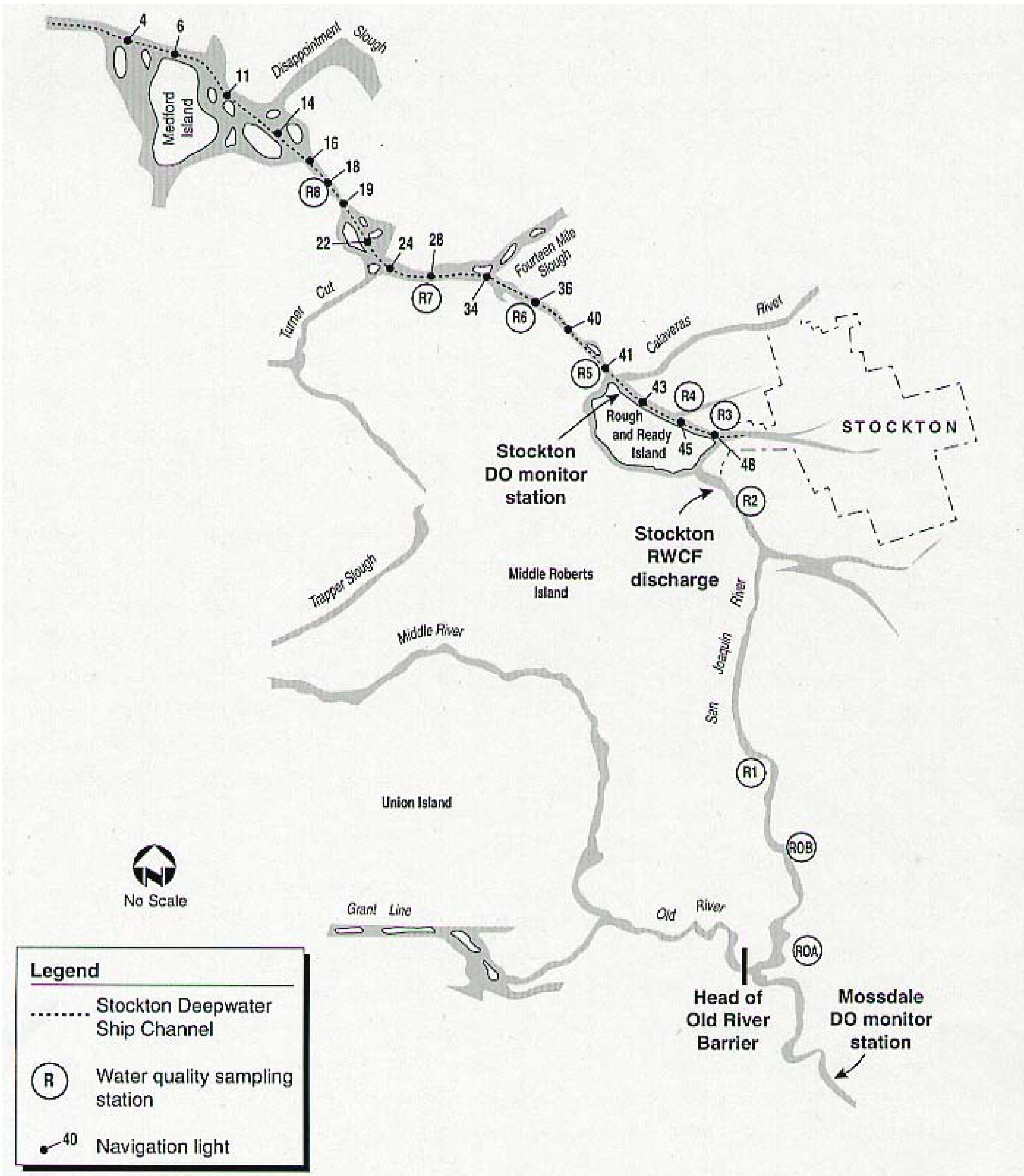

Figure II-1: San Joaquin River and the Stockton Deep Water Ship Channel.

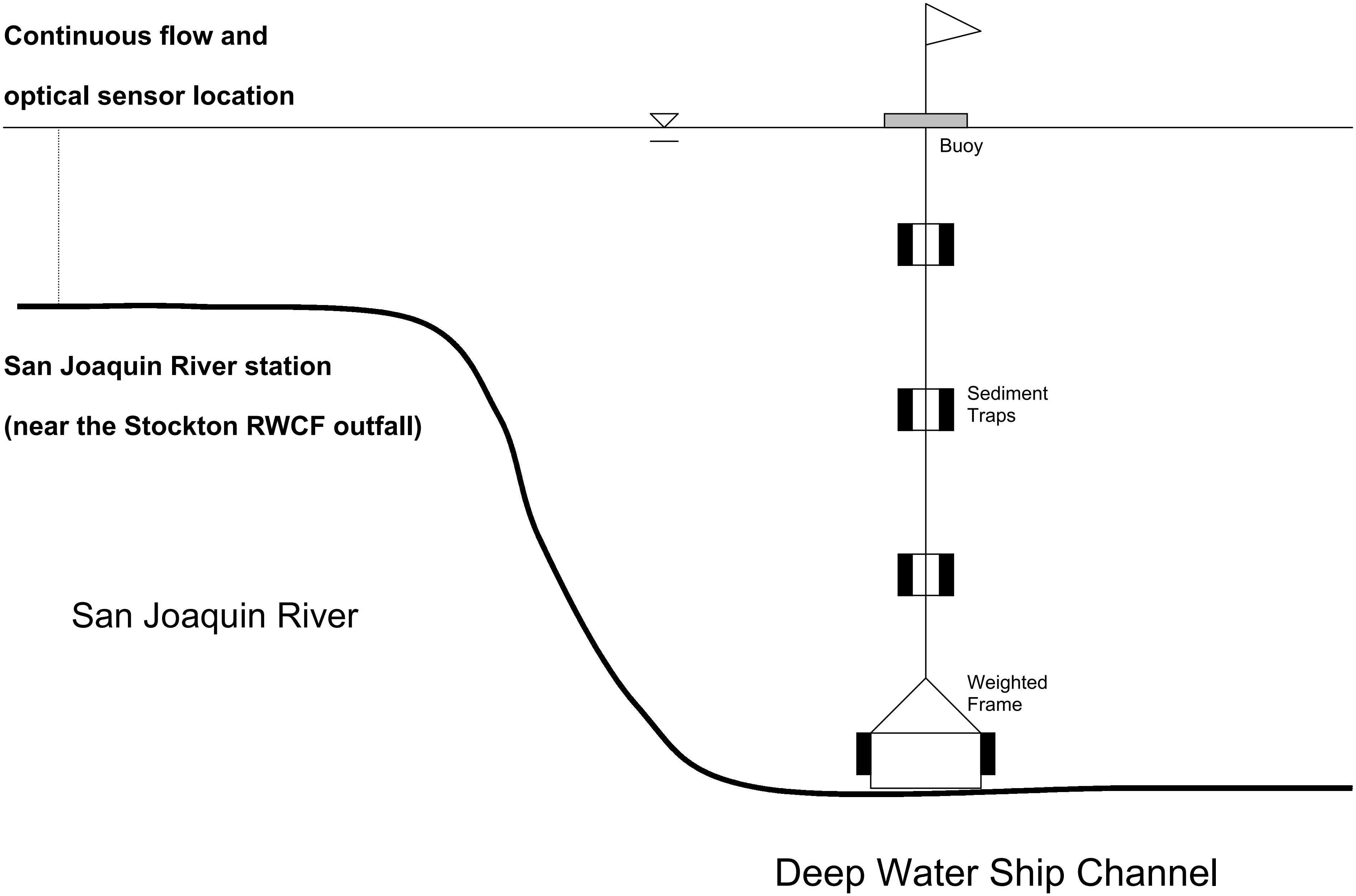

Figure II- 2: Typical Schematic Diagram of a Sediment Trap Station

Table II-1: Dates and approximate times sediment traps were deployed.

Date	Time of Deployment and Recovery	Tide Conditions	Tidal State(s)	Times of Slack Tides	Slack Tide Stage (ft)	Slack Level
7/27/00	Deployed:	3 days before	2 flood	10:41	-0.1	LL
	10:41AM	spring tide	and	16:48	4.3	LH
			2 ebb	22:10	2.6	HL
7/28/00	Recovered:		tides	3:33	6.7	HH
	11:34 AM			11:34	-0.07	LL
				18:46	4.6	LH
8/16/00	Deployed:	2 days	2 flood	7:05	6.0	HH
	7:05 AM	after spring	and	14:37	0.0	LL
		tide	2 ebb	20:34	5.1	LH
8/17/00	Recovered:		tides	2:41	2.4	HL
	7:44 AM			7:44	5.8	HH
8/31/00	Deployed:	3 days	2 flood	7:45	0.32	LL
	7:45 AM	after spring	and	15:00	4.0	HH
9/1/00		tide	2 ebb	21:00	0.53	HL
	Recovered:		tides	3:00	3.54	LH
	8:45 AM			8:45	0.62	LL
9/14/00	Deployed:	1 day	2 flood	6:53	5.7	HH
	6:53 AM	after spring	and	14:02	0.5	LL
		tide	2 ebb	19:41	5.4	LH
9/15/00	Recovered:		tides	2:18	1.5	HL
	7:35 AM			7:35	5.6	HH
9/28/00	Deployed: 7:00		Ebb tide	7:00	3.79	HH
	Recovered: 13:45			13:45	0.51	LL
		1 day after				
	Redeployed: 13:45	spring tide	Flood tide	13:45	0.51	LL
	Recovered: 19:30			19:30	3.68	LH
10/19/00	Deployed: 6:30	At neap tide	Flood tide	6:30	-0.06	LL
	Recovered: 12:30		Ebb tide	12:30	2.88	LH
	Redeployed: 12:30			12:30	2.88	LH
	Recovered: 17:00			17:00	1.25	HL
11/9/00	Deployed: 3:30		Ebb tide	3:30	2.99	LH
11/10/00	Recovered: 10:00	2 days before		10:00	0.22	LL
		spring tide				
	Redeployed: 10:00		Flood tide	10:00	0.22	LL
	Recovered: 16:15			16:15	3.58	HH

LL: Low-Low Slack Tide HL: High-Low Slack Tide
HH: High-High Slack Tide LH: Low-High Slack Tide

Field measurements of water temperature, electrical conductivity, pH, dissolved oxygen were performed with a YSI 600 sonde at each water station and depth. Dissolved oxygen measurements were verified at each trap station with a YSI 55 dissolved oxygen meter and with periodic titrations using the winkler method (APHA *et al.*, 1998). Turbidity measurements were performed in the field with samples collected with the peristaltic pump system at each station and depth. Secchi depth measurements were conducted at each station using a 6-inch secchi disk. Intensities of photosynthetically radiation (PAR) were also measured occasionally in the DWSC using a LI-COR LI-193 SA Spherical Quantum Sensor. Where applicable, field instruments were calibrated with standard solutions in the field prior to measurement, periodically checked thereafter, and at the end of the day.

Water Quality Measurements in the DWSC and San Joaquin River.

Water quality parameters were measured by the field *in-situ* or laboratory methods described earlier. Water quality constituent concentrations were needed to calculate settling velocities of the material captured in the sediment traps.

Field measurements

Water temperature, electrical conductivity, pH, dissolved oxygen, turbidity, and secchi depth measurements were performed on dates and times shown in Appendix A, Table A-1. These field measurements were not used directly to determine deposition rates or settling velocities, but provide qualitative information on water column mixing and stratification and also contribute to the data base used by the San Joaquin Technical Committee. The constituent values are presented in Appendix A, Tables A-2 to A-7. These data yield water column profiles that often suggest the San Joaquin River and DWSC are relatively well-mixed. However, turbidity measurements near the sediment-water interface are usually higher than the rest of the water column, indicating that sediment resuspension in the DWSC is common. Photosynthetically active radiation intensity data is located in Table A-13.

TSS,VSS, and chlorophyll a water concentrations in the DWSC and San Joaquin River.

Volatile suspended solids (VSS), total suspended solids (TSS), chlorophyll *a* (chl *a*), and the sum of chlorophyll *a* and pheophytin *a* (chl *a* + ph *a*) concentrations in the DWSC and the San Joaquin River are presented in Appendix A, Tables A-8 through A-12. Using these data, means and standard deviations were calculated for each station and depth to view general trends in the data. These averages and standard deviations are presented in Tables II-2. Figures II-3 through II-6 graphically display the average constituent concentrations relative to station location and trap depth. Error bars are used to display one standard deviation about the mean.

The average concentrations of all constituents typically decrease with distance downstream from the San Joaquin River. Exceptions to this are shown in Figure II-3 for TSS at Lt. 43 and Lt. 48 where near bottom concentrations at are higher than the concentrations entering from the San Joaquin River. Resuspension is the most likely cause of these elevated concentrations. A slight decrease in the average TSS concentrations is observed between Lt. 48 and Lt. 43 indicating that some of the suspended matter settles and remains buried at the channel bottom. The average TSS concentrations at depths above 7.5 m suggest that downstream of Lt. 48, the TSS concentration in the water column remains relatively constant. This indicates that settling and resuspension rates are on average similar. Volatile suspended solids concentrations exhibit similar patterns. The lower VSS concentrations at Lt. 38 compared with upgradient stations may suggest that resuspension of VSS is not as pronounced.

As shown in Figure II-5, the average chlorophyll *a* concentrations decrease with distance from the upper monitoring station in the San Joaquin River. The most significant reduction in concentration is observed at Lt. 48, just downstream of where the San Joaquin River flows into the DWSC and the water depth increases from approximately 12 feet to over 40 feet. Within the DWSC, chlorophyll *a* concentrations are remarkably uniform, evidence that mixing is sufficient to maintain uniform algae concentrations below the euphotic zone. Algal productivity in the euphotic zone may also be contributing to these uniform chlorophyll *a* gradients. Thus the decrease in chlorophyll *a* appears to be associated with the die-off of algae upon entrance to the DWSC from the San Joaquin River. Figure II-6 plots the sum of chlorophyll *a* and pheophytin *a* in the water column at each depth. The pheophytin *a* concentrations exhibit a slight gradient with depth which may suggest the resuspension of non-vital phytoplankton, possibly associated with inorganic sediments.

Table II-2. Average water concentrations of TSS, VSS, chlorophyll a, and chlorophyll *a* plus pheophytin *a* in the DWSC when sediment traps were deployed.

Location		Depth (ft)	TSS (mg/L)	VSS (mg/L)	Chl *a* (mg/L)	Chl *a*+Ph *a* (mg/L)
LT. 38	Avg	8.2	18.18	3.35	10.28	22.81
		16.4	21.42	3.56	9.37	21.80
		24.6	23.66	3.66	9.10	24.22
		B	24.74	3.95	9.24	24.04
	Std dev	8.2	4.35	1.17	4.19	11.48
		16.4	6.29	1.10	4.25	10.80
		24.6	6.00	0.96	3.46	12.32
		B	8.93	1.58	3.50	12.51
LT. 43	Avg	8.2	16.73	3.43	15.53	28.14
		16.4	19.26	3.67	14.07	29.31
		24.6	25.92	4.29	14.99	30.50
		B	37.56	5.59	15.03	35.00
	Std dev	8.2	2.77	1.13	8.93	16.69
		16.4	2.99	0.98	6.53	16.26
		24.6	7.50	1.22	7.57	17.59
		B	10.12	1.40	8.41	20.49
LT. 48	Avg	8.2	21.27	3.63	21.65	34.73
		16.4	24.07	3.86	20.72	34.59
		24.6	27.97	4.76	21.21	37.17
		B	35.43	5.12	20.52	39.19
	Std dev	8.2	3.94	0.71	12.59	19.87
		16.4	6.02	0.53	10.93	18.50
		24.6	6.93	1.38	11.05	20.49
		B	7.67	1.00	11.09	21.47

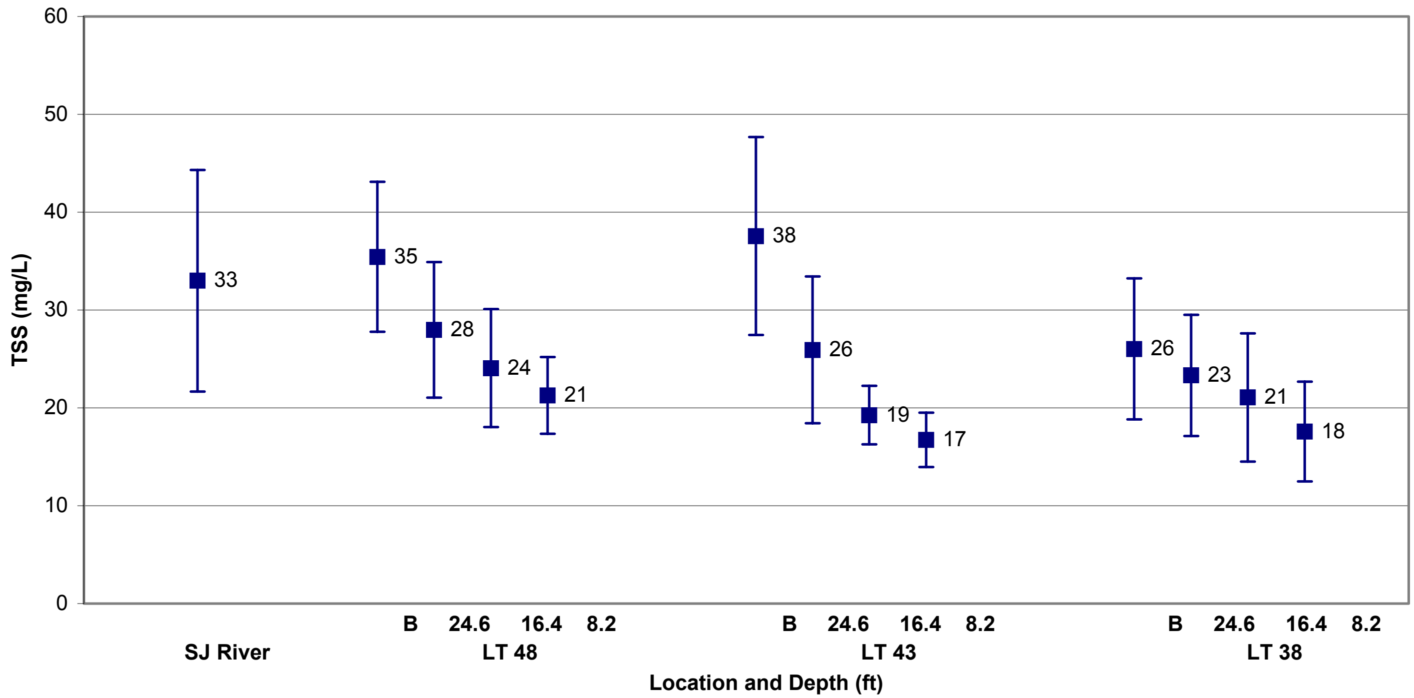

Figure II-3: Averages and standard deviations of TSS water concentrations in the DWSC during periods of trap deployment.

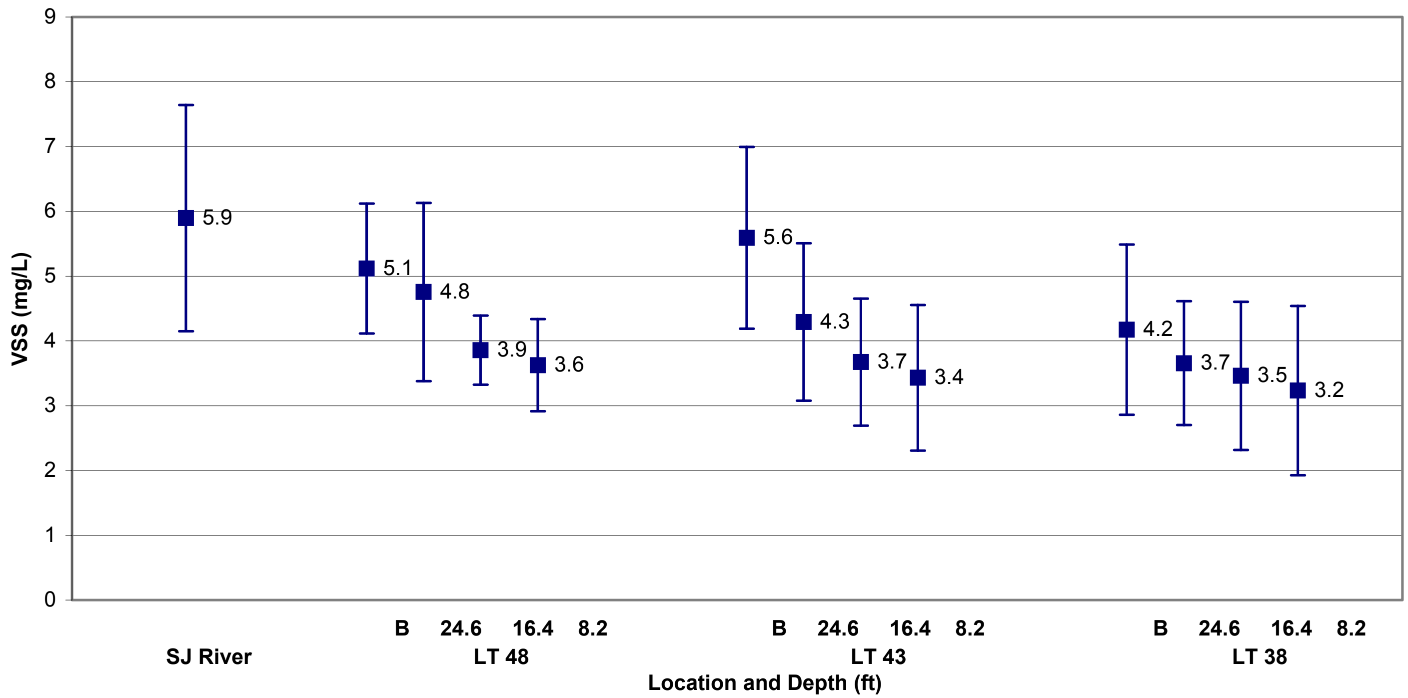

Figure II-4: Averages and standard deviations of VSS water concentrations in the DWSC during periods of trap deployment.

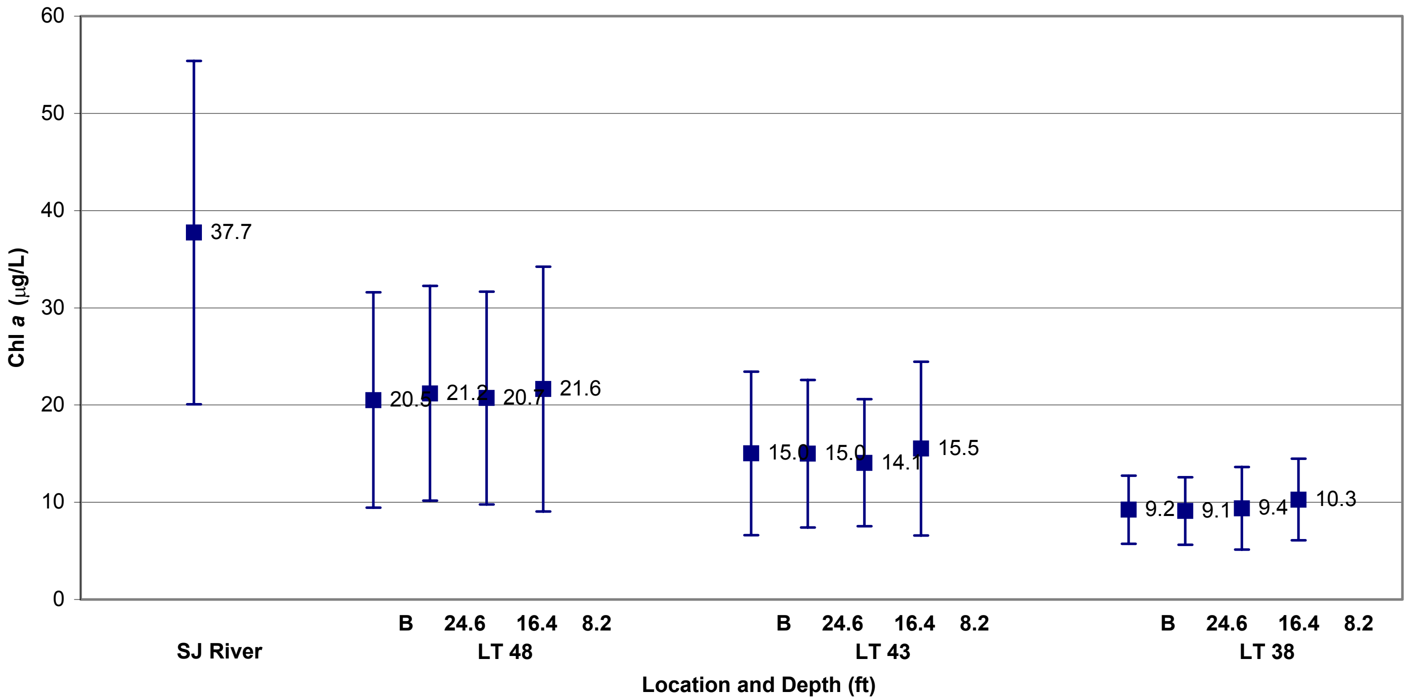

Figure II-5: Averages and standard deviations of chlorophyll *a* water concentrations in the DWSC during periods of trap deployment.

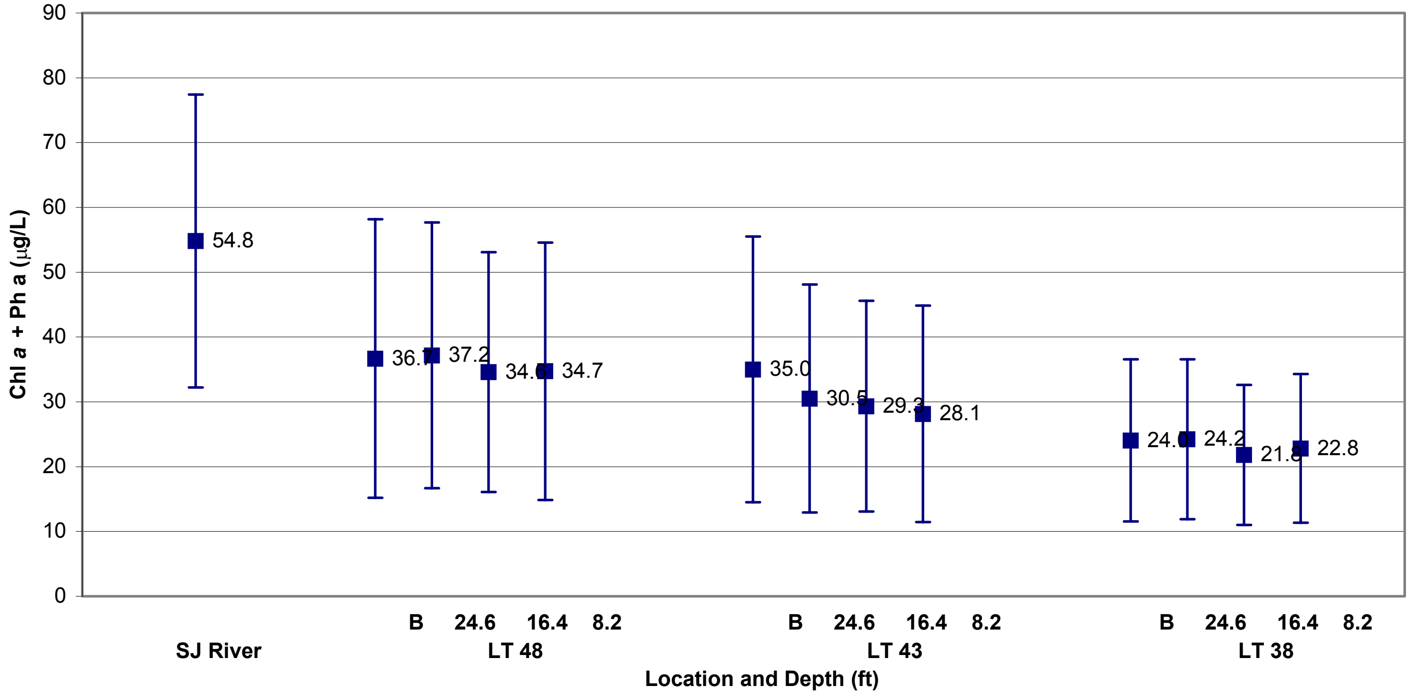

Figure II-6: Averages and standard deviations of chlorophyll *a* plus pheophytin *a* water concentrations in the DWSC during periods of trap deployment.

During the last three sediment trap monitoring days performed on September 28, October 19, and November 9 during the 2000 season, water and sediment samples were collected during the flood and ebb tides instead of collecting composite samples over both tidal conditions. Table II-3 contains the averages and standard deviations of TSS, VSS, chlorophyll *a*, and chlorophyll *a* plus pheophytin *a* concentrations. The means and standard deviations of these constituent concentrations during the two tidal regimes are presented in Figures II-7 through II-10. Water TSS concentrations were typically higher during ebb tides. This appears to be caused by the higher TSS concentrations entering the from the San Joaquin River under ebb flow conditions. During flood tides, the flow direction past the sediment traps is reversed and contains less suspended matter since some sediment has settled out in the DWSC. Differences in concentrations during ebb and flood tides are most pronounced at Lt. 48 since most of the settling and burial occurs near this station where the San Joaquin River enters the DWSC.

Trends in the VSS concentrations in the DWSC during flood and ebb tides are not as consistent as those observed for TSS. At Lt. 43 average VSS concentrations were higher during the flood tides when compared with the ebb tides. However, at all the trap stations the differences in VSS concentrations were relatively small relative to the standard deviation. Even in the San Joaquin River, little difference in VSS concentrations were measured between flood and ebb tides. These data may suggest that suspended organic matter is less subject to burial at the bottom of the DWSC than the heavier inorganic sediments. As shown in Figures II-9 and II-10, chlorophyll *a* and pheophytin *a* concentrations also appear to be independent of the tides. However, the standard deviations associated with these data are significant. These averages rely on data collected during late September through November, a time period in which chlorophyll *a* concentrations decreased from approximately 35 to 5 μg L, yielding high standard deviations shown in Figures II-9 and II-10. Data collected during June and July, 2001 show significant differences between flood and ebb tides suggesting that addition monitoring is necessary to better evaluate tidal conditions on phytoplankton concentrations.

Table II-3 Averages and standard deviations for water concentrations measured in the DWSC for ebb and flood tides.

Location	Ebb tide	Depth	TSS (mg/L)	VSS (mg/L)	Chl *a* (μg/L)	Chl *a*+Ph *a* (μg/L)
LT. 38	Avg	8.2	14.55	2.22	10.36	15.99
		16.4	18.12	2.96	8.01	17.10
		24.6	20.84	3.46	7.70	17.55
		B	15.19	2.23	8.13	17.00
	Std dev	8.2	1.14	0.40	6.82	10.17
		16.4	3.79	0.91	3.50	9.67
		24.6	5.12	1.02	3.48	9.03
		B	5.90	0.74	3.96	8.55
LT. 43	Avg	8.2	14.86	2.70	12.00	22.63
		16.4	17.23	2.99	11.34	22.41
		24.6	19.92	3.33	11.32	21.02
		B	34.18	4.83	11.40	25.94
	Std dev	8.2	2.56	0.79	7.37	16.28
		16.4	1.04	0.39	6.30	16.54
		24.6	5.10	0.85	6.86	13.51
		B	10.44	1.87	5.90	16.64
LT. 48	Avg	8.2	17.88	3.18	18.61	25.76
		16.4	27.61	4.07	15.36	25.24
		24.6	26.25	3.97	16.66	27.70
		B	31.18	4.35	14.88	24.98
	Std dev	8.2	3.02	0.80	17.15	20.98
		16.4	4.67	0.31	9.26	14.48
		24.6	1.37	0.40	9.80	16.77
		B	8.74	0.22	9.54	15.48

	Flood Tide	Depth	TSS	VSS	Chl *a*	Chl *a*+Ph *a*
LT. 38	Avg	8.2	16.10	2.83	9.25	17.92
		16.4	16.89	2.78	9.60	16.26
		24.6	18.96	2.87	8.92	17.24
		B	23.00	3.55	7.70	18.52
	Std dev	8.2	2.46	0.34	3.87	10.52
		16.4	2.62	0.80	5.88	10.10
		24.6	3.06	0.81	4.11	10.25
		B	3.82	0.56	3.68	12.59
LT. 43	Avg	8.2	15.25	3.00	14.52	21.57
		16.4	17.23	3.39	11.60	19.86
		24.6	23.58	4.02	11.60	20.85
		B	31.88	5.08	11.62	22.87
	Std dev	8.2	1.30	0.60	10.70	16.29
		16.4	0.25	0.60	6.68	13.23
		24.6	3.18	0.89	6.38	14.01
		B	6.21	1.32	8.21	18.06
LT. 48	Avg	8.2	23.56	3.78	16.08	25.21
		16.4	21.02	3.60	15.64	24.84
		24.6	24.57	4.08	14.93	25.39
		B	37.79	4.77	15.12	30.61
	Std dev	8.2	2.62	0.51	10.06	17.22
		16.4	4.74	0.40	10.99	18.01
		24.6	4.82	0.25	10.54	18.68
		B	10.39	1.24	10.76	20.13

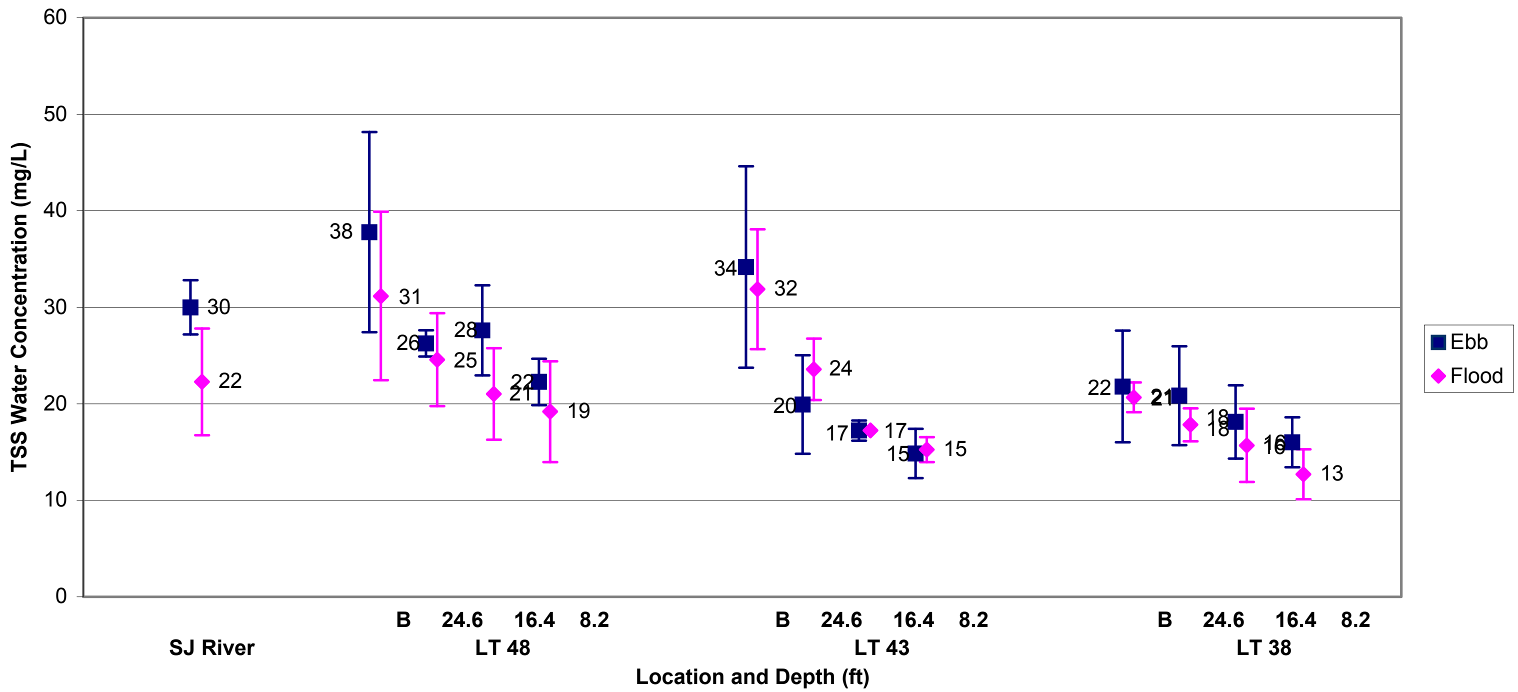

Figure II-7: Averages and standard deviations of TSS water concentrations in the DWSC for flood and ebb tides during periods of trap deployment.

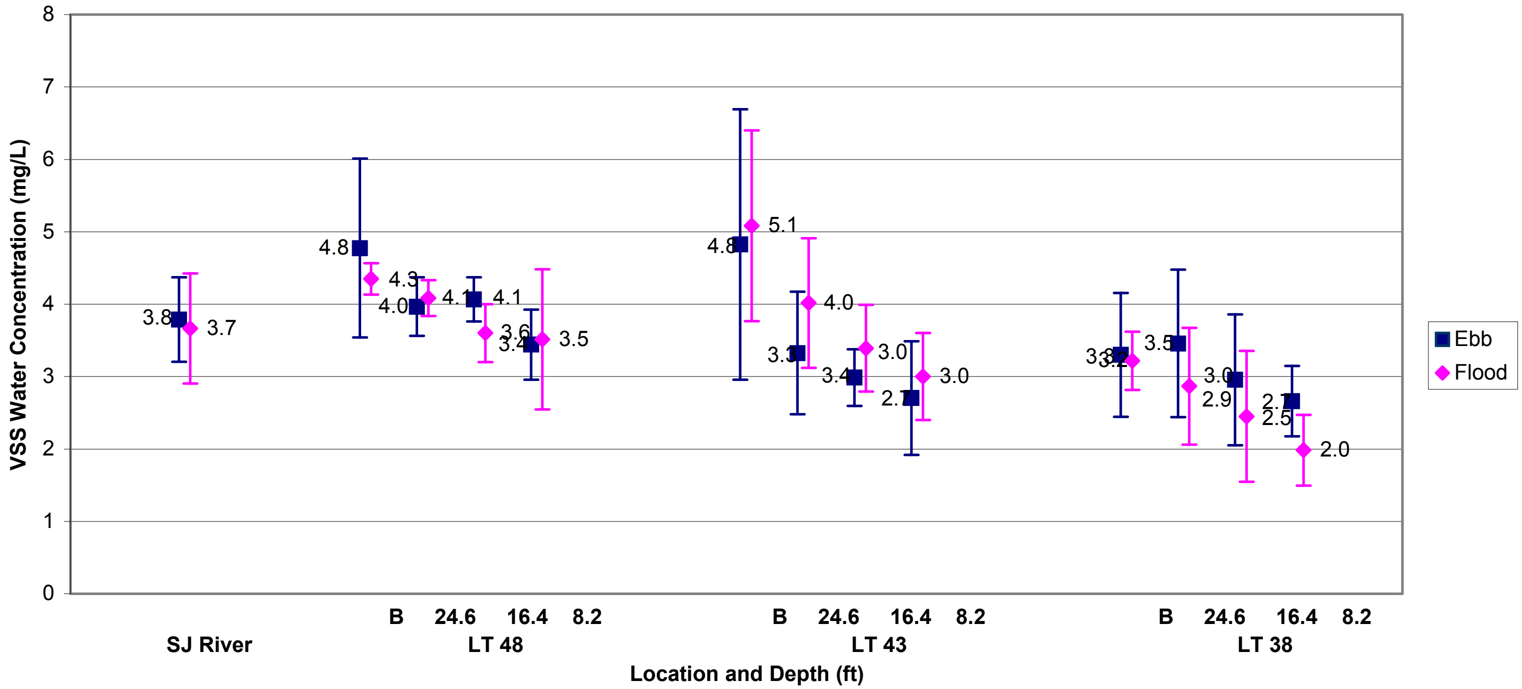

Figure II-8: Averages and standard deviations of VSS water concentrations in the DWSC for flood and ebb tides during periods of trap deployment.

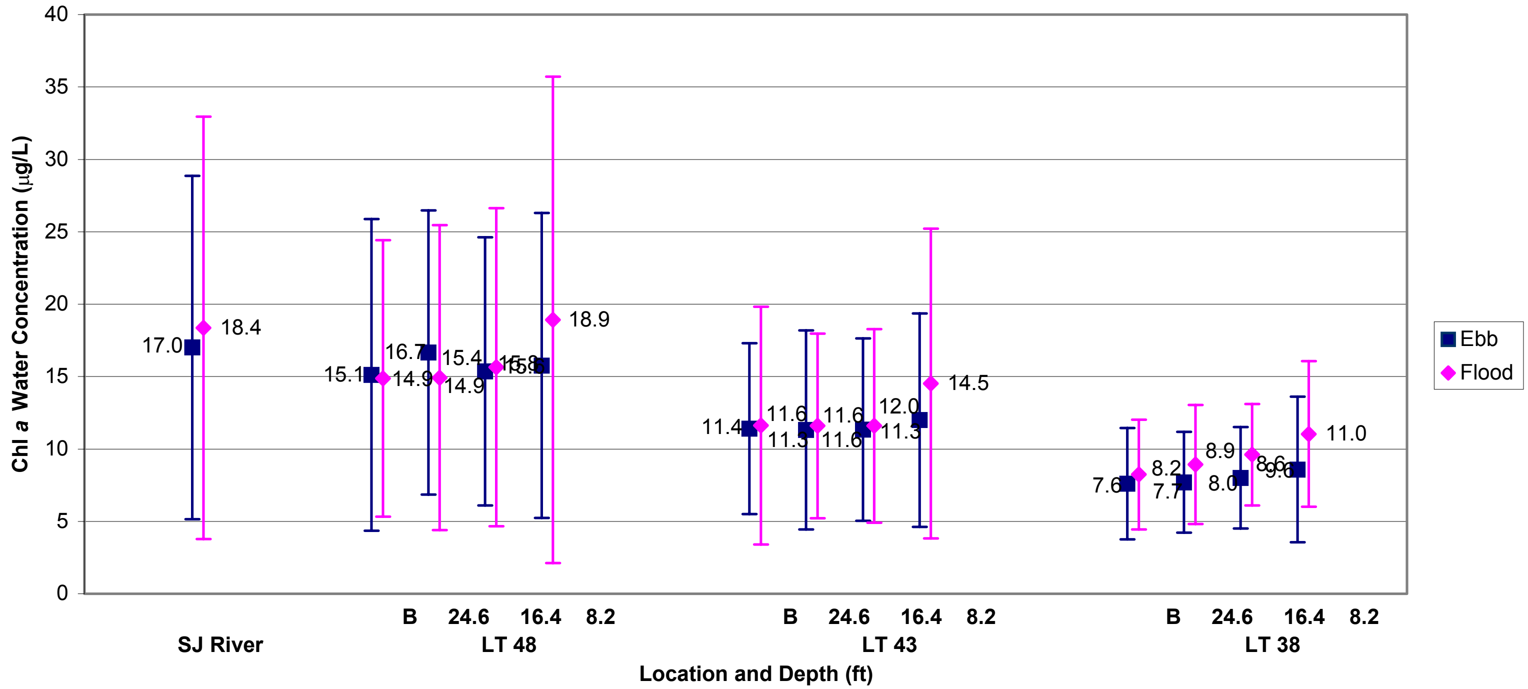

Figure II-9: Averages and standard deviations of chlorophyll *a* water concentrations in the DWSC for flood and ebb tides during periods of trap deployment.

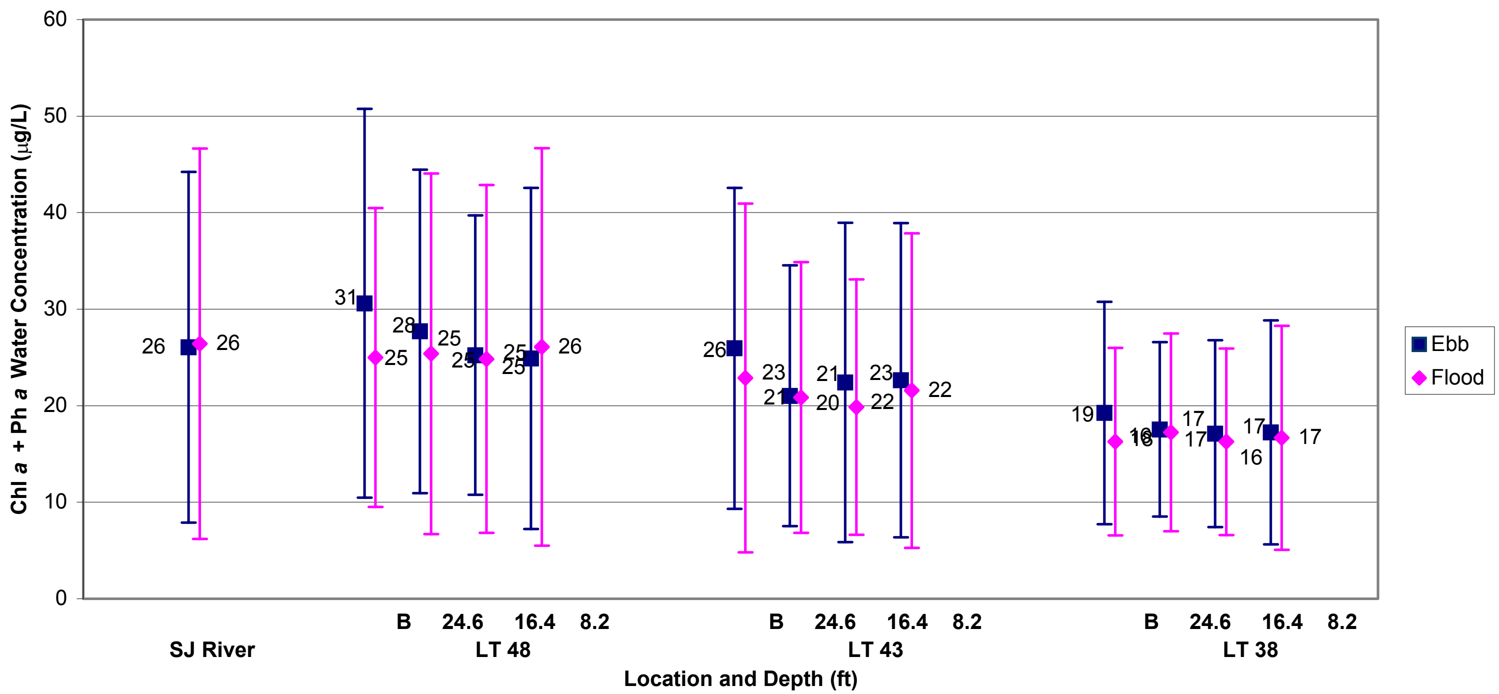

Figure II-10: Averages and standard deviations of chlorophyll *a* plus pheophytin *a* water concentrations in the DWSC for flood and ebb tides during periods of trap deployment.

Deposition Fluxes of Trapped Sediments in the DWSC

The deposition fluxes of TSS, VSS, chlorophyll *a*, and chlorophyll *a* plus pheophytin *a* captured in the sediment traps are presented in Appendix B, Tables B-1 through B-4. Averages and standard deviations of the deposition fluxes at each station and depth are provided in Table II-4 and are shown in Figures II-11 through II-14.

Figure II-11 presents the deposition fluxes for TSS in the DWSC. Deposition is greatest at Lt. 48 with significantly lower deposition fluxes at the downstream stations (Lt. 38 and Lt. 43). The data suggest that most of the sediment burial occurs between Lt. 48 and Lt. 43 since the fluxes at Lt. 43 and Lt. 38 are similar. The deposition fluxes are also dependent on depth with the highest deposition rates measured near the channel bottom. Sediment resuspension appears to be the cause of this flux profile in the water column. The TSS fluxes at Lt. 38 are somewhat higher than at Lt. 43. This may be caused by wind induced resuspension since the orientation of the DWSC is more exposed to westerly winds at Lt. 38 than at Lt. 43. The differences may also be associated with the location of the traps; the station at Lt. 43 is nearer the south bank while the Lt. 38 station is closer to the north bank. Lateral variability will be assessed during the 2001 season.

The fluxes of VSS, chlorophyll *a*, and pheophytin *a* all exhibit similar deposition behavior observed for TSS as shown in Figures II-12 through II-14. This suggests that the settling of organic matter and algae may be associated with the settling TSS. As discussed later, calculations of settling velocities and the strong correlation observed for VSS and TSS for the trapped sediments further support this hypothesis.

Table II-4: Averages and standard deviations of deposition fluxes in the DWSC.

		Depth (ft)	TSS (g/m^2hr)	VSS (g/m^2hr)	Chla (mg/m^2hr)	Chla+Pha (mg/m^2hr)
LT. 38	Avg	8.2	9.9	1.0	1.05	3.31
		16.4	18.1	1.7	1.20	5.58
		24.6	26.3	2.5	1.47	7.21
		B	38.1	3.3	1.60	9.76
	Std dev	8.2	2.0	0.3	0.85	2.55
		16.4	4.7	0.7	1.02	3.91
		24.6	11.7	1.4	1.02	5.24
		B	11.1	1.6	1.14	7.04
LT. 43	Avg	8.2	6.1	0.7	1.06	3.22
		16.4	11.8	1.3	1.46	4.83
		24.6	20.1	2.0	2.08	7.06
		B	47.3	4.6	3.51	17.29
	Std dev	8.2	1.6	0.2	0.85	2.10
		16.4	1.7	0.2	1.09	3.14
		24.6	6.7	0.6	1.36	4.84
		B	23.3	2.6	2.06	9.94
LT. 48	Avg	8.2	23.8	2.1	2.41	6.88
		16.4	40.6	3.5	3.02	10.30
		24.6	59.8	5.1	4.22	13.42
		B	92.5	7.4	4.72	22.51
	Std dev	8.2	9.9	0.8	1.97	4.27
		16.4	17.5	1.3	1.87	6.75
		24.6	22.8	1.9	2.71	7.93
		B	36.4	2.6	2.25	12.16

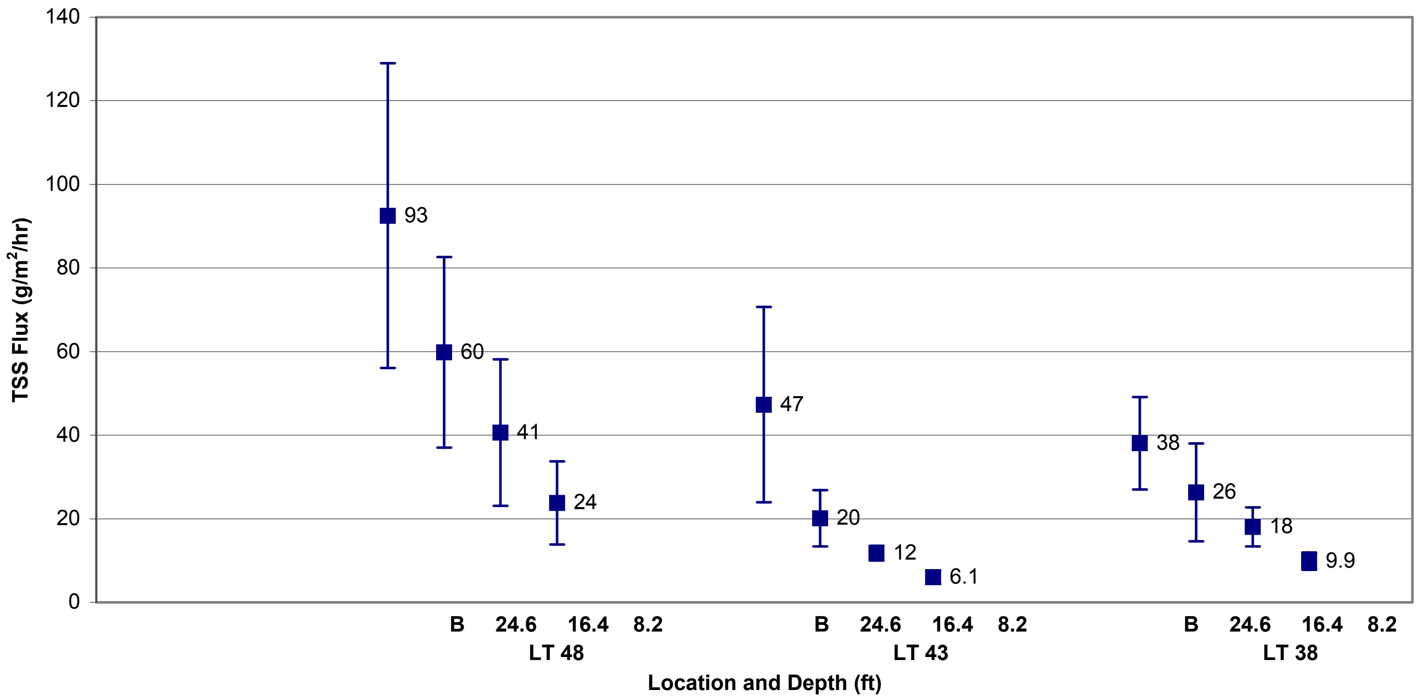

Figure II-11: Averages and standard deviations of TSS deposition fluxes in the DWSC during periods of trap deployment.

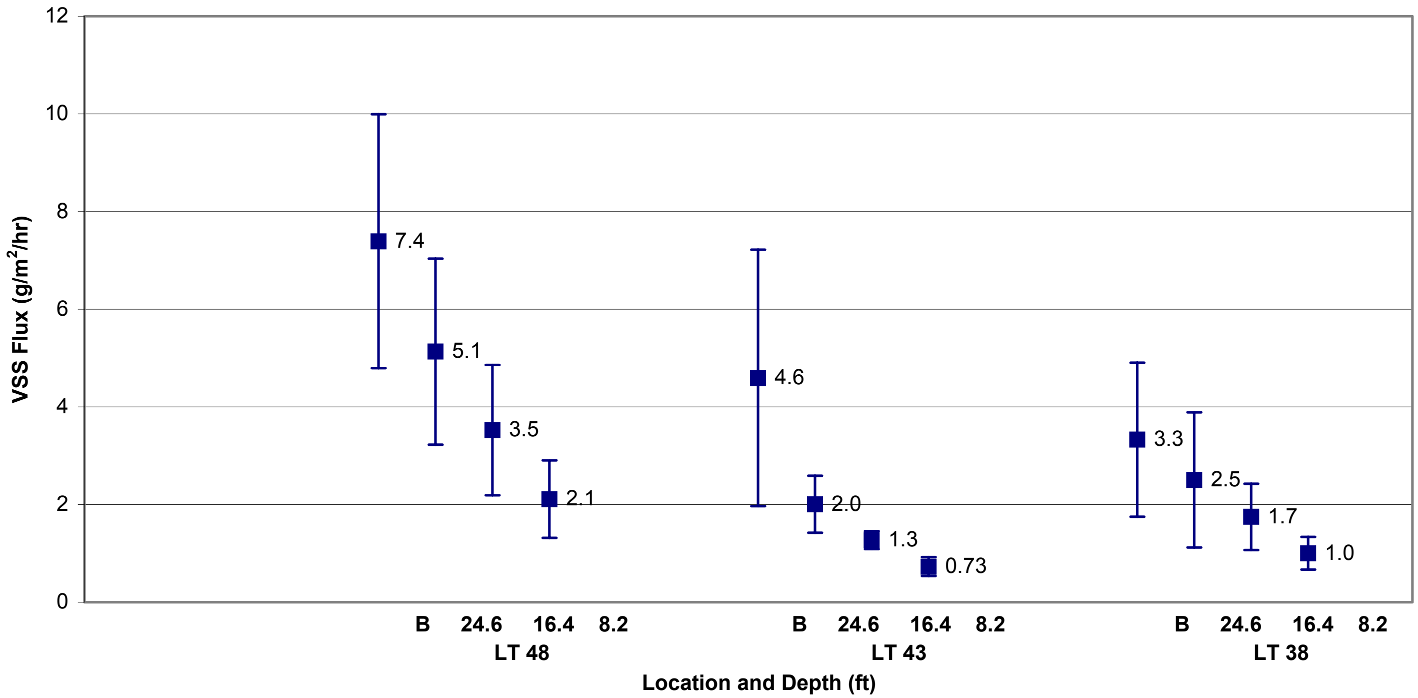

Figure II-12 Averages and standard deviations of VSS deposition fluxes in the DWSC during periods of trap deployment.

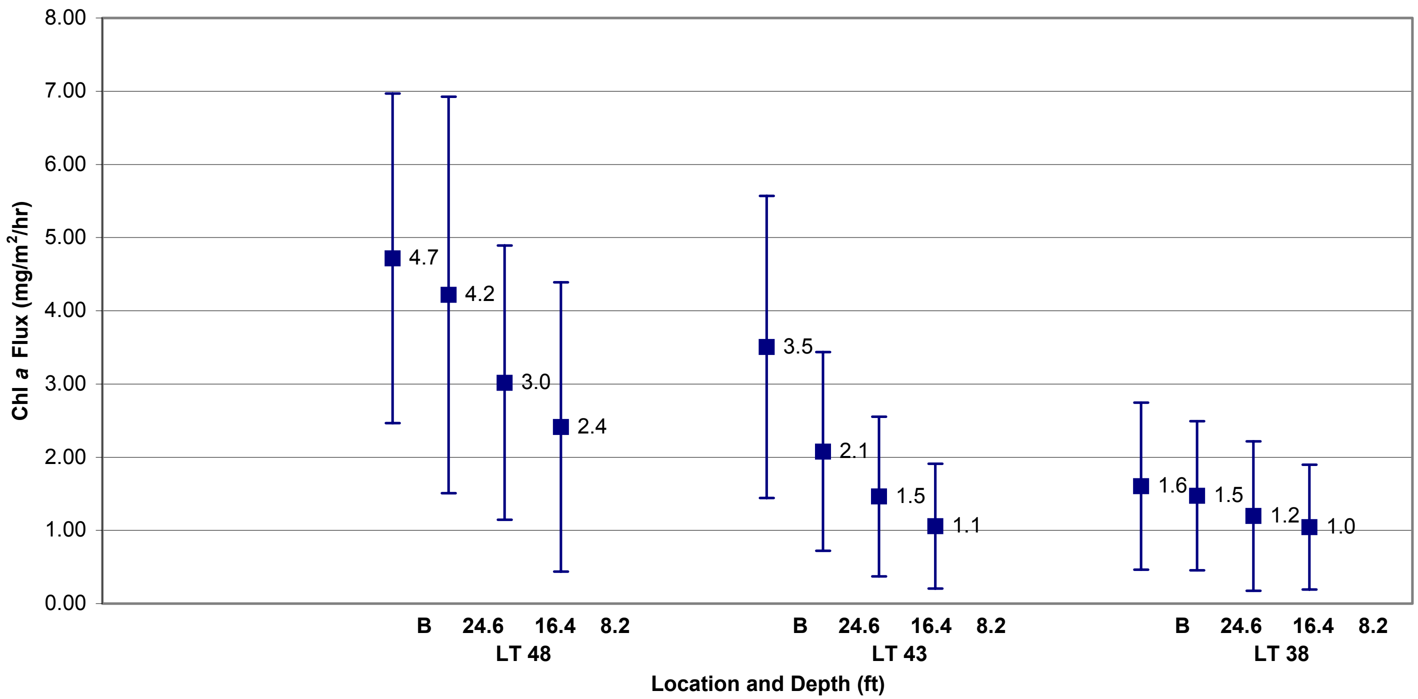

Figure II-13: Averages and standard deviations of chlorophyll *a* deposition fluxes in the DWSC during periods of trap deployment.

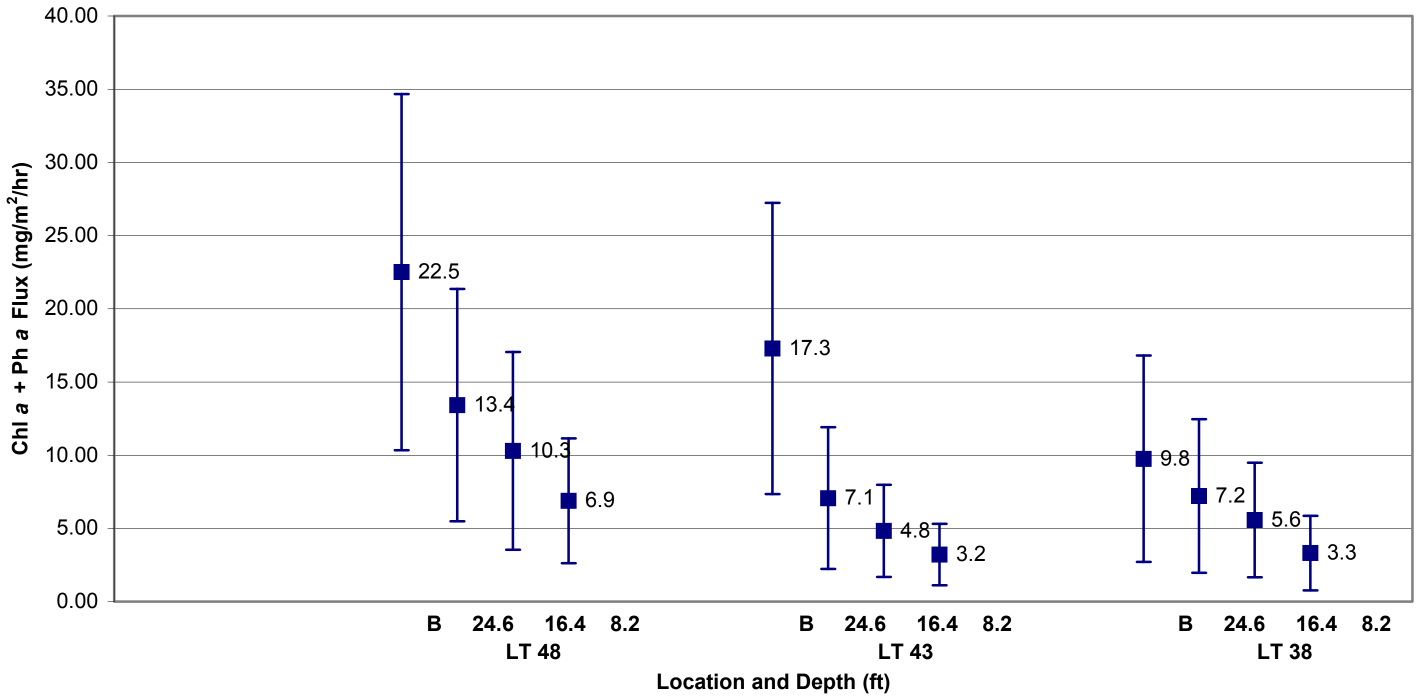

Figure II-14: Averages and standard deviations of chlorophyll *a* plus pheophytin *a* deposition fluxes in the DWSC during periods of trap deployment.

Deposition fluxes of TSS, VSS, chlorophyll *a*, and chlorophyll *a* plus pheophytin *a* for ebb and flood tides were measured on September 28, October 19, and November 9 of 2000. Average values and standard deviations of these data are listed in Table II-5. Plots of the tidal deposition fluxes are presented in Figures II-15 through II-18.

As shown in Figure II-15, the TSS deposition is consistently higher during ebb tides. This is consistent with higher TSS concentrations input from the San Joaquin River during ebb flows. The difference between flood and ebb tide deposition fluxes decreases with the distance downstream from the Port of Stockton and is probably associated with sediment burial between Lt. 48 and Lt. 43. At Lt. 43 and Lt.38 there is little difference between the deposition fluxes measured during ebb and flood tides. Figure II-16 indicates that VSS deposition fluxes behave similarly to the TSS deposition pattern. Again higher deposition fluxes were observed during ebb tides.

Unlike the VSS and TSS deposition fluxes, the chlorophyll *a* and pheophytin *a* fluxes do not seem to be influenced by ebb or flood tides. This tidal independence was also evident with the water concentrations presented earlier. As will be shown later, these measurements contradict good correlations of chlorophyll *a* with TSS for the trapped sediments. As discussed for the water concentrations, additional measurements are needed to resolve these differences.

Table II-5: Averages and standard deviations of deposition fluxes measured during flood or ebb tides.

Ebb tide

Location		Depth (ft)	TSS ($g/m^2/hr$)	VSS ($g/m^2/hr$)	Chl *a* ($mg/m^2/hr$)	Chl *a*+Ph *a* ($mg/m^2/hr$)
LT. 38	Avg	8.2	9.11	1.05	1.07	3.20
		16.4	15.48	1.71	1.18	4.99
		24.6	23.78	2.48	1.43	6.31
		B	36.95	3.75	1.58	9.84
	Std dev	8.2	0.91	0.17	0.90	2.59
		16.4	4.39	0.51	1.12	4.22
		24.6	9.32	0.99	1.17	5.30
		B	18.44	1.93	1.45	8.82
LT. 43	Avg	8.2	5.24	0.64	1.14	2.44
		16.4	11.87	1.26	1.63	4.61
		24.6	19.78	2.06	1.89	6.01
		B	47.30	4.57	3.44	17.67
	Std dev	8.2	2.82	0.23	0.98	1.91
		16.4	0.30	0.11	1.33	3.86
		24.6	3.57	0.41	1.53	5.20
		B	33.61	3.58	3.20	14.93
LT. 48	Avg	8.2	32.42	2.72	2.41	7.40
		16.4	57.18	4.57	3.05	10.75
		24.6	78.85	6.37	3.75	13.45
		B	112.44	8.55	3.60	18.01
	Std dev	8.2	4.82	0.51	2.18	6.04
		16.4	9.04	0.92	2.47	8.74
		24.6	8.16	1.27	3.09	10.79
		B	33.34	2.43	2.97	15.50

Flood tide

			TSS	VSS	Chl *a*	Chl *a*+Ph *a*
LT. 38	Avg	8.2	9.19	0.81	1.02	3.43
		16.4	16.02	1.33	1.35	4.93
		24.6	21.39	1.82	1.40	5.82
		B	32.95	2.31	1.53	7.54
	Std dev	8.2	1.01	0.42	1.00	3.08
		16.4	2.41	0.89	1.32	4.48
		24.6	5.60	1.34	1.29	5.14
		B	3.53	1.79	1.33	6.57
LT. 43	Avg	8.2	6.95	0.85	1.22	2.91
		16.4	10.70	1.17	1.48	3.89
		24.6	15.89	1.61	1.67	5.17
		B	56.07	5.98	3.61	14.10
	Std dev	8.2	0.32	0.19	1.14	2.66
		16.4	1.30	0.18	1.49	3.74
		24.6	4.36	0.43	1.64	5.32
		B	25.62	3.21	0.91	0.58
LT. 48	Avg	8.2	17.57	1.64	2.86	5.81
		16.4	29.30	2.72	2.64	6.67
		24.6	42.57	4.21	4.20	10.51
		B	81.72	6.78	5.09	18.79
	Std dev	8.2	14.74	1.11	2.85	4.87
		16.4	24.69	1.97	2.34	5.47
		24.6	31.27	2.89	3.91	8.49
		B	74.00	5.19	1.42	0.68

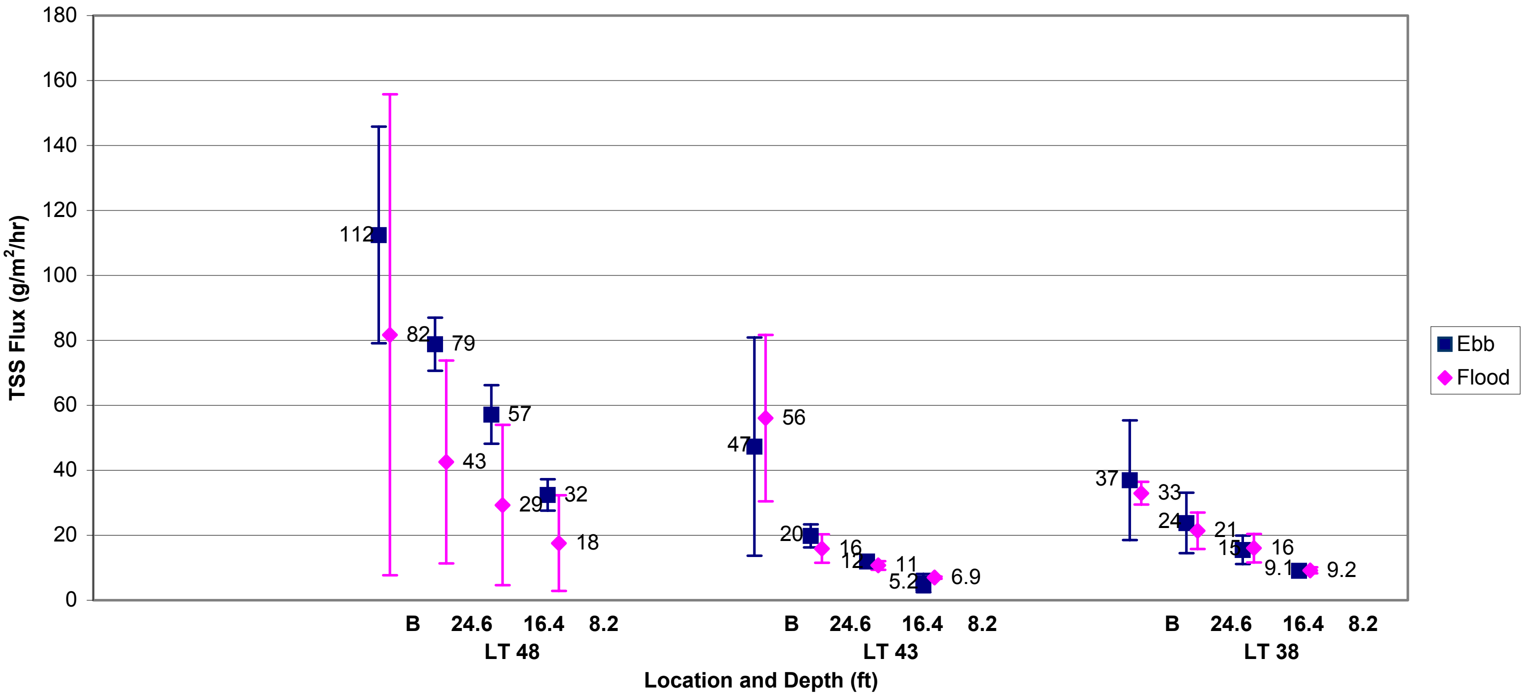

Figure II-15: Averages and standard deviations of TSS deposition fluxes in the DWSC for flood and ebb tides during periods of trap deployment.

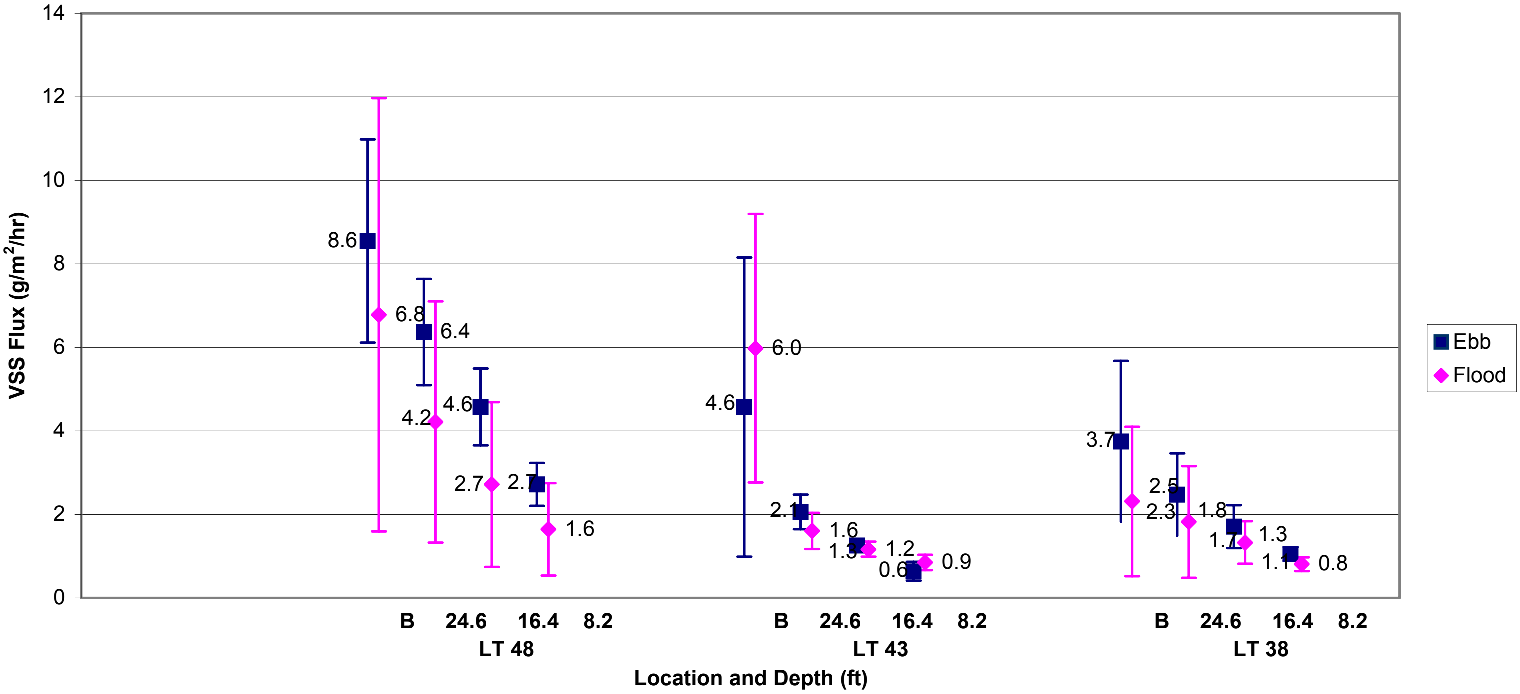

Figure II-16: Averages and standard deviations of VSS deposition fluxes in the DWSC for flood and ebb tides during periods of trap deployment.

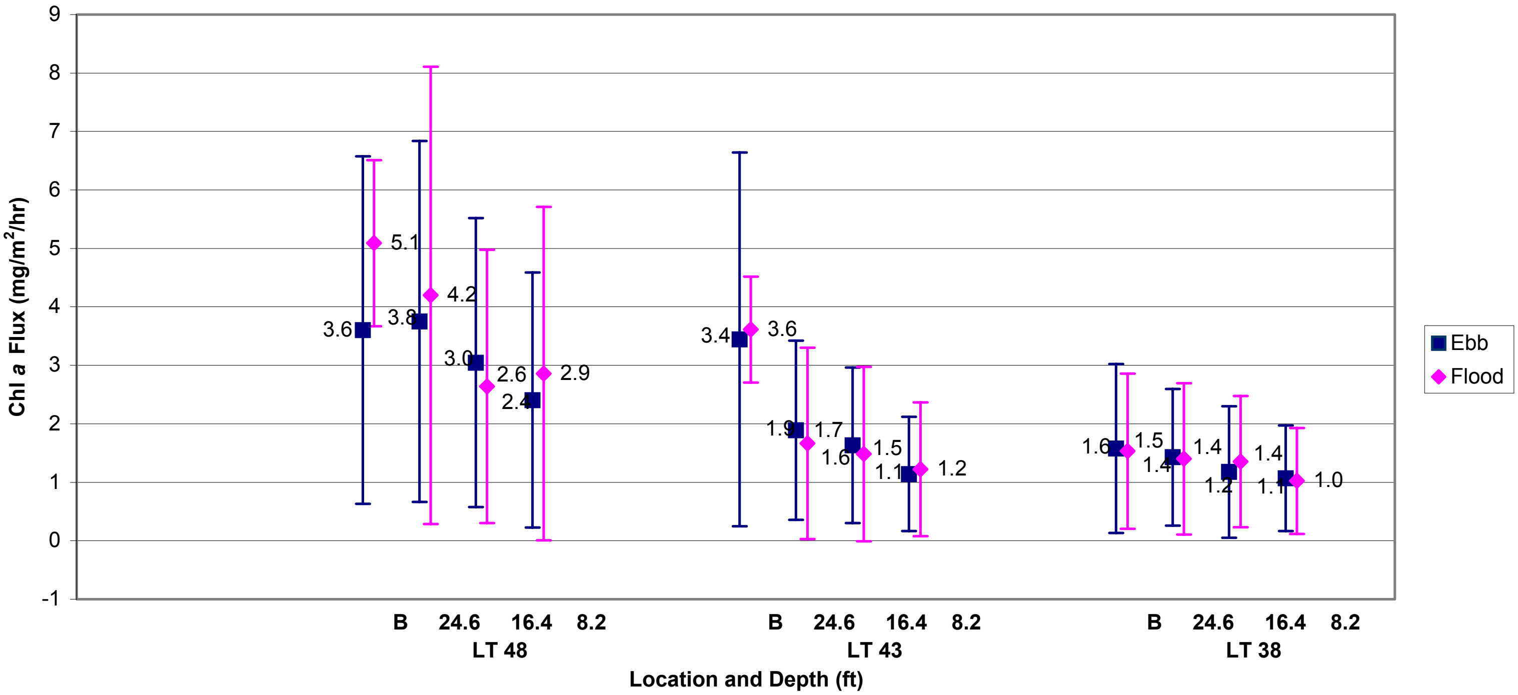

Figure II-17: Averages and standard deviations of chlorophyll *a* deposition fluxes in the DWSC for flood and ebb tides during periods of trap deployment.

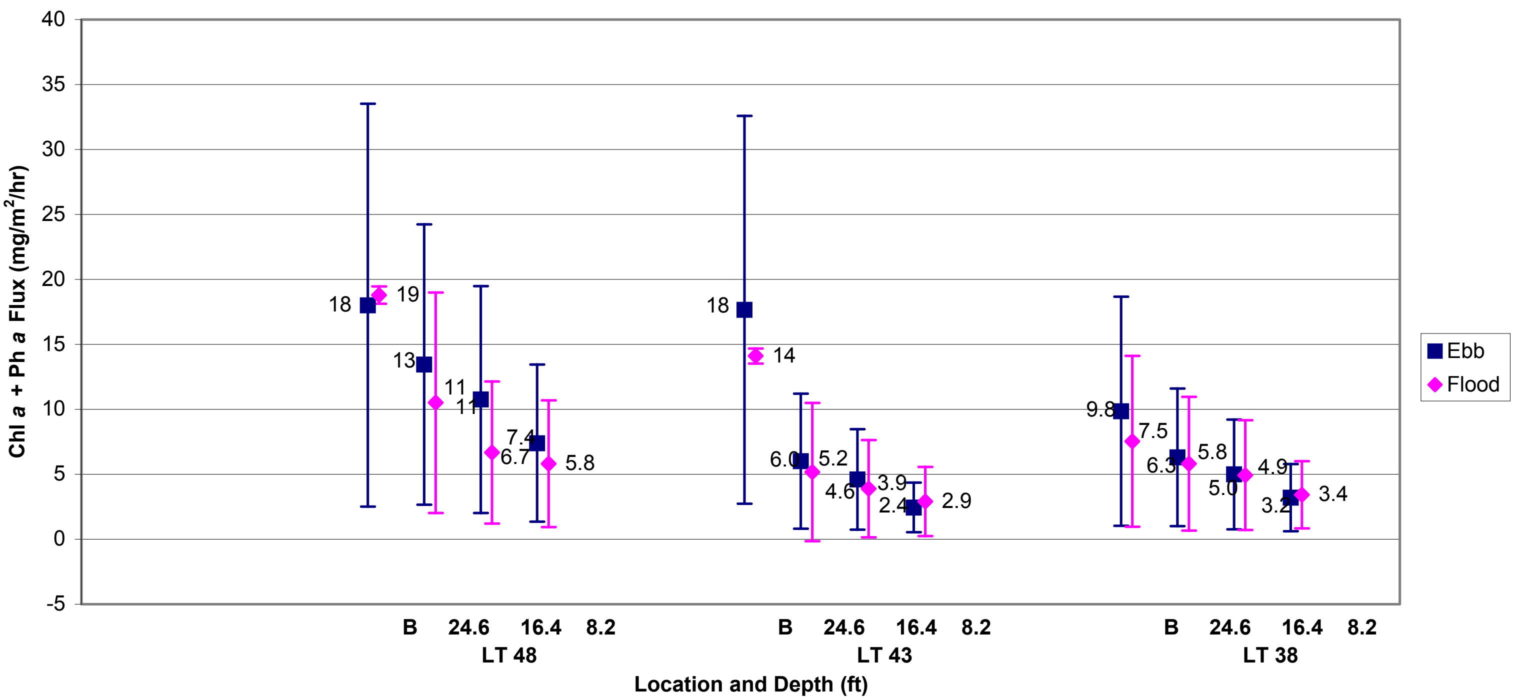

Figure II-18: Averages and standard deviations of chlorophyll *a* plus pheophytin *a* deposition fluxes in the DWSC for flood and ebb tides during periods of trap deployment.

Settling Velocities of Trapped Sediments in the DWSC.

Settling velocities of TSS, VSS, chlorophyll *a*, and chlorophyll *a* plus pheophytin *a* were calculated at each trap by dividing the deposition flux by the water concentration. These results are presented in Appendix C, Tables C-1 through C-4. The averages and standard deviations of these settling velocities are presented in Table II-6 and plotted in Figures II-19 through II-22.

The settling velocities of TSS decrease with distance above the channel bottom and were lowest downstream of Lt. 48. At each station, the highest settling rate was associated with the sediment trap located at the bottom of the channel. This appears to be associated with resuspension. Relatively heavy sediments can be resuspended high enough to be permanently captured in the sediment trap where turbulence is small relative to the water column. This trapping of the resuspended matter yields higher calculated settling velocities at the bottom trap because channel mixing is not energetic enough to carry the heavy particles higher in the water column. The relatively high settling rates calculated with trap deposition fluxes also provide evidence that resuspension is significant. At the settling rates presented here, the water column would be clear of particulate matter at Lt. 43 in the absence of resuspension. However, water concentration and deposition fluxes at Lt. 43 and Lt. 38 show that particulate concentrations are significant and appear to approach a overall steady condition where settling rates are approximately equal to resuspension rates.

Shown in Figures II-20 through II-22 are the calculated settling velocities of VSS, chlorophyll *a* and chlorophyll *a* plus pheophytin *a*. These data exhibit a similar pattern as the TSS results. Similar to the TSS data, these settling velocities for organic matter and algae are quite high suggesting again that resuspension is significant and that some fraction may be associated with the heavier inorganic sediments. The higher settling velocities for the pheophytin *a* compared with chlorophyll *a* may support this hypothesis. If pheophytin pigments are associated with dying or decaying algae, then the higher pheophytin settling velocities may be caused by non-vital algae bound to inorganic sediments that are subsequently resuspended in the water column and permanently captured in the sediment traps. The lower chlorophyll *a* settling velocities, when compared to pheophytin *a* values, may also be caused by algae that can regulate their position in the water column and thus avoid gravitational settling and capture in the traps.

Table II-6: Averages and standard deviations of settling velocities in the DWSC.

		Depth (m)	TSS	VSS	Chl a	Chl a+Ph a
LT. 38	Avg	2.5	0.612	0.372	0.088	0.159
		5.0	0.924	0.553	0.120	0.249
		7.5	1.178	0.734	0.161	0.297
		B	1.521	0.830	0.164	0.404
	Std dev	2.5	0.148	0.197	0.056	0.091
		5.0	0.132	0.226	0.086	0.132
		7.5	0.234	0.379	0.101	0.166
		B	0.296	0.374	0.118	0.213
LT. 43	Avg	2.5	0.369	0.228	0.063	0.113
		5.0	0.616	0.360	0.101	0.161
		7.5	0.839	0.508	0.128	0.215
		B	1.305	0.846	0.238	0.495
	Std dev	2.5	0.111	0.083	0.045	0.057
		5.0	0.083	0.075	0.077	0.083
		7.5	0.222	0.126	0.077	0.107
		B	0.670	0.509	0.199	0.310
LT. 48	Avg	2.5	1.139	0.617	0.106	0.209
		5.0	1.736	0.922	0.144	0.300
		7.5	2.271	1.208	0.191	0.373
		B	2.529	1.429	0.212	0.533
	Std dev	2.5	0.525	0.308	0.083	0.140
		5.0	0.784	0.356	0.089	0.196
		7.5	0.875	0.525	0.117	0.236
		B	1.011	0.595	0.093	0.220

B: two feet above channel bottom.

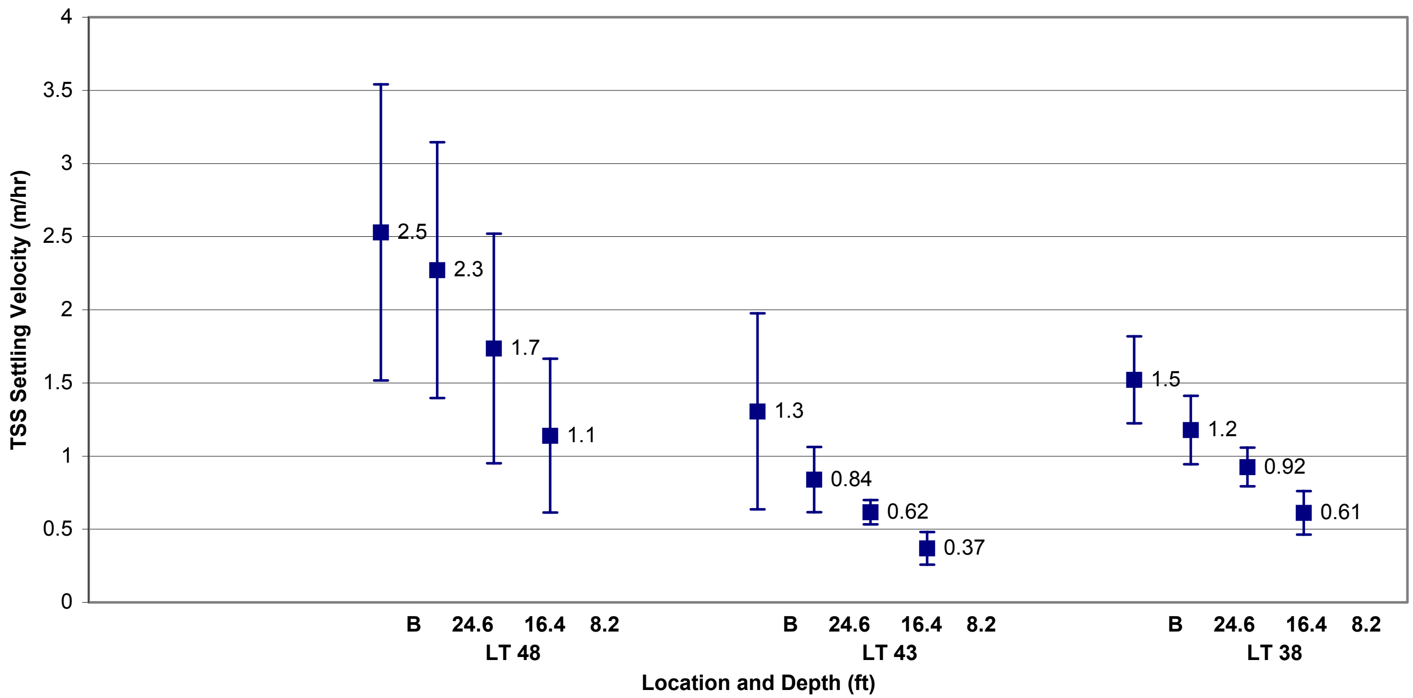

Figure II-19: Average and standard deviation of TSS settling velocities in the DWSC during periods of trap deployment.

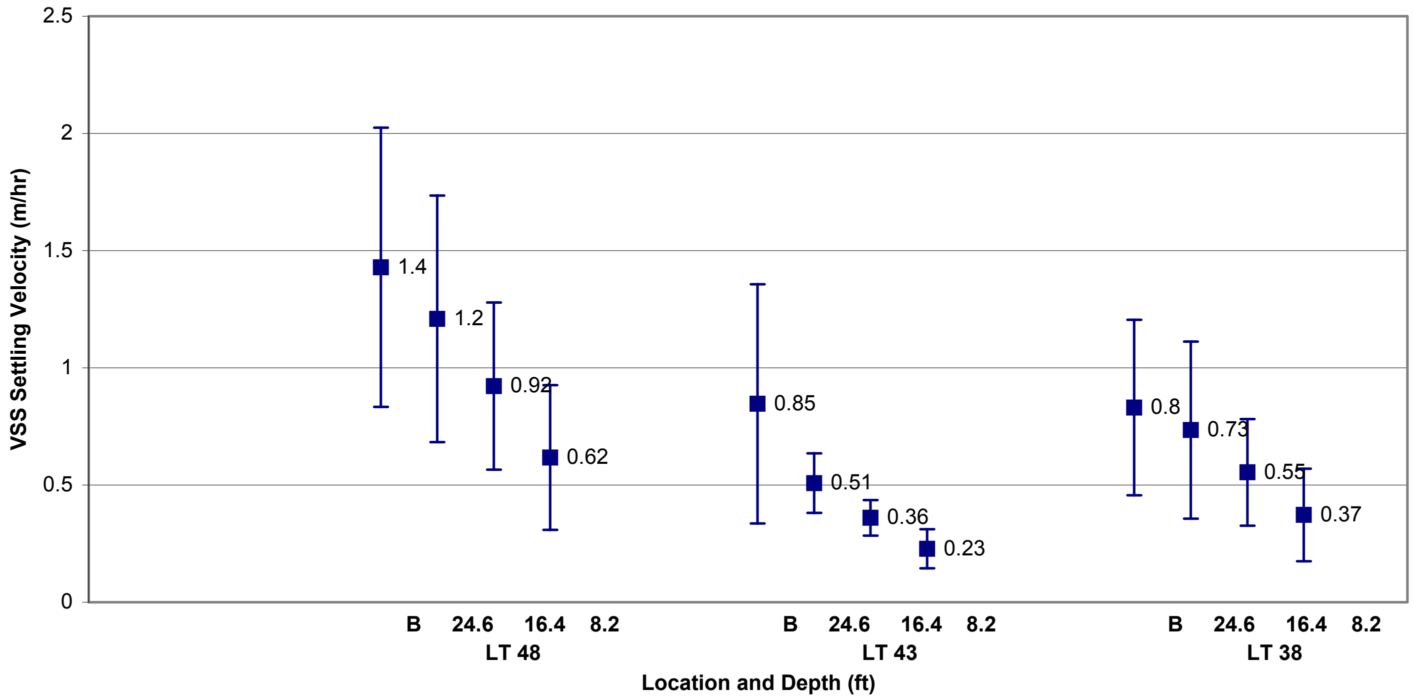

Figure II-20: Averages and standard deviations of VSS settling velocities in the DWSC during periods of trap deployment.

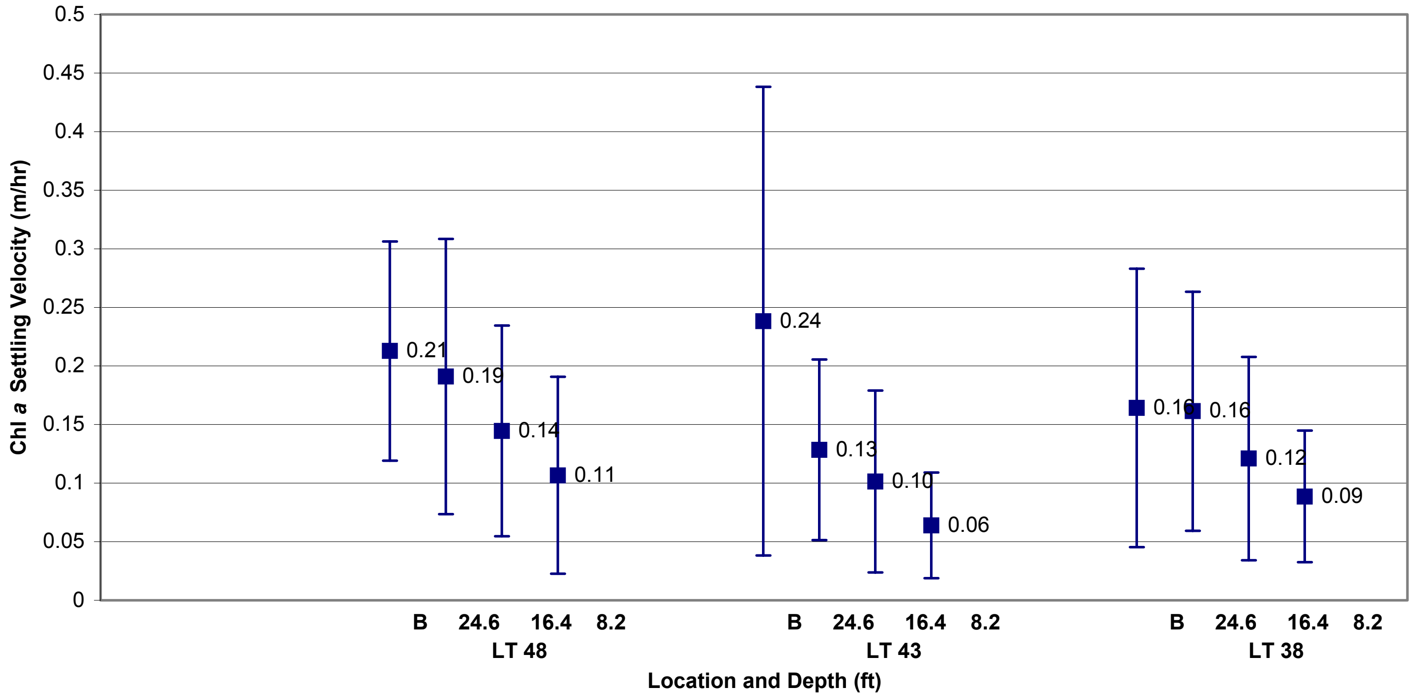

Figure II-21: Averages and standard deviations of chlorophyll *a* settling velocities in the DWSC during periods of trap deployment.

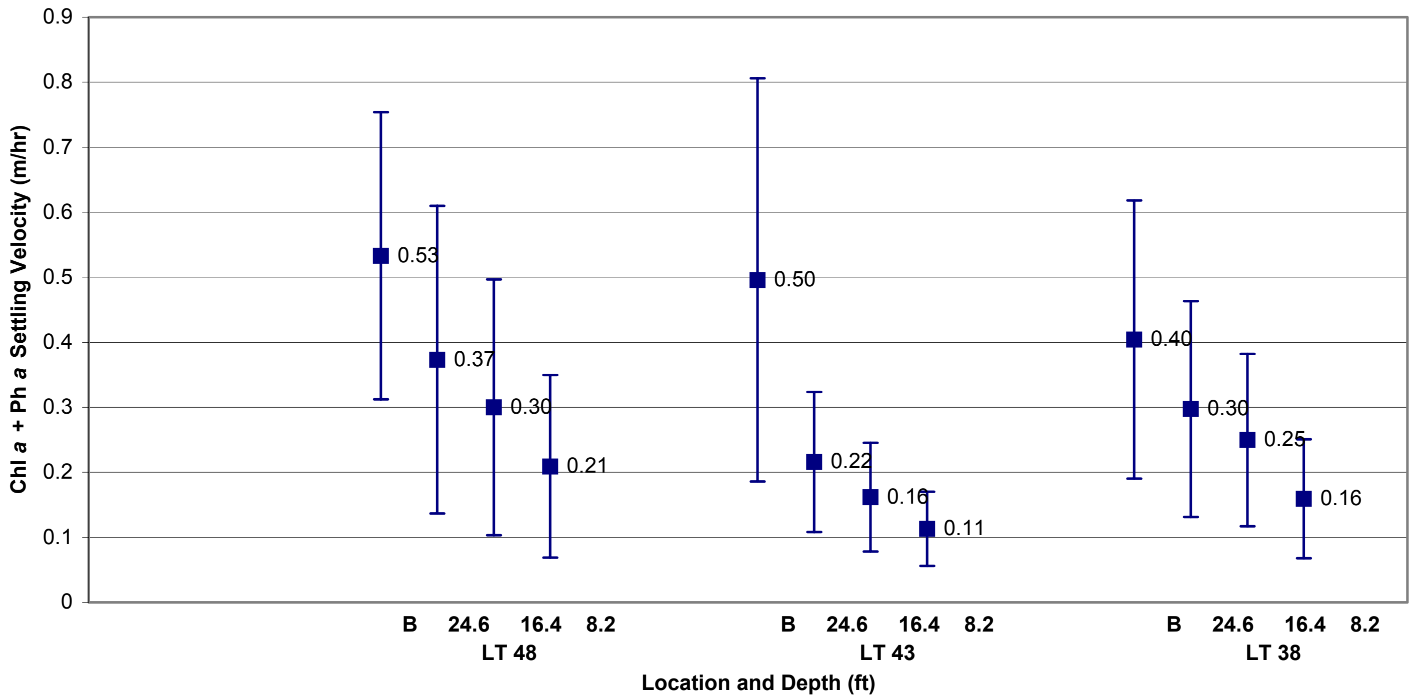

Figure II-22: Averages and standard deviations of chlorophyll *a* plus pheophytin *a* settling velocities in the DWSC during periods of trap deployment.

Averages and standard deviations for TSS, VSS, chlorophyll *a*, and chlorophyll *a* plus pheophytin *a* settling velocities calculated for ebb and flood tides are shown in Table II-7. Figures II-23 to II-26 graphically present these results for the respective constituents.

The settling velocities shown in Figure II-23 for TSS are generally higher during ebb tides. The highest values were calculated for the Lt. 48 station where average ebb tide velocities ranged from 1.5 to 3.1 m/hr and flood tide velocities varied from 1.0 to 2.4 m/hr. As with the TSS deposition fluxes, settling velocities do not appear to be tidally influenced at Lt. 43 and Lt. 38 for all trap depths except at the channel bottom. The relatively high average settling velocities observed at Lt. 43 near the channel bottom are caused by two suspect deposition flux measurements for the bottom traps on September 28 and October 19. Global positioning systems (GPS) measurements of the trap position at Lt. 43 indicated that the trap had been moved during one of the tides on each day. Dragging the trap along the bottom would disturb the sediments and yield artificially high deposition rates. These anomalous data may be removed from the averages in a subsequent draft.

As shown in Figure II-24, settling velocities for VSS are similar to TSS observations, but exhibit lower calculated velocities. As with TSS the highest calculated settling velocities are near the sediment-water interface where resuspension increases trap deposition fluxes that in turn yield high calculated settling velocities. Settling velocities appear greatest for ebb tides at Lt. 48, but relatively little difference in settling velocities was observed at the other two downstream trap stations (Lt. 43 and Lt. 38). Chlorophyll *a* calculated settling velocities ranged from 0.1 to 0.3 m/hr. Chlorophyll *a* + pheophytin *a* settling velocities exhibit a steeper gradient in the water column than chlorophyll *a* alone suggesting that resuspension effects have a greater influence on non-vital algae. Chlorophyll *a* and pheophytin *a* settling velocities do not appear to be influenced by the tidal flows as shown in Figures II-25 and II-26.

Table II-7: Settling velocites for TSS, VSS, chlorophyll *a* and chlorophyll *a* plus pheophytin *a* within the DWSC during ebb and flood tides.

Ebb

Location		Depth (ft)	TSS (m/hr)	VSS (m/hr)	Chl *a* (m/hr)	Chl *a*+Ph *a* (m/hr)
LT. 38	Avg	8.2	0.58	0.40	0.10	0.15
		16.4	0.85	0.59	0.13	0.24
		24.6	1.11	0.70	0.16	0.30
		B	1.62	1.08	0.16	0.41
	Std dev	8.2	0.09	0.04	0.07	0.09
		16.4	0.14	0.09	0.13	0.17
		24.6	0.19	0.08	0.12	0.22
		B	0.45	0.31	0.17	0.30
LT. 43	Avg	8.2	0.36	0.25	0.08	0.10
		16.4	0.69	0.42	0.13	0.18
		24.6	1.02	0.63	0.15	0.23
		B	1.28	0.86	0.28	0.55
	Std dev	8.2	0.18	0.12	0.07	0.07
		16.4	0.06	0.05	0.12	0.12
		24.6	0.20	0.04	0.12	0.15
		B	0.68	0.39	0.30	0.46
LT. 48	Avg	8.2	1.47	0.80	0.11	0.25
		16.4	2.11	1.12	0.17	0.36
		24.6	3.01	1.60	0.19	0.41
		B	3.09	1.81	0.19	0.50
	Std dev	8.2	0.33	0.20	0.12	0.19
		16.4	0.49	0.16	0.13	0.26
		24.6	0.39	0.22	0.14	0.31
		B	1.18	0.45	0.14	0.34

Flood

			TSS	VSS	Chl *a*	Chl *a*+Ph *a*
LT. 38	Avg	8.2	0.63	0.37	0.08	0.17
		16.4	0.95	0.51	0.11	0.24
		24.6	1.12	0.69	0.13	0.27
		B	2.33	1.25	0.16	0.38
	Std dev	8.2	0.04	0.25	0.05	0.11
		16.4	0.04	0.38	0.07	0.15
		24.6	0.13	0.56	0.10	0.17
		B	1.27	1.26	0.12	0.21
LT. 43	Avg	8.2	0.46	0.29	0.07	0.11
		16.4	0.62	0.35	0.10	0.16
		24.6	0.68	0.40	0.12	0.19
		B	1.77	1.22	0.23	0.49
	Std dev	8.2	0.05	0.04	0.04	0.07
		16.4	0.07	0.02	0.07	0.09
		24.6	0.16	0.07	0.08	0.12
		B	1.12	0.93	0.03	0.20
LT. 48	Avg	8.2	0.97	0.57	0.13	0.20
		16.4	1.43	0.80	0.14	0.25
		24.6	1.66	1.06	0.23	0.37
		B	2.37	1.51	0.27	0.59
	Std dev	8.2	0.91	0.56	0.08	0.16
		16.4	1.27	0.66	0.10	0.24
		24.6	1.05	0.80	0.15	0.31
		B	1.46	1.08	0.04	0.19

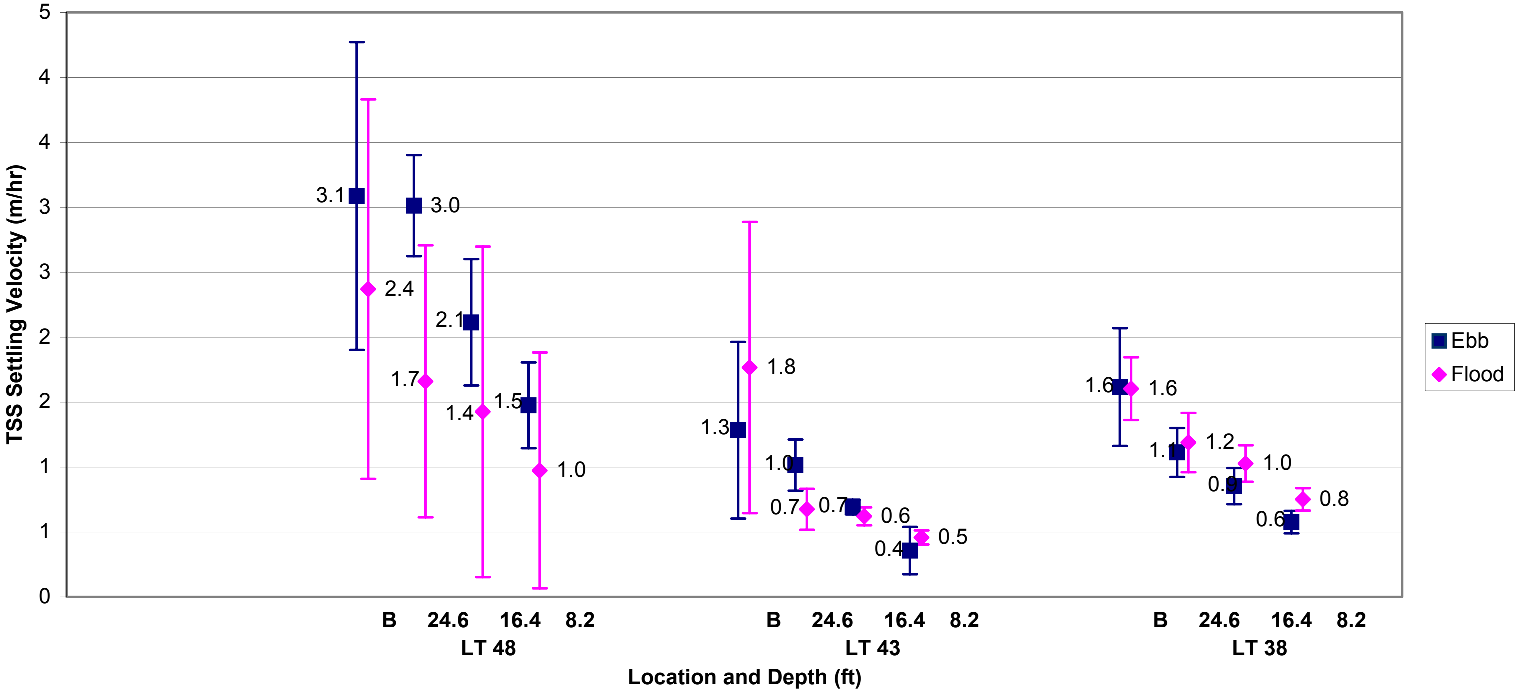

Figure II-23: Averages and standard deviations of TSS settling velocities in the DWSC for flood and ebb tides during periods of trap deployment.

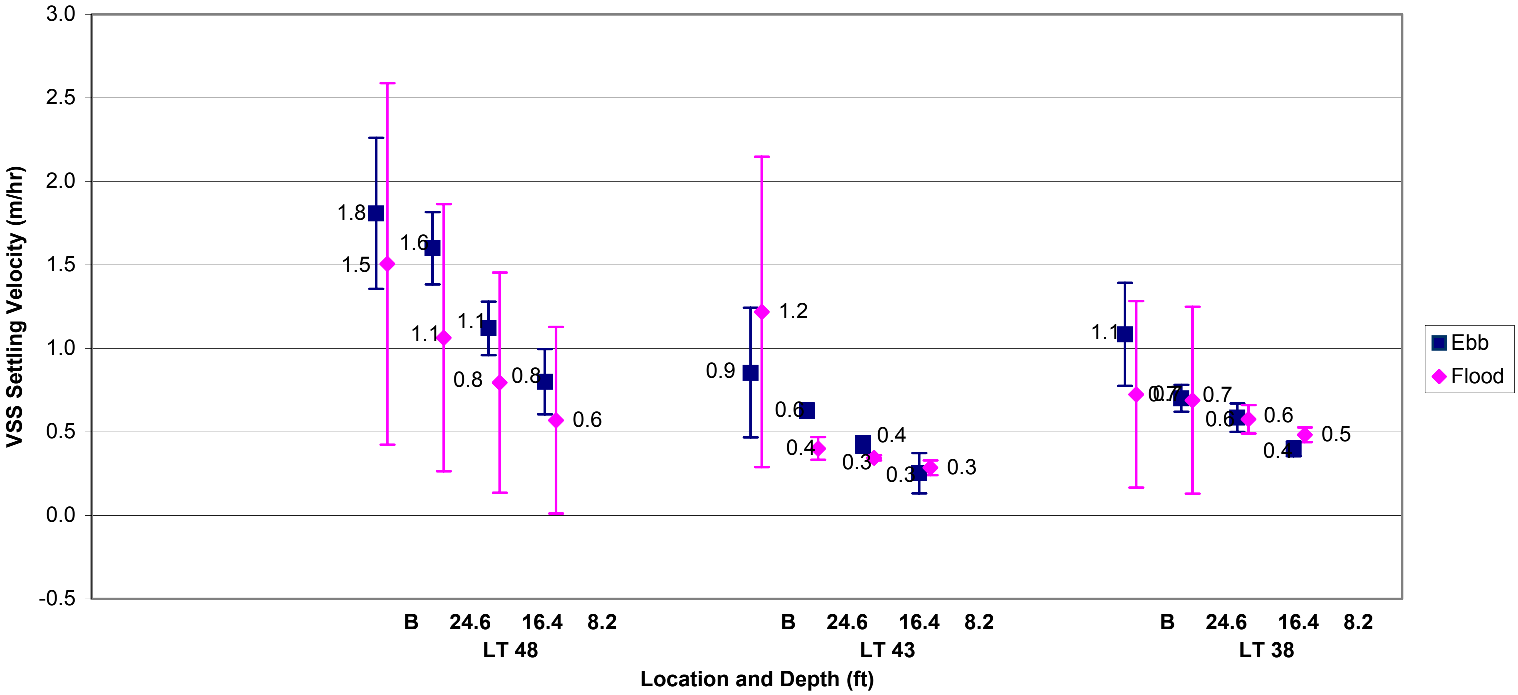

Figure II-24: Averages and standard deviations of VSS settling velocities in the DWSC for flood and ebb tides during periods of trap deployment.

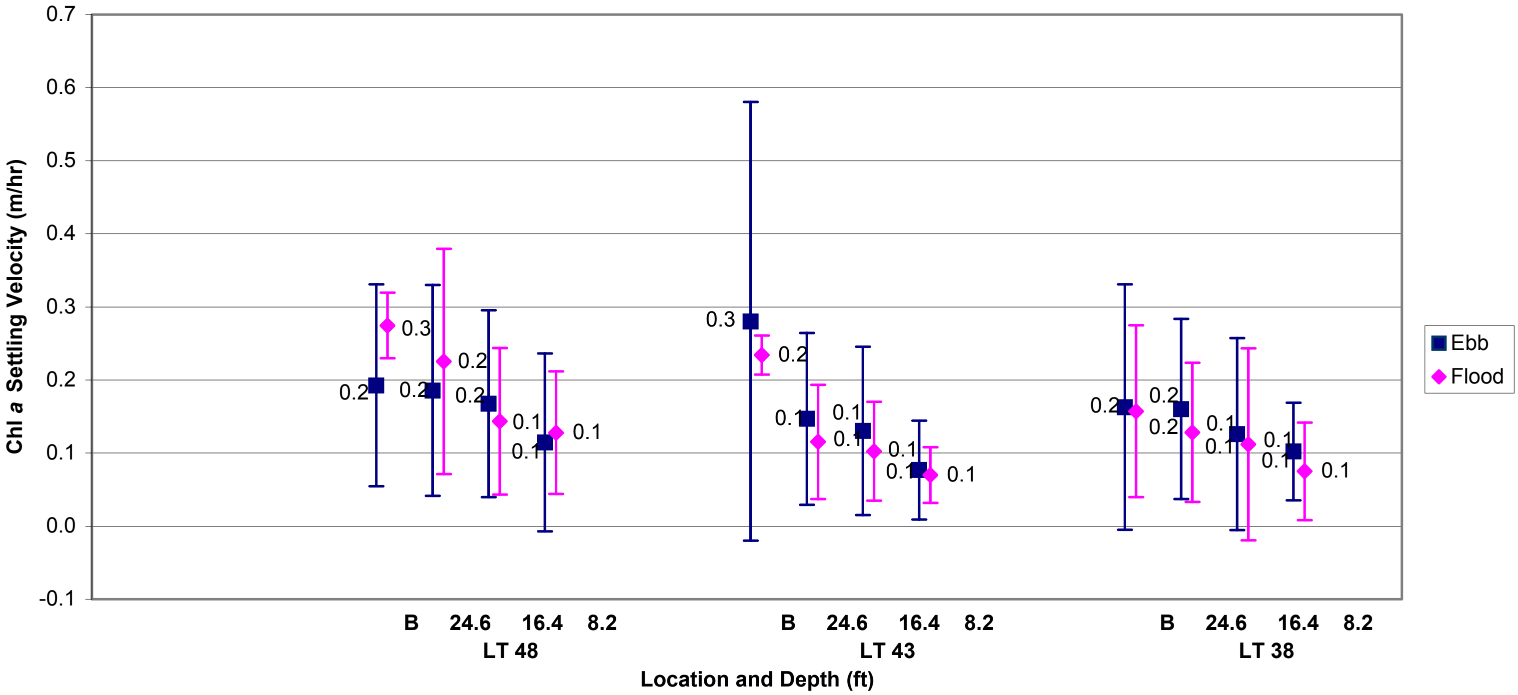

Figure II-25: Averages and standard deviations of chlorophyll *a* settling velocities in the DWSC for flood and ebb tides during periods of trap deployment.

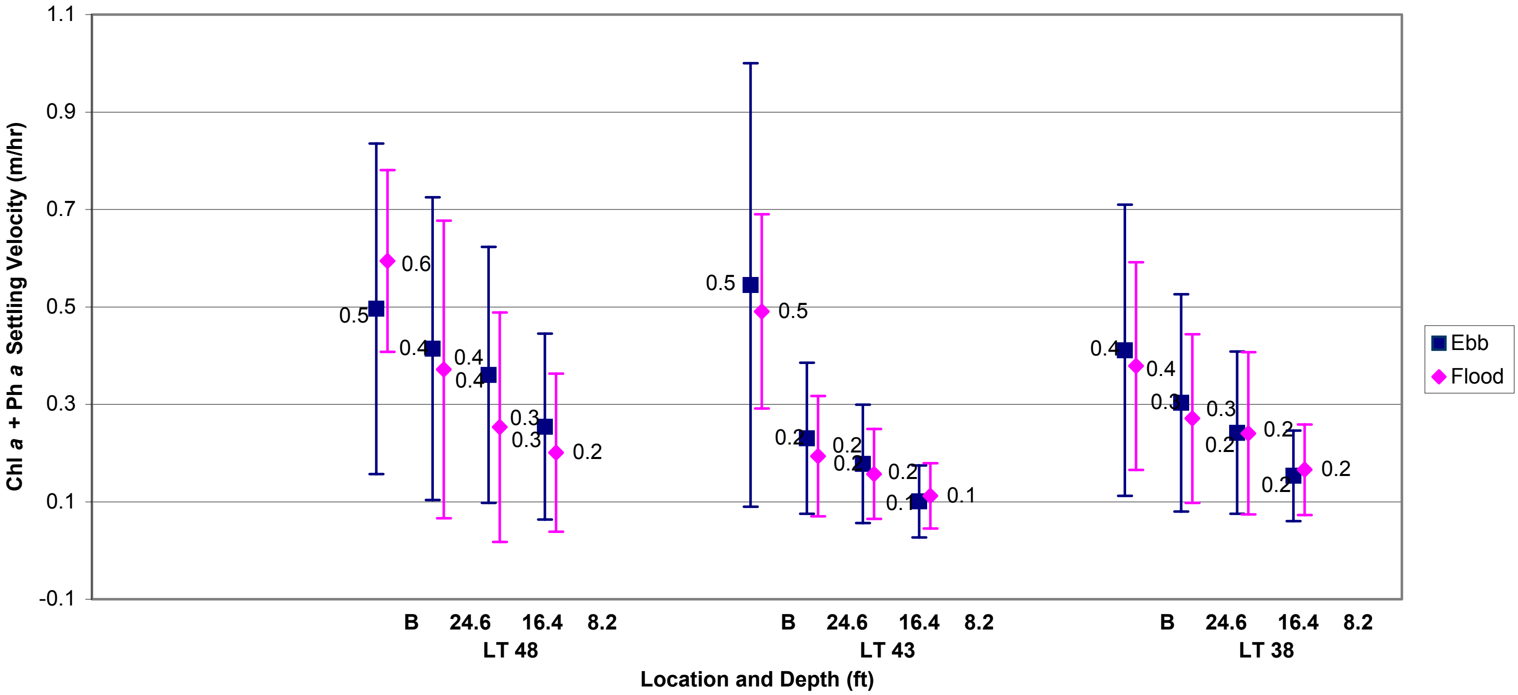

Figure II-26: Averages and standard deviations of chlorophyll *a* plus pheophytin *a* settling velocities in the DWSC for flood and ebb tides during periods of trap deployment.

III. Long-Term Biochemical Oxygen Demand Measurements

Long-term biochemical oxygen demand (BOD) measurements were performed with water and trapped sediments collected from the DWSC and the San Joaquin River.

Materials and Methods

Selected water and sediment samples were placed in 300-mL BOD bottles without dilution or seeding. Measurements of dissolved oxygen were performed periodically over 40 days using a DO electrode and meter. Readings were periodically checked with a different meter and by the Winkler method (APHA, AWWA, and WEF, 1998). When DO levels were measured below 4 or 5 mg/L, reaeration was accomplished by shaking the sample in a 4-L Erlenmeyer flask until saturation was achieved. One or two blanks and glucose-glutamic acid standards (with seed) were also included with each trial.

The kinetic rate decay constant and the ultimate BOD, L_0, was estimated by linearizing the data and fitting with a least-squares line. Assuming the decay of organic matter to behave as a first-order reaction,

$$BOD_t = L_0[1 - e^{-kt}]$$

where BOD_t is the biochemical oxygen demand calculated at time, t, in mg/L, k is the first-order decay rate constant, and L_0 is the ultimate BOD. Determination of k and L_0 is determined graphically by using the following linear approximation of the above equation:

$$\left[\frac{t}{y_t}\right]^{1/3} = (kL_0)^{-1/3} + \left[\frac{k^{2/3}}{6L_0^{1/3}}\right]t,$$

where $y_t = BOD_t$.

A plot of $\left[\frac{t}{y_t}\right]^{1/3}$ vs. t is a straight line with slope $m = \frac{1}{6}k^{2/3}L_0^{-1/3}$ and y-intercept of $b = (kL_0)^{-1/3}$. The first-order rate constant and ultimate BOD are calculated from k=6m/b and $L_0=1/(6mb^2)$.

Estimates of the decay constant and ultimate BOD

Examples of the BOD data are presented in Figures III-1 through III-3 for the September 14, 2000 data. The goodness of fit was evaluated by squared correlation coefficients (R^2) and visual inspection. Anomalous data points were selectively removed so as not to skew the fitted line. However, virtually all the k values were estimated with at least five data points. The sediment oxygen demand was determined by subtracting the water contribution and dividing by the TSS, VSS, chlorophyll *a*, or chlorophyll *a* plus pheophytin *a* concentration. Figure III-3 shows the milligrams of oxygen demand associated with the trapped sediments per milligram of trapped VSS.

Table III-1 presents the first-order decay constant, k at 20°C, ultimate BOD, and the correlation coefficient for the San Joaquin River. Tables III-2 through III-4 contain these parameters for the DWSC water samples. The $BOD_{uLt.}/BOD_5$ ratio can be determined by,

$$BOD_{ult} / BOD_5 = 1/(1 - e^{-k \times 5}),$$

Figure III-4 presents the decay constant for water samples collected from the San Joaquin River and the DWSC for each monitoring run conducted from August through November. The highest decay rates ranged from a high of 0.17 d^{-1} in late August to 0.06 d^{-1} in November. While the decay constant decreased with time, the ultimate BOD remained fairly constant throughout the late summer and fall months as shown in Figure III-5. However, a number of high $BOD_{uLt.}$ values were measured in the San Joaquin during a flood tide and at Lt. 48 in the DWSC during both flood and ebb tides on November 9. These high BOD values could be associated with ammonia releases from the Stockton wastewater treatment plant outfall.

Trapped sediment decay rates, k, and regression coefficients, R^2, are presented in Tables III-6 and III-7, respectively. The sediment rates are more variable than the water decay rates, ranging from approximately 0.03 to 0.23 d^{-1}. For many of the data sets the highest decay rates were associated with sediments collected from the upper traps and decreased with trap depth. This may be caused by higher fractions of refractory organic matter captured in the traps near the channel bottom. Tables III-8 through III-11 provide the $BOD_{uLt.}$ per mass of TSS, VSS, chlorophyll *a*, and chlorophyll *a* plus pheophytin *a* in the sediments. The chlorophyll *a* plus pheophytin *a* normalization seems to yield the most consistent oxygen demand per constituent mass, suggesting that most of the sediment BOD is associated with decaying phytoplankton.

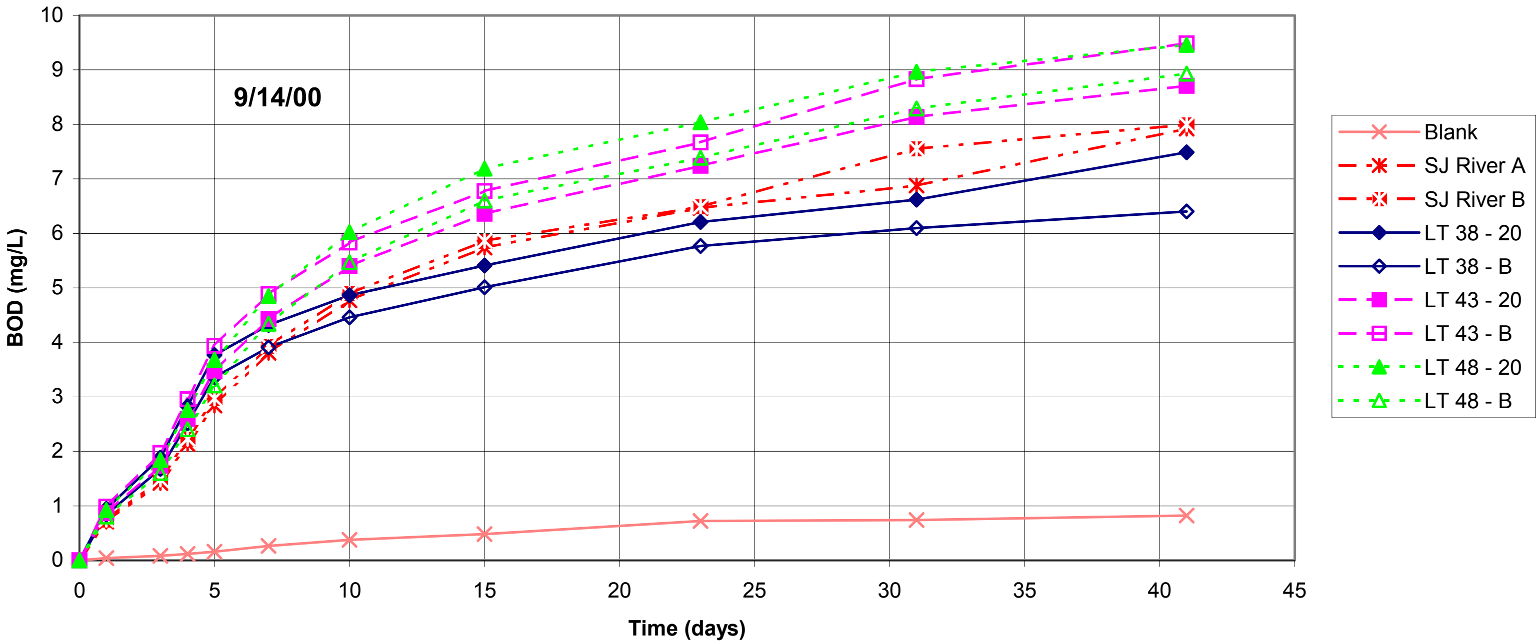

Figure III-1. Typical BOD measurements for water samples collected in the DWSC or San Joaquin River.

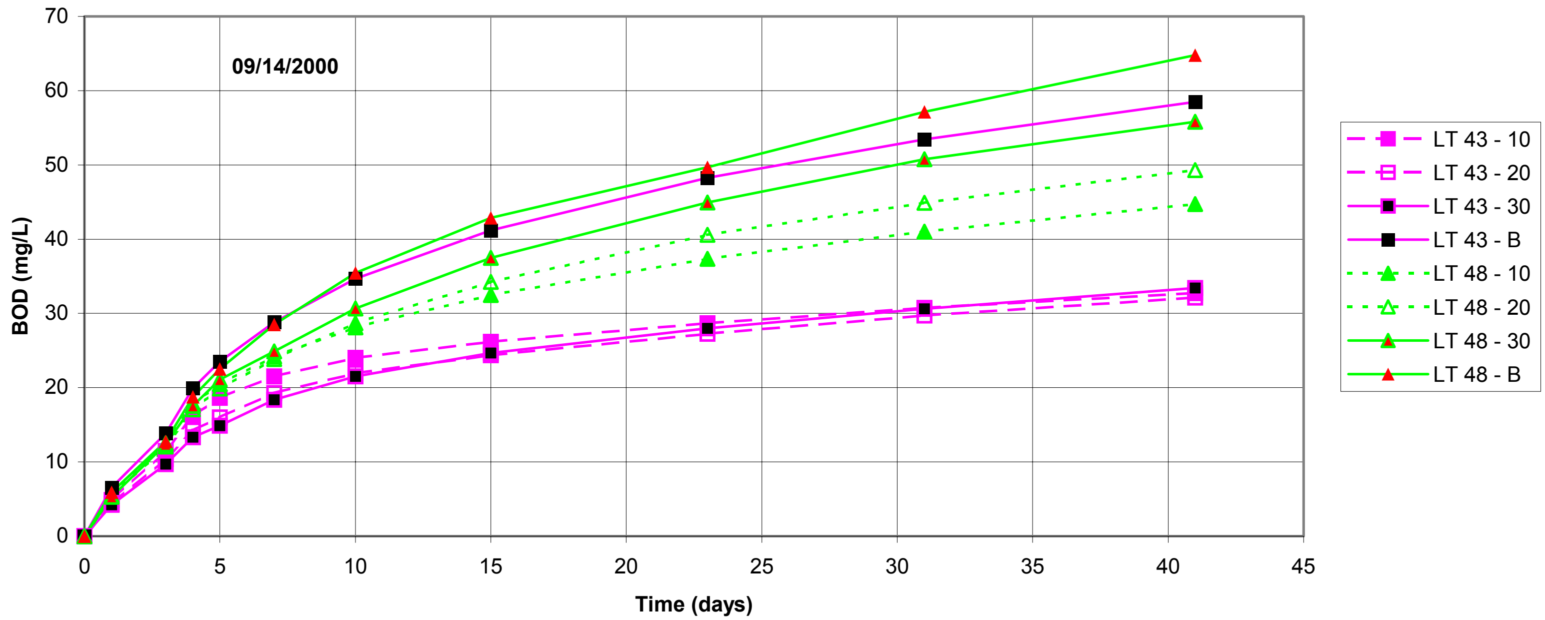

Figure III-2: Typical BOD measurements for trapped sediments suspended in DWSC water.

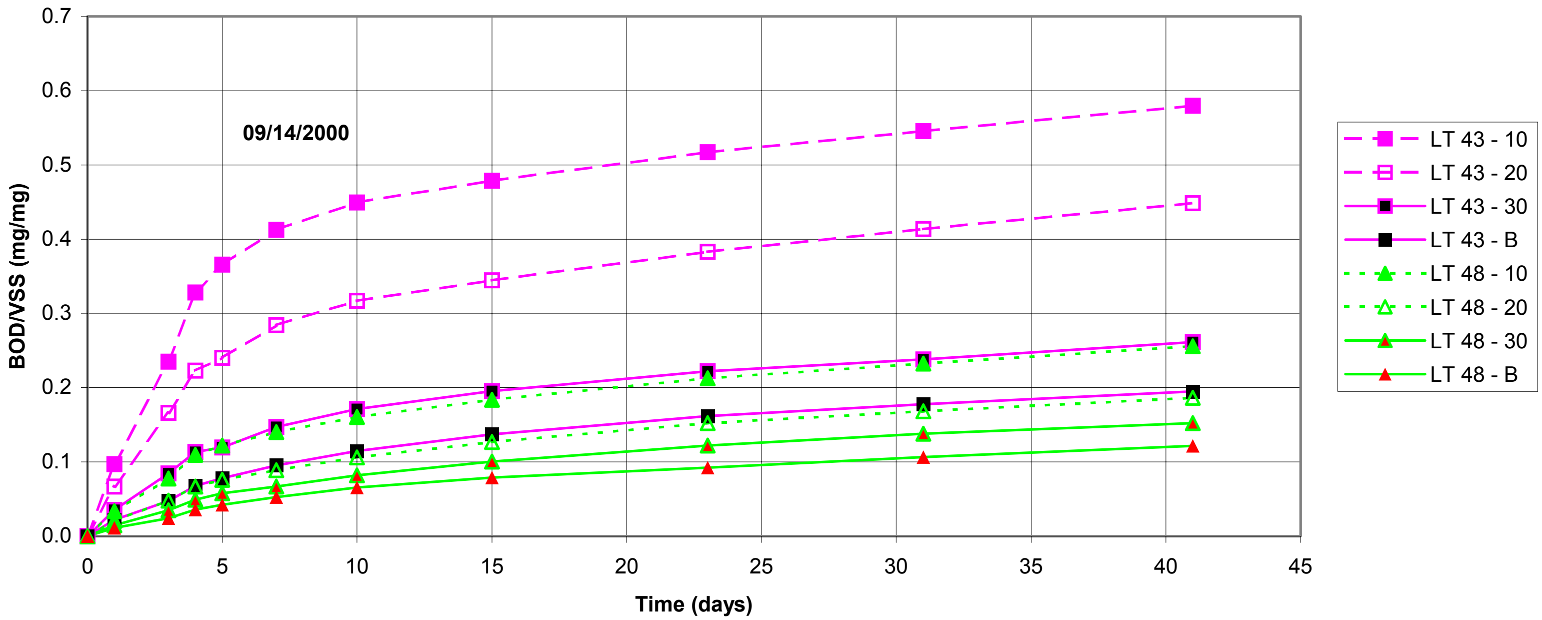

Figure III-3: The exerted BOD for trapped sediments after the water contribution is subtracted. The sediment BOD is also divided by the VSS concentration of the sediment-water suspension.

Table III-1 San Joaquin River BOD regression data and other water quality parameters.

Parameters for San Joaquin River Samples									
Units = varying									
Parameter	Tide	Date							
		7/27/00	8/16/00	8/31/00	9/14/00	Tide	9/28/00	10/19/00	11/9/00
		(Spring - 3)	(Spring + 2)	(Spring + 3)	(Spring + 1)		(Spring + 1)	(Neap + 0)	(Spring - 2)
$BOD_{uLt.}k$ (days^{-1})	25 Hour Composite		0.095	0.132	0.083		0.104	0.101	0.071
$BOD_{uLt.}L_o$ (mg/L O_2)			15.3	11.4	8.1		7.8	5.8	5.8
$BOD_{uLt.}R^2$			0.990	0.947	0.943		0.997	0.976	0.993
TSS (mg/L)		47.4	30.2	26.8	28.6	Ebb	28.0	---	32.0
VSS (mg/L)		8.1	6.3	5.1	4.9		4.2	---	3.4
Chl *a (mg/L)*			55.1	39.8	39.8		27.2	19.8	4.0
Chl *a* + Ph *a* (mg/L)			73.0	62.6	62.6		42.2	29.5	6.4
Turbidity (NTU)		36	25	25	26		27	27	24
$BOD_{uLt.}k$ (days^{-1})							0.101	0.096	0.052
$BOD_{uLt.}L_o$ (mg/L O_2)							6.3	5.2	20.0
$BOD_{uLt.}R^2$							0.997	0.963	0.929
TSS (mg/L)						Flood	26.2	---	18.4
VSS (mg/L)							4.2	---	3.1
Chl *a (mg/L)*							34.2	15.5	5.4
Chl *a* + Ph *a* (mg/L)							48.2	22.8	8.2
Turbidity (NTU)							23	21	19
Hatched area indicate composite samples or experiment not performed for that date									

Table III-2: BOD rate constants for DWSC waters.

BOD Rate Constant (k) - Water Samples

Units = day^{-1}

Location	Depth (ft)	Date						
		7/27/00 (Spring - 3)	8/16/00 (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1]	8.2		0.116	---	---	0.112	0.116	---
	16.4		---	---	0.124	---	---	---
	24.6		---	---	---	---	---	---
	B		---	0.157	0.119	0.127	0.125	---
LT. 38[2]	8.2					0.122	0.110	---
	16.4					---	---	---
	24.6					---	---	---
	B					0.112	0.124	---
LT. 43[1]	8.2		---	0.161	---	---	---	0.075
	16.4		---	0.173	0.090	---	---	---
	24.6		---	0.147	---	---	---	---
	B		---	---	0.097	---	---	0.076
LT. 43[2]	8.2					---	---	0.083
	16.4					---	---	---
	24.6					---	---	---
	B					---	---	0.082
LT. 48[1]	8.2		---	---	---	0.105	0.076	0.078
	16.4		---	---	0.086	---	---	---
	24.6		---	---	---	---	---	---
	B		---	---	0.079	0.110	0.097	0.058
LT. 48[2]	8.2					0.111	0.109	0.076
	16.4					---	---	---
	24.6					---	---	---
	B					0.114	0.109	0.079

[1] 9/28, 10/19, & 11/9 - Ebb Tide

[2] 9/28,10/19, & 11/9 - Flood Tide

Hatched area indicate composite samples or experiment not performed for that date

Table III-3: Ultimate BOD fitted values for DWSC waters.
Units = mg / L

Location	Depth (ft)	Date						
		7/27/00 (Spring - 3)	8/16/00 (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1]	8.2		9.4	---	---	7.5	8.2	---
	16.4		---	---	7.2	---	---	---
	24.6		---	---	---	---	---	---
	B		---	6.7	6.7	7.0	8.2	---
LT. 38[2]	8.2					6.0	6.2	---
	16.4					---	---	---
	24.6					---	---	---
	B					6.6	7.2	---
LT. 43[1]	8.2		---	7.0	---	---	---	10.5
	16.4		---	5.7	8.9	---	---	---
	24.6		---	7.3	---	---	---	---
	B		---	---	9.4	---	---	9.0
LT. 43[2]	8.2					---	---	11.4
	16.4					---	---	---
	24.6					---	---	---
	B					---	---	10.4
LT. 48[1]	8.2		---	---	---	10.1	10.9	16.4
	16.4		---	---	10.0	---	---	---
	24.6		---	---	---	---	---	---
	B		---	---	9.4	6.8	10.5	19.3
LT. 48[2]	8.2					6.9	6.3	16.9
	16.4					---	---	---
	24.6					---	---	---
	B					6.5	7.4	15.3

[1] 9/28, 10/19, & 11/9 - Ebb Tide

[2] 9/28,10/19, & 11/9 - Flood Tide

Hatched area indicate composite samples or experiment not performed for that date

Table III-4: Least-square regression coefficients (R^2) for DWSC waters.

Location	Depth (ft)	Date						
		7/27/00 (Spring - 3)	8/16/00 (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1]	8.2		0.948	---	---	0.997	0.968	---
	16.4		---	---	0.970	---	---	---
	24.6		---	---	---	---	---	---
	B		---	0.987	0.971	0.993	0.961	---
LT. 38[2]	8.2					0.992	0.957	---
	16.4					---	---	---
	24.6					---	---	---
	B					0.978	0.956	---
LT. 43[1]	8.2		---	0.981	---	---	---	0.992
	16.4		---	0.969	0.955	---	---	---
	24.6		---	0.981	---	---	---	---
	B		---	---	0.957	---	---	0.997
LT. 43[2]	8.2					---	---	0.994
	16.4					---	---	---
	24.6					---	---	---
	B					---	---	0.998
LT. 48[1]	8.2		---	---	---	0.989	0.965	0.981
	16.4		---	---	0.948	---	---	---
	24.6		---	---	---	---	---	---
	B		---	---	0.936	0.996	0.994	0.990
LT. 48[2]	8.2					0.995	0.959	0.993
	16.4					---	---	---
	24.6					---	---	---
	B					0.996	0.964	0.992

[1] 9/28, 10/19, & 11/9 - Ebb Tide

[2] 9/28,10/19, & 11/9 - Flood Tide

Hatched area indicate composite samples or experiment not performed for that date

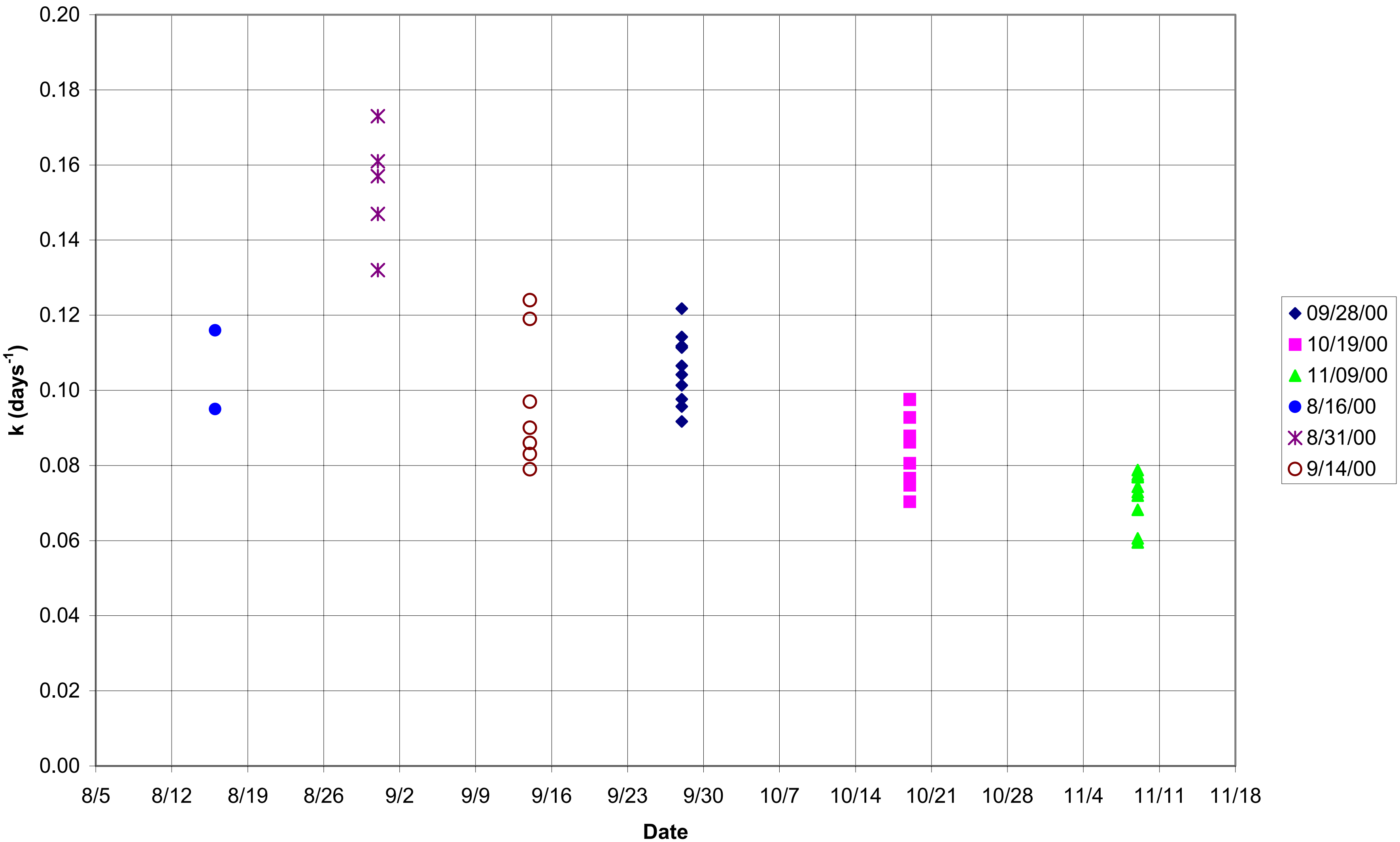

Figure III-4: BOD decay constants at 20° C for DWSC and San Joaquin River water.

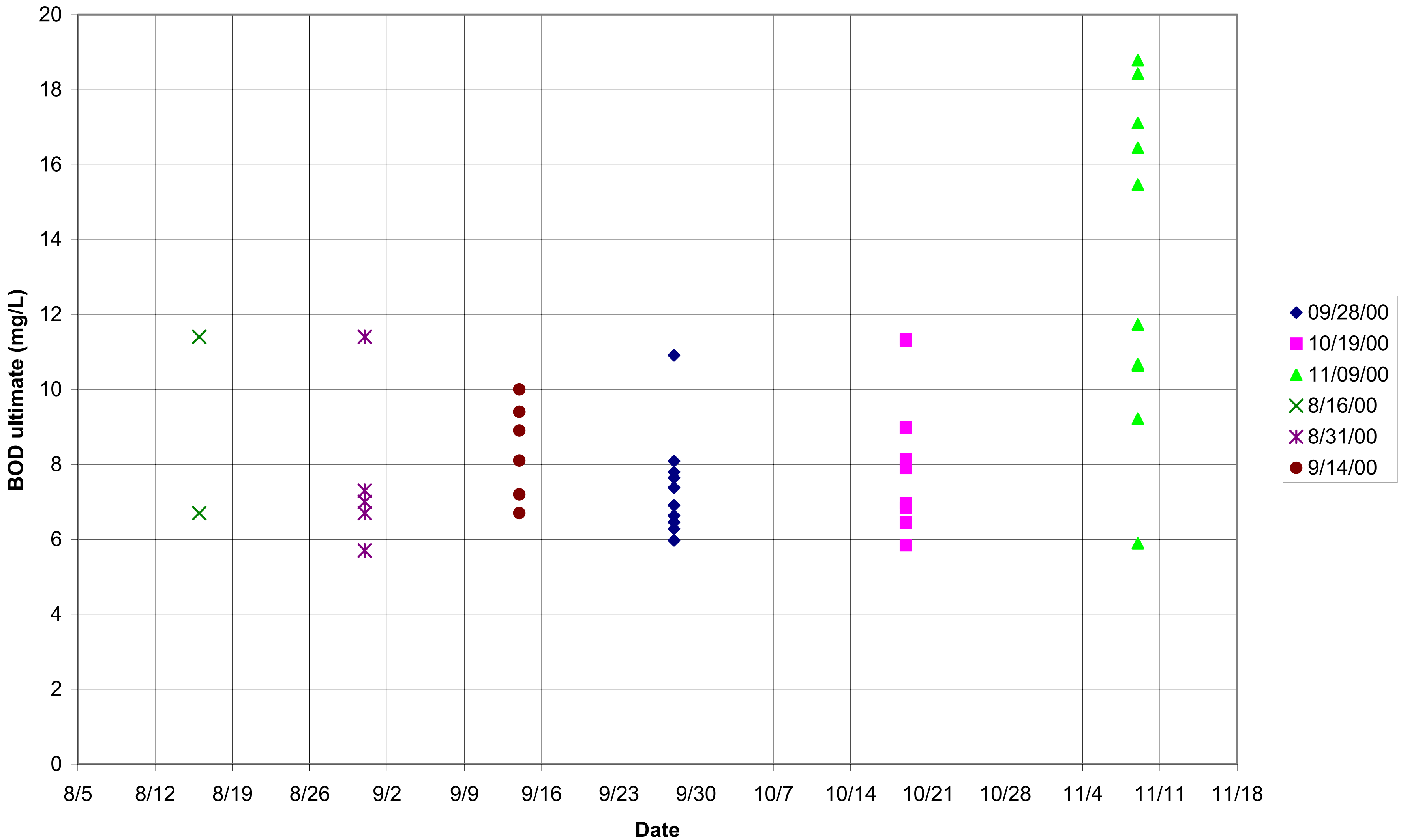

Figure III-5: Ultimate BOD during the study period for DWSC and San Joaquin River water.

Table III-6: BOD first-order decay rate constants for trapped sediments in the DWSC (units = day^{-1}).

Location	Depth (ft)	Date						
		7/27/00[3] (Spring - 3)	8/16/00[3] (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1,4]	8.2		0.000	---	---	0.158	0.065	---
	16.4		0.065	---	---	---	---	---
	24.6		---	---	---	---	---	---
	B		0.010	0.067	---	0.092	0.016	---
LT. 38[2]	8.2					0.117	0.057	---
	16.4					---	---	---
	24.6					---	---	---
	B					0.075	0.022	---
LT. 43[1]	8.2		---	0.121	0.162	---	---	0.123
	16.4		---	0.117	0.148	---	---	---
	24.6		---	0.091	0.131	---	---	---
	B		---	---	0.105	---	---	0.159
LT. 43[2]	8.2					---	---	0.189
	16.4					---	---	---
	24.6					---	---	---
	B					---	---	0.226
LT. 48[1]	8.2		---	---	0.129	0.243	0.034	-0.558
	16.4		---	---	0.109	---	---	---
	24.6		---	---	0.096	---	---	---
	B		---	---	0.091	0.074	0.050	0.104
LT. 48[2]	8.2					0.027	0.073	0.043
	16.4					---	---	---
	24.6					---	---	---
	B					0.055	0.069	---

[1] 9/28, 10/19, & 11/9 - Ebb Tide

[2] 9/28,10/19, & 11/9 - Flood Tide

[3] Size 10 Sediment Trap

[4] 9/14 Trap lost

Hatched area indicate composite samples or experiment not performed for that date

Table III-7: Least-square regression coefficients (R^2) for DWSC waters.

Regression Coefficient (R^2) - Sediment Samples

Units = none

Location	Depth (ft)	Date						
		7/27/00[3] (Spring - 3)	8/16/00[3] (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1,4]	8.2		0.000	---	---	0.778	0.138	---
	16.4		0.919	---	---	---	---	---
	24.6		---	---	---	---	---	---
	B		0.119	0.979	---	0.710	0.944	---
LT. 38[2]	8.2					0.865	0.988	---
	16.4					---	---	---
	24.6					---	---	---
	B					0.995	0.837	---
LT. 43[1]	8.2		---	0.978	0.983	---	---	0.996
	16.4		---	0.972	0.980	---	---	---
	24.6		---	0.981	0.981	---	---	---
	B		---	---	0.974	---	---	0.977
LT. 43[2]	8.2					---	---	0.928
	16.4					---	---	---
	24.6					---	---	---
	B					---	---	0.954
LT. 48[1]	8.2		---	---	0.974	0.988	0.998	0.770
	16.4		---	---	0.972	---	---	---
	24.6		---	---	0.972	---	---	---
	B		---	---	0.974	0.962	0.902	0.997
LT. 48[2]	8.2					0.869	0.991	0.777
	16.4					---	---	---
	24.6					---	---	---
	B					0.994	0.993	0.727

[1] 9/28, 10/19, & 11/9 - Ebb Tide

[2] 9/28,10/19, & 11/9 - Flood Tide

[3] Size 10 Sediment Trap

[4] 9/14 Trap lost

Hatched area indicate composite samples or experiment not performed for that date

Table III-8: Ultimate BOD/TSS of sediment trapped in the DWSC.
Units = mg O_2 / mg TSS

Location	Depth (ft)	Date						
		7/27/00[3] (Spring - 3)	8/16/00[3] (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1,4]	8.2		0.131	---	---	0.033	-0.001	---
	16.4		0.001	---	---	---	---	---
	24.6		---	---	---	---	---	---
	B		0.002	0.013	---	0.012	0.020	---
LT. 38[2]	8.2					0.027	0.020	---
	16.4					---	---	---
	24.6					---	---	---
	B					0.012	0.019	---
LT. 43[1]	8.2		---	0.058	0.076	---	---	0.010
	16.4		---	0.036	0.048	---	---	---
	24.6		---	0.017	0.025	---	---	---
	B		---	---	0.018	---	---	0.019
LT. 43[2]	8.2					---	---	0.018
	16.4					---	---	---
	24.6					---	---	---
	B					---	---	0.003
LT. 48[1]	8.2		---	---	0.024	0.038	0.014	-0.001
	16.4		---	---	0.016	---	---	---
	24.6		---	---	0.014	---	---	---
	B		---	---	0.010	0.026	0.016	0.035
LT. 48[2]	8.2					0.018	0.015	-0.055
	16.4					---	---	---
	24.6					---	---	---
	B					0.011	0.012	---

[1] 9/28, 10/19, & 11/9 - Ebb Tide

[2] 9/28,10/19, & 11/9 - Flood Tide

[3] Size 10 Sediment Trap

[4] 9/14 Trap lost

Hatched area indicate composite samples or experiment not performed for that date

Table III-9: Ulitmate BOD/VSS of sediments trapped in the DWSC.
Units = mg O_2 / mg VSS

Location	Depth (ft)	Date						
		7/27/00[3] (Spring - 3)	8/16/00[3] (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1,4]	8.2		1.205	---	---	0.327	-0.010	---
	16.4		0.006	---	---	---	---	---
	24.6		---	---	---	---	---	---
	B		0.025	0.131	---	0.115	0.224	---
LT. 38[2]	8.2					0.236	0.191	---
	16.4					---	---	---
	24.6					---	---	---
	B					0.113	0.185	---
LT. 43[1]	8.2		---	0.494	0.619	---	---	0.091
	16.4		---	0.343	0.453	---	---	---
	24.6		---	0.188	0.279	---	---	---
	B		---	---	0.188	---	---	0.180
LT. 43[2]	8.2					---	---	0.158
	16.4					---	---	---
	24.6					---	---	---
	B					---	---	0.026
LT. 48[1]	8.2		---	---	0.247	0.413	0.165	-0.010
	16.4		---	---	0.176	---	---	---
	24.6		---	---	0.145	---	---	---
	B		---	---	0.113	0.258	0.205	0.381
LT. 48[2]	8.2					0.225	0.182	-0.663
	16.4					---	---	---
	24.6					---	---	---
	B					0.150	0.159	---

[1] 9/28, 10/19, & 11/9 - Ebb Tide
[2] 9/28,10/19, & 11/9 - Flood Tide
[3] Size 10 Sediment Trap
[4] 9/14 Trap lost
Hatched area indicate composite samples or experiment not performed for that date

Table III-10: Ulitmate BOD/Chl *a* of sediments trapped in the DWSC.
Units = mg O_2 / mg Chl *a*

Location	Depth (ft)	Date						
		7/27/00[3] (Spring - 3)	8/16/00[3] (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1,4]	8.2			---	---	0.55	-0.01	---
	16.4			---	---	---	---	---
	24.6			---	---	---	---	---
	B			0.36	---	0.22	0.52	---
LT. 38[2]	8.2					0.45	25.98	---
	16.4					---	---	---
	24.6					---	---	---
	B					0.34	0.60	---
LT. 43[1]	8.2			1.72	1.23	---	---	-0.30
	16.4			0.64	0.50	---	---	---
	24.6			0.28	0.16	---	---	---
	B			---	0.31	---	---	1.33
LT. 43[2]	8.2					---	---	0.57
	16.4					---	---	---
	24.6					---	---	---
	B					---	---	---
LT. 48[1]	8.2			---	0.55	0.10	0.22	0.02
	16.4			---	0.22	---	---	---
	24.6			---	0.19	---	---	---
	B			---	0.15	0.19	0.26	0.97
LT. 48[2]	8.2					0.26	0.40	-0.99
	16.4					---	---	---
	24.6					---	---	---
	B					0.41	0.56	---

[1] 9/28, 10/19, & 11/9 - Ebb Tide

[2] 9/28,10/19, & 11/9 - Flood Tide

[3] Size 10 Sediment Trap

[4] 9/14 Trap lost

Hatched area indicate composite samples or experiment not performed for that date

Table III-11: Ultimate BOD/(Chl *a* + Ph *a*) for sediments trapped in the DWSC.
Units = mg O_2 / mg Chl *a* + Ph *a*

Location	Depth (ft)	Date						
		7/26/00[3] (Spring - 3)	8/16/00[3] (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1,4]	8.2			---	---	0.062	-0.003	---
	16.4			---	---	---	---	---
	24.6			---	---	---	---	---
	B			0.040	---	0.035	-0.007	---
LT. 38[2]	8.2					0.072	0.082	---
	16.4					---	---	---
	24.6					---	---	---
	B					0.038	0.080	---
LT. 43[1]	8.2			0.102	0.102	---	---	0.085
	16.4			0.088	0.068	---	---	---
	24.6			0.055	0.044	---	---	---
	B			---	0.043	---	---	0.193
LT. 43[2]	8.2					---	---	0.189
	16.4					---	---	---
	24.6					---	---	---
	B					---	---	---
LT. 48[1]	8.2			---	0.087	0.042	0.060	-0.011
	16.4			---	0.042	---	---	---
	24.6			---	0.048	---	---	---
	B			---	0.025	0.048	0.060	0.090
LT. 48[2]	8.2					0.062	0.091	-0.490
	16.4					---	---	---
	24.6					---	---	---
	B					0.052	0.095	---

[1] 9/28, 10/19, & 11/9 - Ebb Tide
[2] 9/28,10/19, & 11/9 - Flood Tide
[3] Size 10 Sediment Trap
[4] 9/14 Trap lost
Hatched area indicate composite samples or experiment not performed for that date

III. Constituent Correlations

The data presented in previous sections were used to investigate correlations among the constituents. The following correlation plots are shown in Figures IV-1 to Figure IV-25:

DWSC Water constituents

Figure IV-1	VSS	vs.	TSS
Figure IV-2	chlorophyll *a*	vs.	pheophytin *a*
Figure IV-3	chlorophyll *a*	vs.	TSS
Figure IV-4	chlorophyll *a* + pheophytin *a*	vs.	TSS
Figure IV-5	chlorophyll *a*	vs.	VSS
Figure IV-6	chlorophyll *a* + pheophytin *a*	vs.	VSS
Figure IV-7	TSS	vs.	turbidity
Figure IV-8	VSS	vs.	turbidity
Figure IV-9	chlorophyll *a*	vs.	turbidity
Figure IV-10	chlorophyll *a* + pheophytin *a*	vs.	turbidity
Figure IV-11	$BOD_{uLt.}$	vs.	turbidity
Figure IV-12	$BOD_{uLt.}$	vs.	TSS
Figure IV-13	$BOD_{uLt.}$	vs.	VSS
Figure IV-14	$BOD_{uLt.}$	vs.	chlorophyll *a*
Figure IV-15	$BOD_{uLt.}$	vs.	chlorophyll *a* + pheophytin *a*

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Figure IV-16	VSS	vs.	TSS
Figure IV-17	chlorophyll *a*	vs.	pheophytin *a*
Figure IV-18	chlorophyll *a*	vs.	TSS
Figure IV-19	chlorophyll *a* + pheophytin *a*	vs.	TSS
Figure IV-20	chlorophyll *a*	vs.	VSS
Figure IV-21	chlorophyll *a* + pheophytin *a*	vs.	VSS
Figure IV-22	$BOD_{uLt.}$	vs.	TSS
Figure IV-23	$BOD_{uLt.}$	vs.	VSS
Figure IV-24	$BOD_{uLt.}$	vs.	chlorophyll *a*
Figure IV-25	$BOD_{uLt.}$	vs.	chlorophyll *a* + pheophytin *a*

A line was fit to these data using the method of least squares. The goodness of fit was evaluated by squared regression coefficient, R^2. Table IV-1 contains water constituents while Table IV-2 presents plots of sediment constituents. The equation of the line and the R^2 value for each plot is provided in Table IV-1 and IV-2.

Correlations for all the DWSC water samples are generally poor since R^2 values range from 0 to 0.6. The best correlation observed in this group was VSS vs. TSS. This relationship suggests that of the suspended matter in the DWSC approximately 16 percent is organic assuming calcium carbonate precipitate is not present. The correlations of BOD_{ult} with any of the suspended constituents is remarkably poor, suggesting that most of the BOD in the DWSC is of a soluble nature, where soluble is defined as all matter that passes through filter membranes.

Contrary to the DWSC water, relatively good correlations of BOD_{ult} with VSS, chlorophyll *a*, or chlorophyll *a* plus pheophytin *a* were observed for water samples collected in the upstream San Joaquin River station. The correlation of BOD_{ult} with VSS suggests that 1 mg/L of VSS yields 2 mg/L of BOD_{ult} as shown in Figure IV-13. Care should be used with this relationship as it was developed using relatively few data points and the curve was forced through the origin. Figure IV-14 presents the correlation of BOD_{ult} with chlorophyll *a*. This relationship suggests that every 100 µg/L of chlorophyll *a* will yield 24 mg/L of ultimate oxygen demand. Lastly Figure IV-15 shows the plot of BOD_{ult} vs. the sum of chlorophyll *a* and pheophytin *a*. This relationship indicates that every 100 µg/L of chlorophyll *a* plus pheophytin *a* will yield 17 mg/L of ultimate oxygen demand.

The correlations for sediments trapped in the DWSC are relatively good when compared with the correlations shown previously with the water from the DWSC. Values of R^2 ranged from 0.71 to 0.98 for fitted lines shown in Figures IV-16 to IV-25. The fitted curves with the BOD_{ult} data are excellent, with the sum of chlorophyll *a* and pheophytin *a* yielding the best parameter by which BOD_{ult} values can be estimated for trapped sediments. The sediment relationships should not be used for estimating BOD_{ult} values for water samples since the ratio of chlorophyll *a* to pheophytin *a* is about 0.24 compared with 0.89 observed for the water samples. It appears the organic matter associated with pheophytin *a* in the trapped sediments is much more refractory than the matter suspended in the water column.

Table IV-2: Fitted equations and regression coefficients for DWSC water constituent correlations.

Figure	y-axis constituent		x-axis constituent	Fitted Line	R^2
Figure IV-1	VSS	vs.	TSS	VSS (mg/L) = 0.16 × TSS (mg/L)	0.62
Figure IV-2	Chlorophyll *a*	vs.	pheophytin *a*	Chl *a* (μg/L) = 0.89 × Ph *a* (μg/L)	0.25
Figure IV-3	chlorophyll *a*	vs.	TSS	Chl *a* (μg/L) = 0.58 × TSS (mg/L)	0.05
Figure IV-4	chlorophyll *a* + pheophytin *a*	vs.	TSS	Chl *a* (μg/L) + Ph *a* (μg/L)= 1.2 × TSS (mg/L)	0.18
Figure IV-5	chlorophyll *a*	vs.	VSS	Chl *a* (μg/L) = 3.8 × VSS (mg/L)	0.18
Figure IV-6	chlorophyll *a* + pheophytin *a*	vs.	VSS	Chl *a* + Ph *a* (μg/L)= 7.7 × VSS (mg/L)	0.40
Figure IV-7	TSS	vs.	turbidity	TSS (mg/L) = 0.98 × turbidity (NTU) + 1.43	0.50
Figure IV-8	VSS	vs.	turbidity	VSS (mg/L) = 0.13 × turbidity (NTU) + 0.92	0.43
Figure IV-9	chlorophyll *a*	vs.	turbidity	Chl *a* (μg/L) = 0.45 × turbidity (NTU) + 4.6	0.10
Figure IV-10	chlorophyll *a* + pheophytin *a*	vs.	turbidity	Chl *a* + Ph *a* (μg/L) = 1.42 × turbidity (NTU) – 3.2	0.29
Figure IV-11	$BOD_{uLt.}$	vs.	turbidity	$BOD_{uLt.}$ (mg/L) = -.0047 × turbidity (NTU) - 9.24	0.00
Figure IV-12	$BOD_{uLt.}$	vs.	TSS	$BOD_{uLt.}$ (mg/L) = 0.0019 × TSS (mg/L) + 8.1	0.00
Figure IV-13	$BOD_{uLt.}$	vs.	VSS	$BOD_{uLt.}$ (mg/L) = 0.060 × VSS (mg/L) + 7.9	0.00
Figure IV-14	$BOD_{uLt.}$	vs.	chlorophyll *a*	$BOD_{uLt.}$ (mg/L) = 0.00055 × Chl *a* (μg/L) + 8.1	0.00
Figure IV-15	$BOD_{uLt.}$	vs.	chlorophyll *a* + pheophytin *a*	$BOD_{uLt.}$ (mg/L) = -0.016 × [Chl *a*+Ph *a*] (μg/L) + 8.1	0.02

Table IV-3: Constituent correlations for trapped sediments.

Figure	y-axis constituent		x-axis constituent	Fitted Line	R^2
Figure IV-16	VSS	vs.	TSS	VSS (mg) = 0.16 × TSS (mg)	0.98
Figure IV-17	chlorophyll *a*	vs.	pheophytin *a*	Chl *a* (μg) = 0.24 × Ph *a* (μg)	0.83
Figure IV-18	chlorophyll *a*	vs.	TSS	Chl *a* (μg) = 0.068 × TSS (mg)	0.71
Figure IV-19	chlorophyll *a* + pheophytin *a*	vs.	TSS	Chl *a* + Ph *a* (μg)= 0.32 × TSS (mg)	0.84
Figure IV-20	chlorophyll *a*	vs.	VSS	Chl *a* (μg) = 0.72 × VSS (mg)	0.72
Figure IV-21	chlorophyll *a* + pheophytin *a*	vs.	VSS	Chl *a* + Ph *a* (μg)= 3.7 × VSS (mg)	0.87
Figure IV-22	$BOD_{uLt.}$	vs.	TSS	$BOD_{uLt.}$ (mg) = 0.012 × TSS (mg) + 1.3	0.78
Figure IV-23	$BOD_{uLt.}$	vs.	VSS	$BOD_{uLt.}$ (mg) = 0.13 × VSS (mg) + 1.2	0.80
Figure IV-24	$BOD_{uLt.}$	vs.	chlorophyll *a*	$BOD_{uLt.}$ (mg) = 0.20 × Chl *a* (μg) + 1.6	0.72
Figure IV-25	$BOD_{uLt.}$	vs.	chlorophyll *a* + pheophytin *a*	$BOD_{uLt.}$ (mg) = 0.044 × [Chl *a*+Ph *a*] (μg) + 0.89	0.87

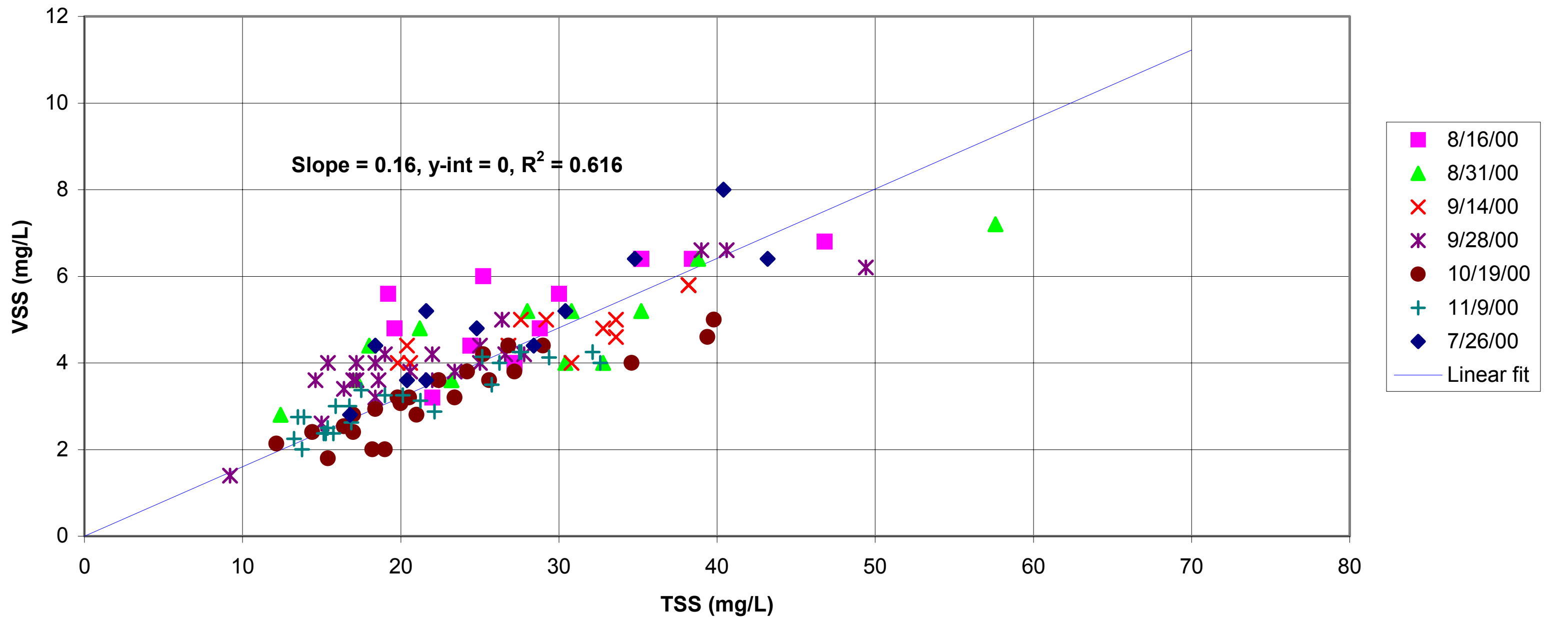

Figure IV-1: VSS vs. TSS for DWSC waters.

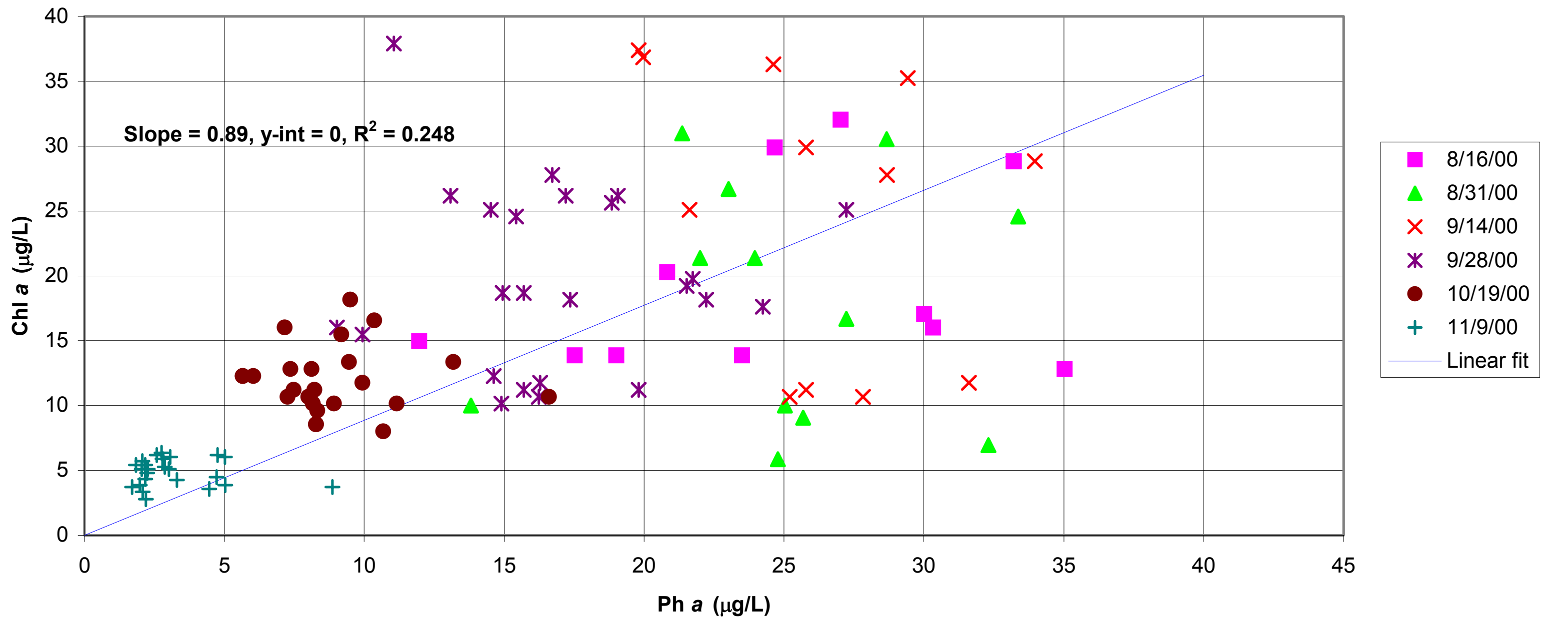

Figure IV-2: Chlorophyll *a* vs. pheophytin *a* for DWSC waters.

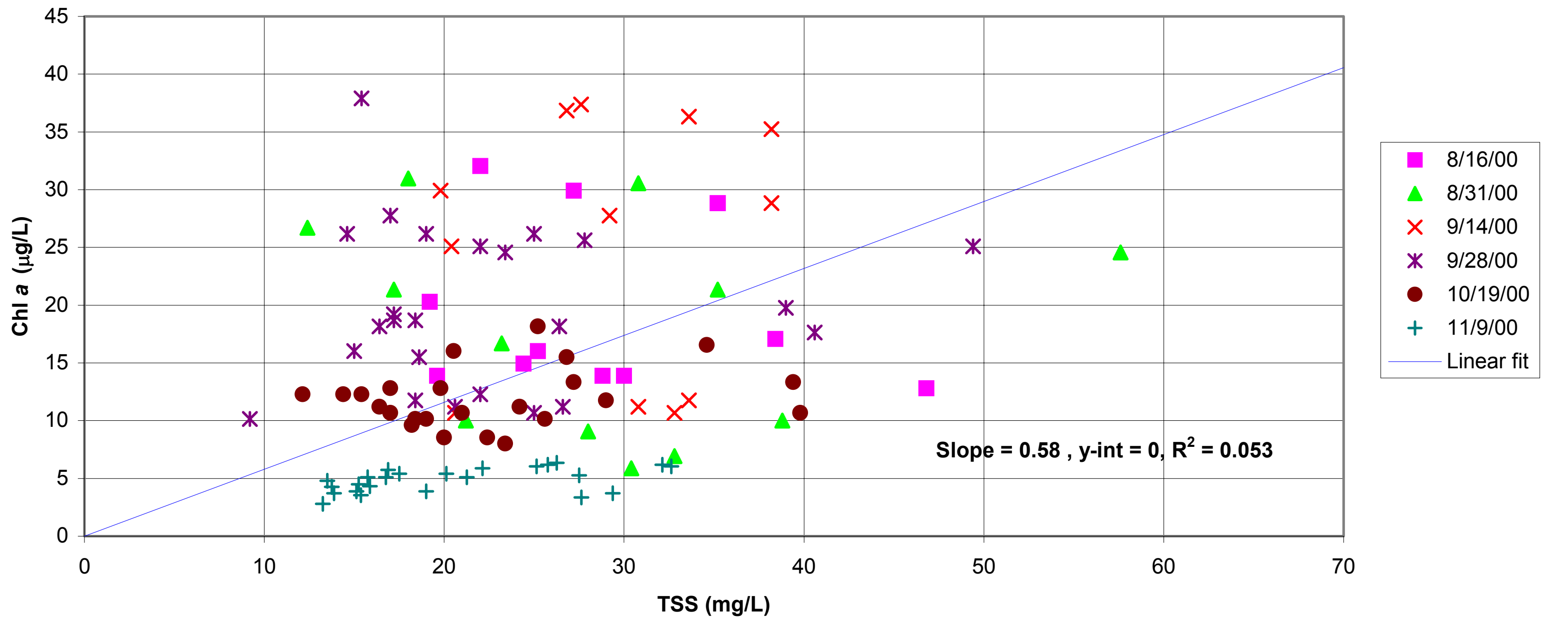

Figure IV-3: Chlorophyll *a* vs. TSS for DWSC waters.

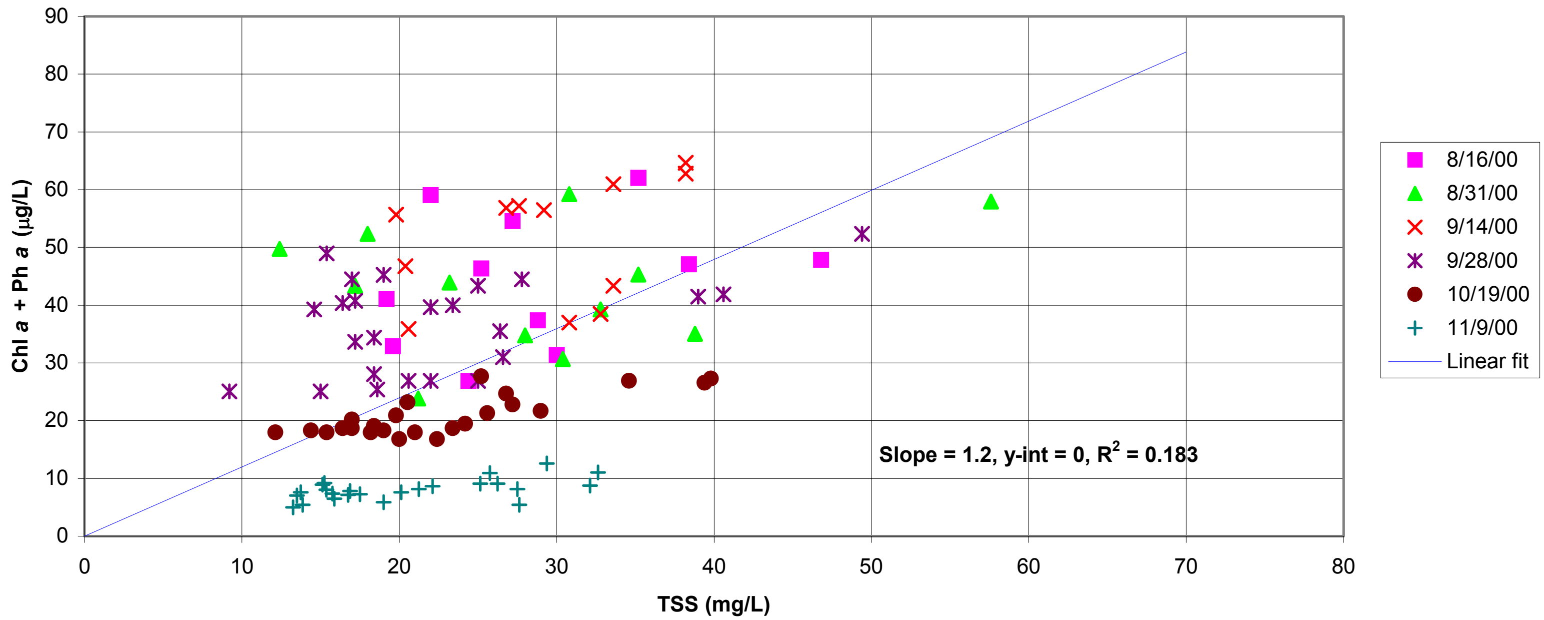

Figure IV-4: Chlorophyll *a* + pheophytin *a* vs. TSS for DWSC waters.

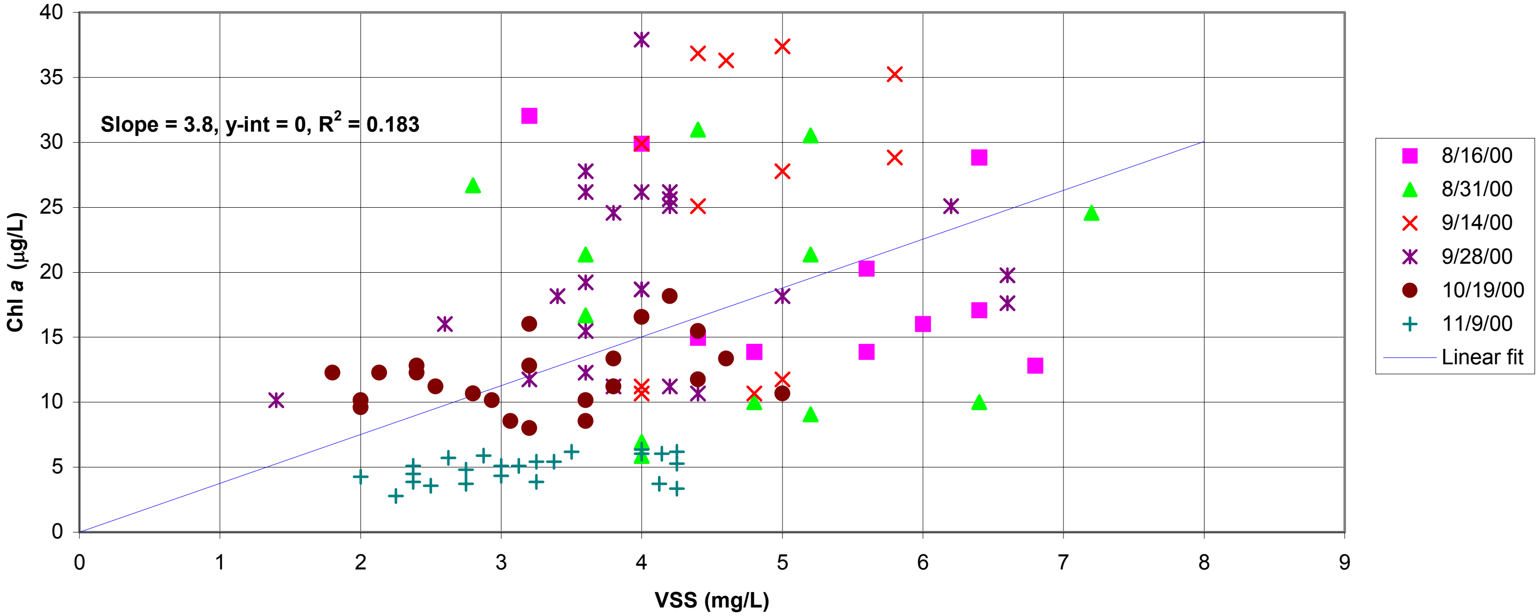

Figure IV-5: Chlorophyll *a* vs. VSS for DWSC waters.

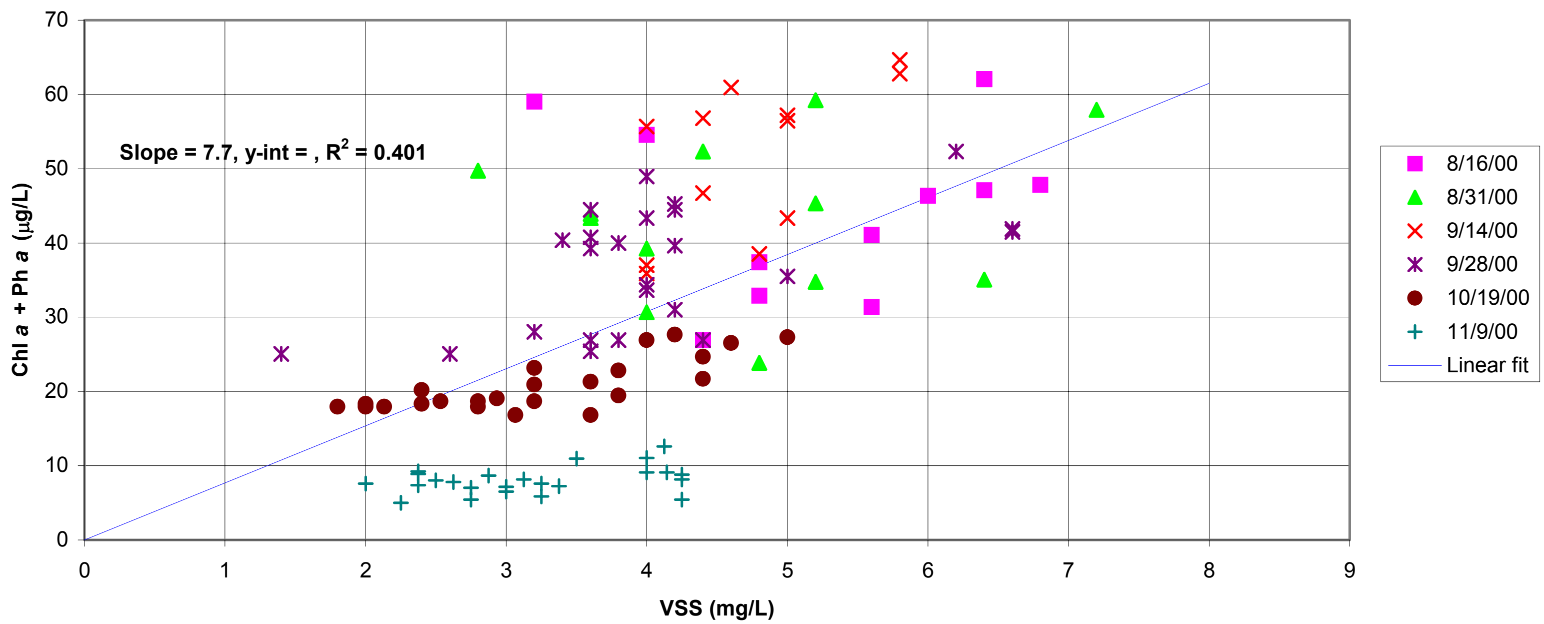

Figure IV-6: Chlorophyll *a* + pheophytin *a* vs. VSS for DWSC waters.

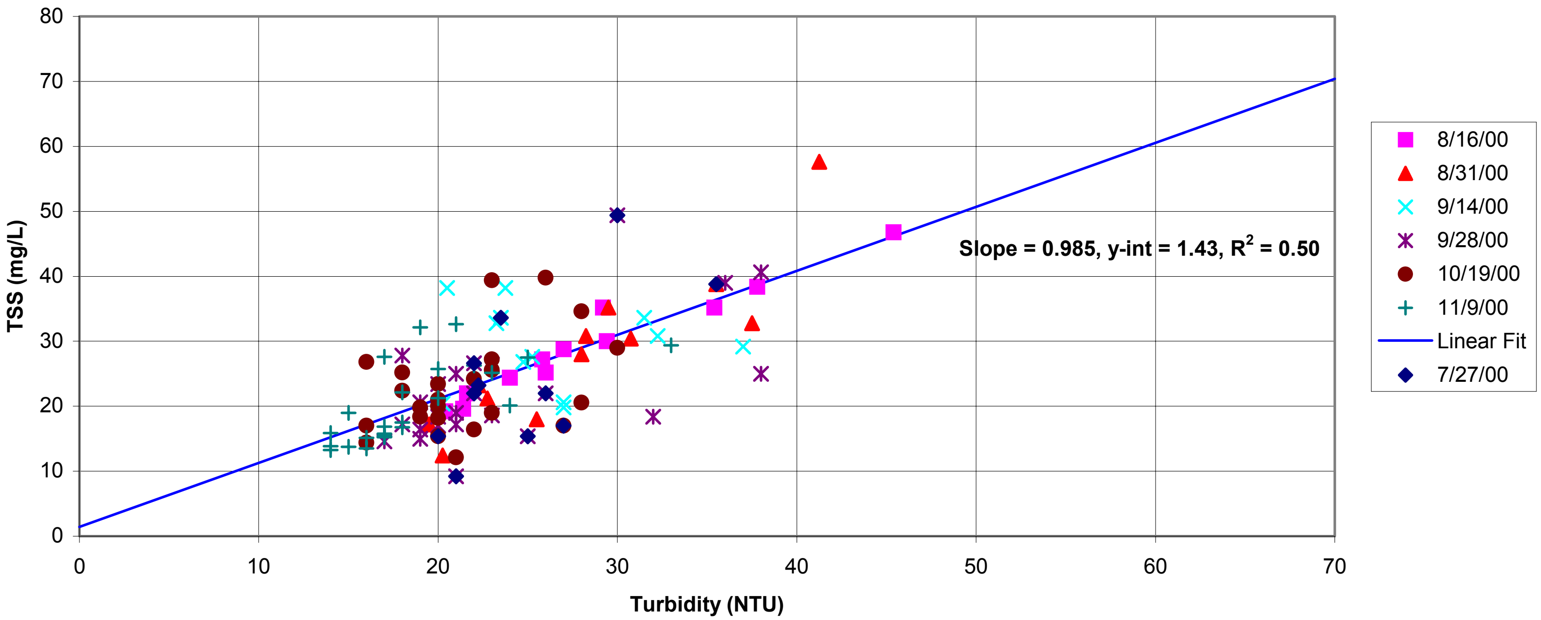

Figure IV-7: TSS vs. turbidity for DWSC waters.

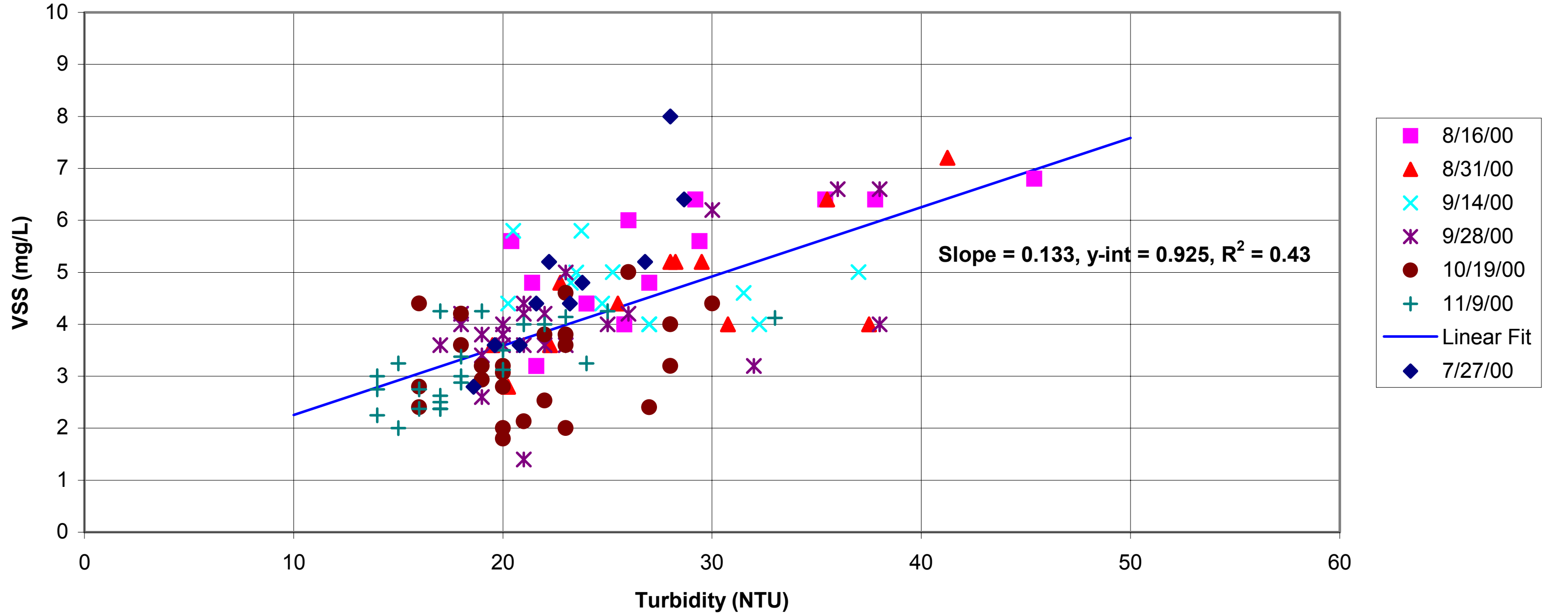

Figure IV-8: VSS vs. turbidity for DWSC waters.

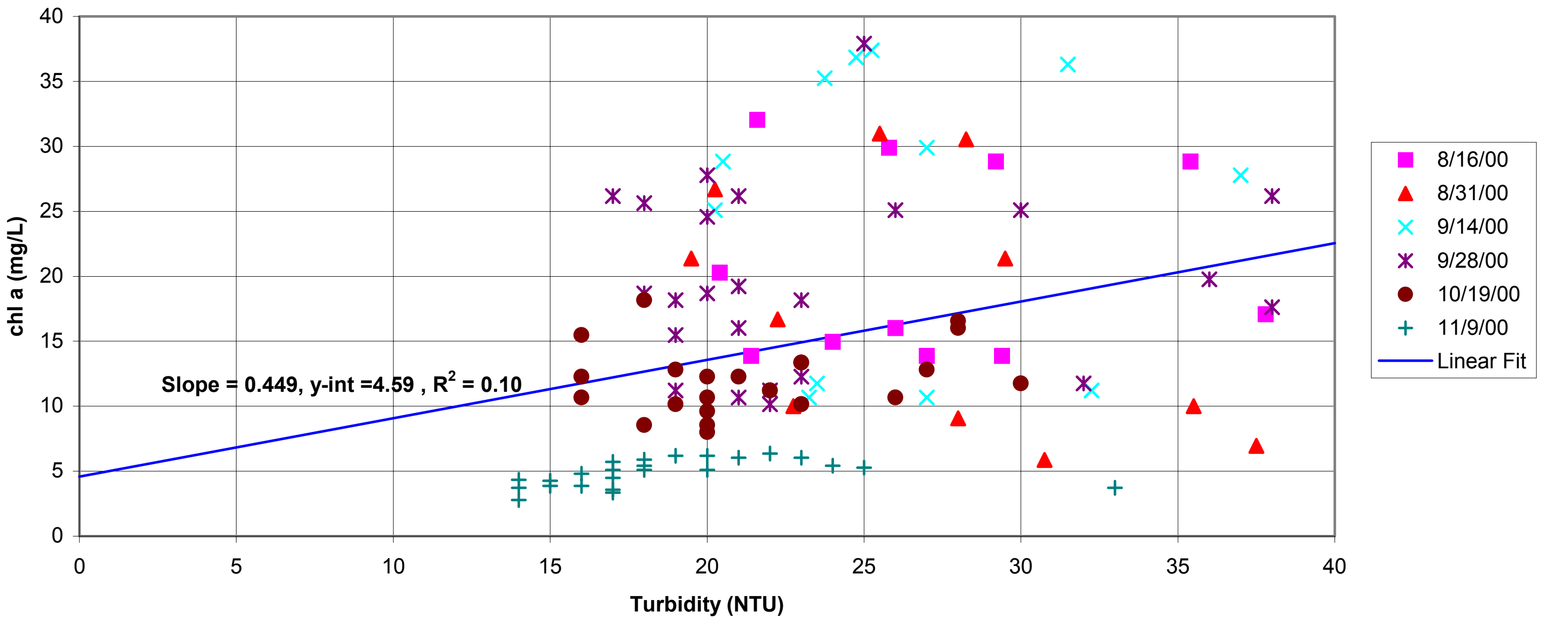

Figure IV-9: Chlorophyll *a* vs. turbidity for DWSC waters.

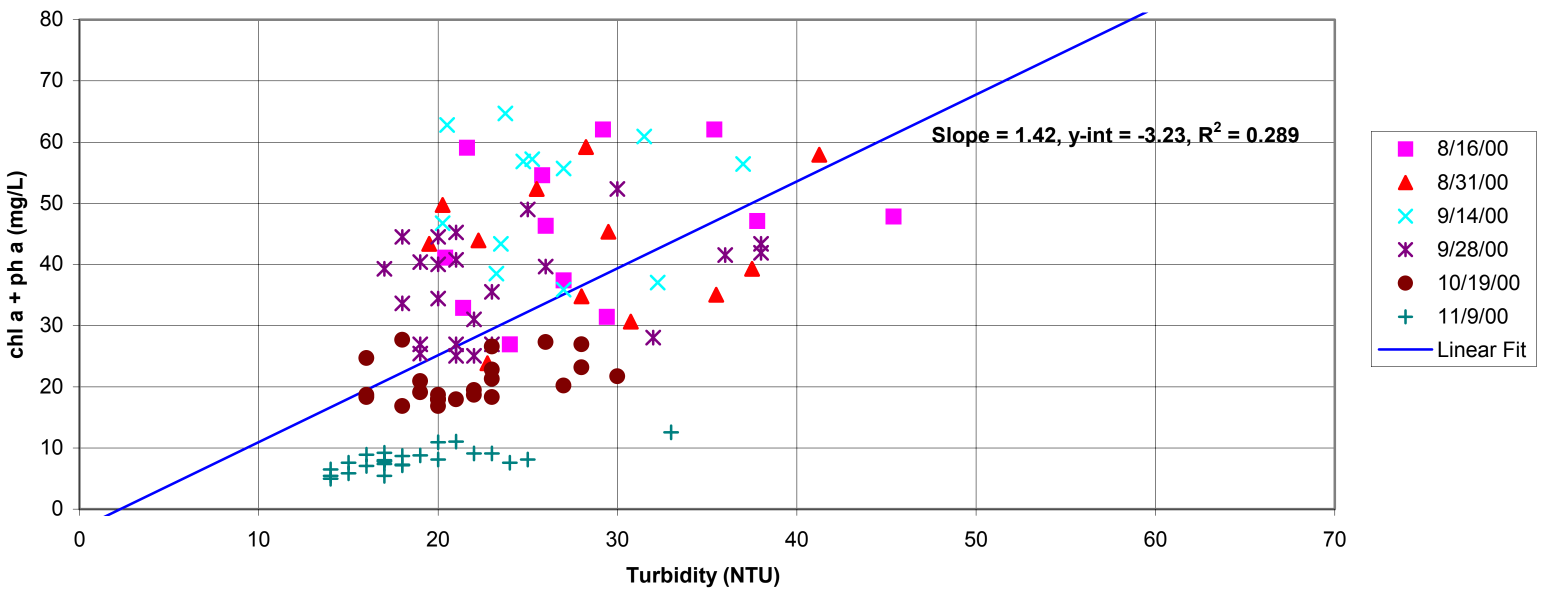

Figure IV-10: Chlorophyll *a* + pheophytin *a* vs. turbidity for DWSC waters.

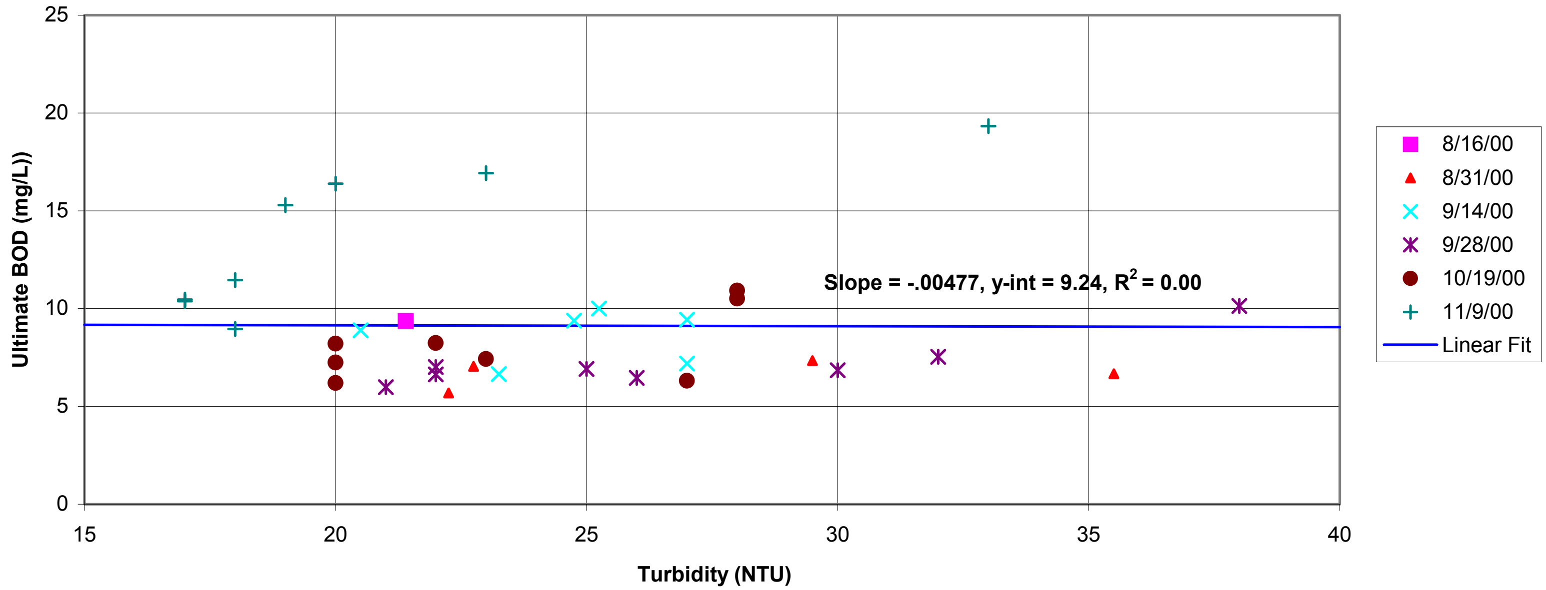

Figure IV-11: Ultimate BOD vs. turbidity for DWSC waters.

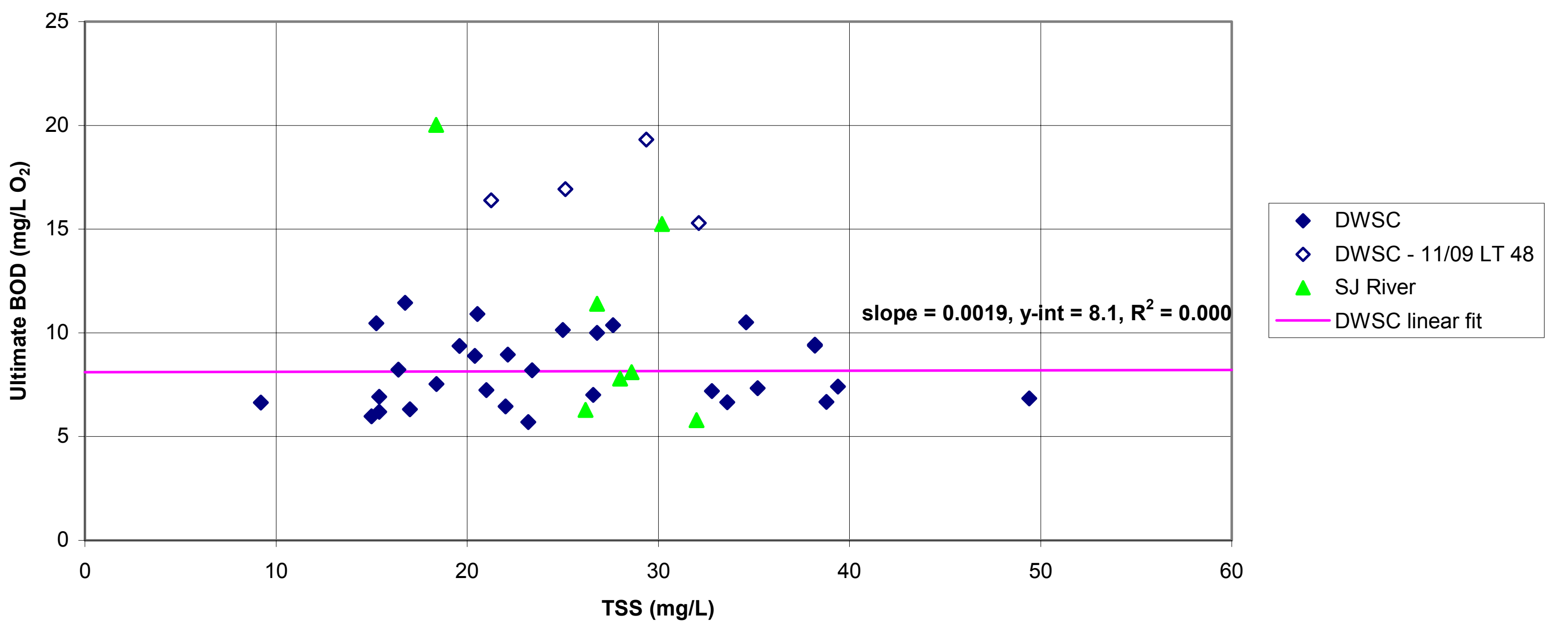

Figure IV-12: Ultimate BOD vs. TSS for DWSC and San Joaquin River waters.

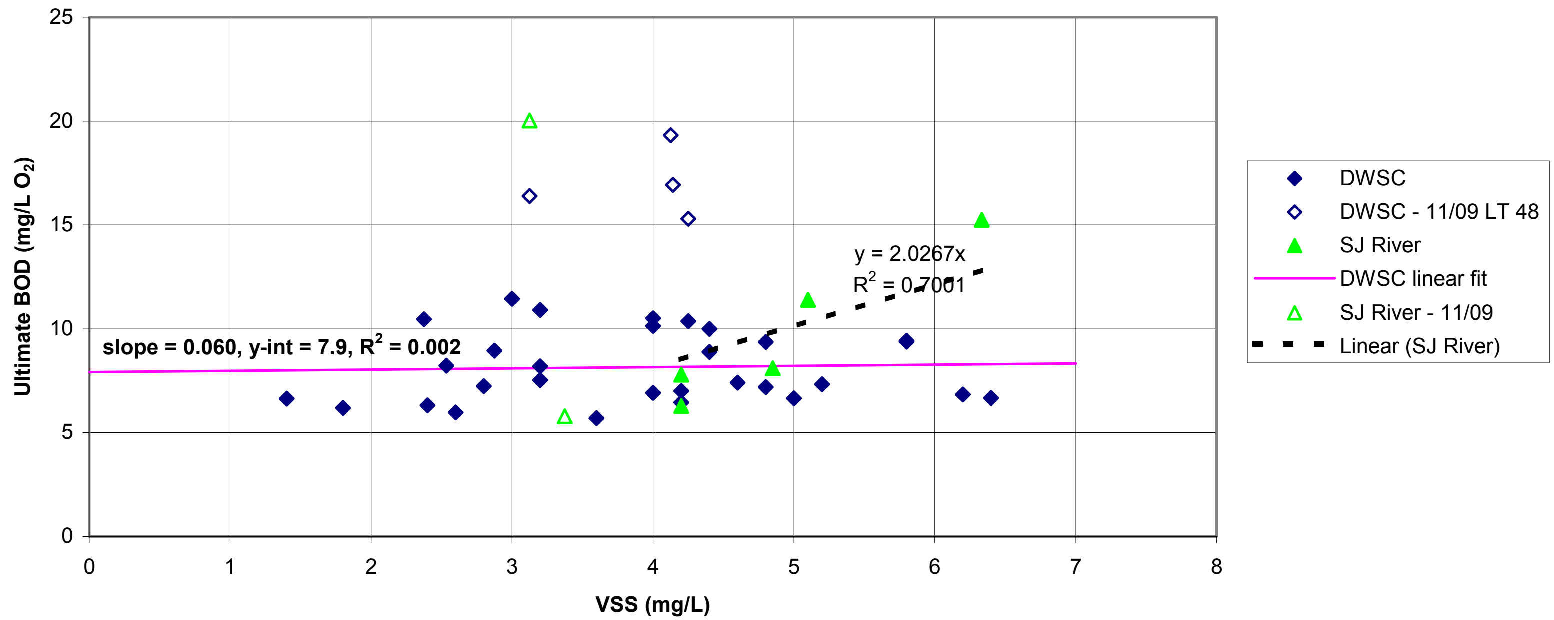

Figure IV-13: Ultimate BOD vs. VSS for DWSC and San Joaquin River waters.

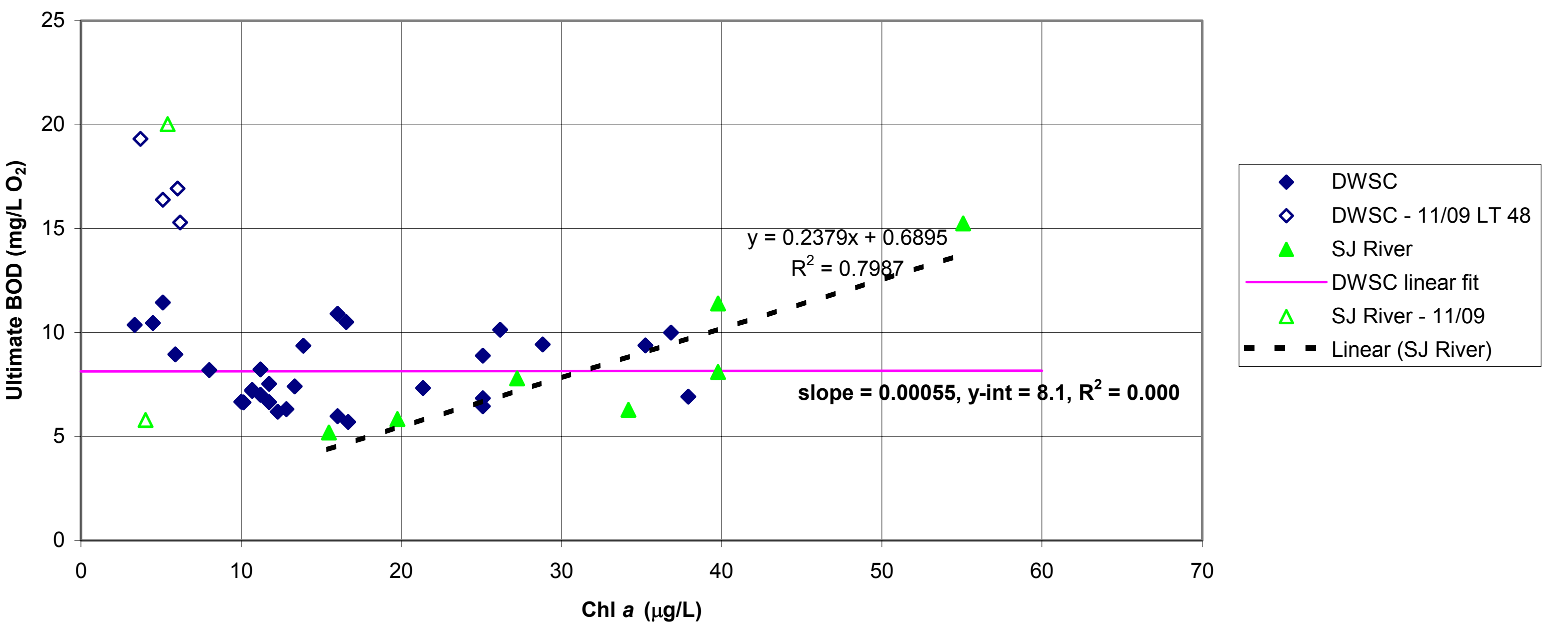

Figure IV-14: Ultimate BOD vs. chlorophyll *a* for DWSC and San Joaquin River waters.

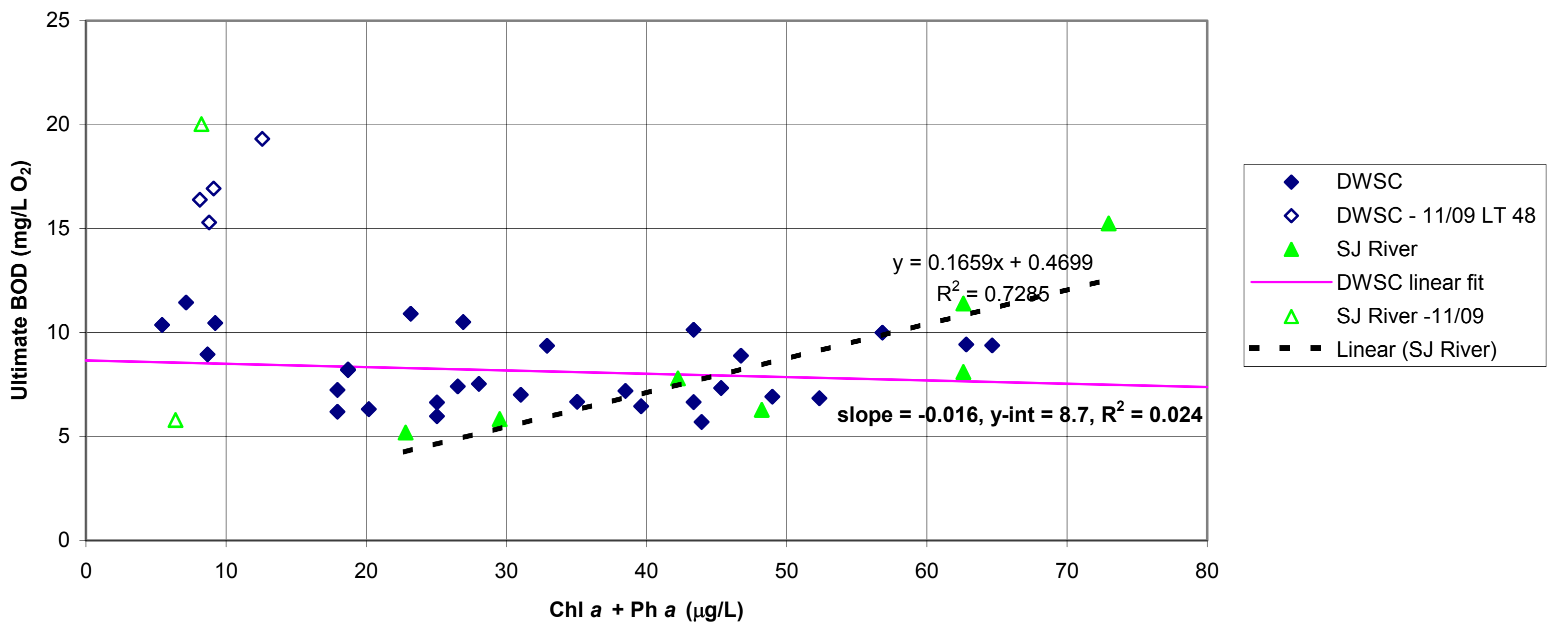

Figure IV-15: Ultimate BOD vs. chlorophyll *a* + pheophytin *a* for DWSC and San Joaquin River waters.

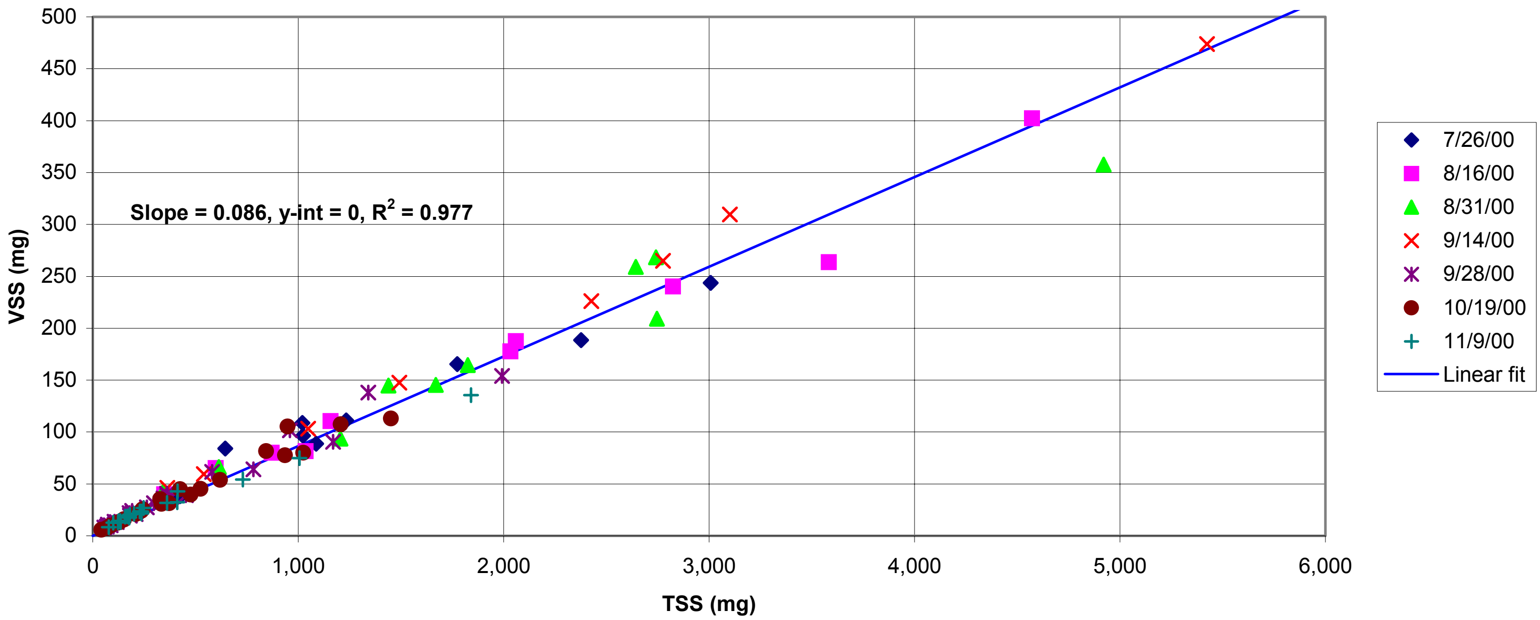

Figure IV-16: VSS vs. TSS for sediments trapped in the DWSC.

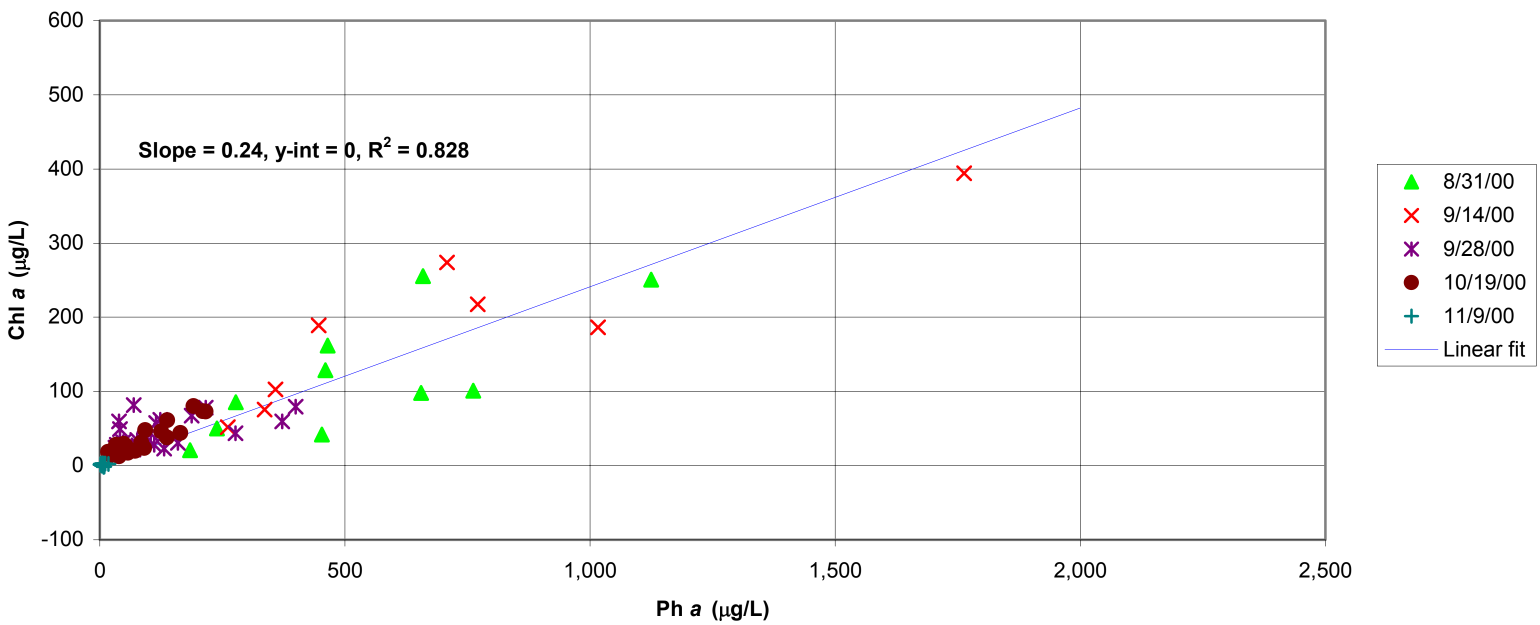

Figure IV-17: Chlorophyll *a* vs. pheopytin *a* or sediments trapped in the DWSC.

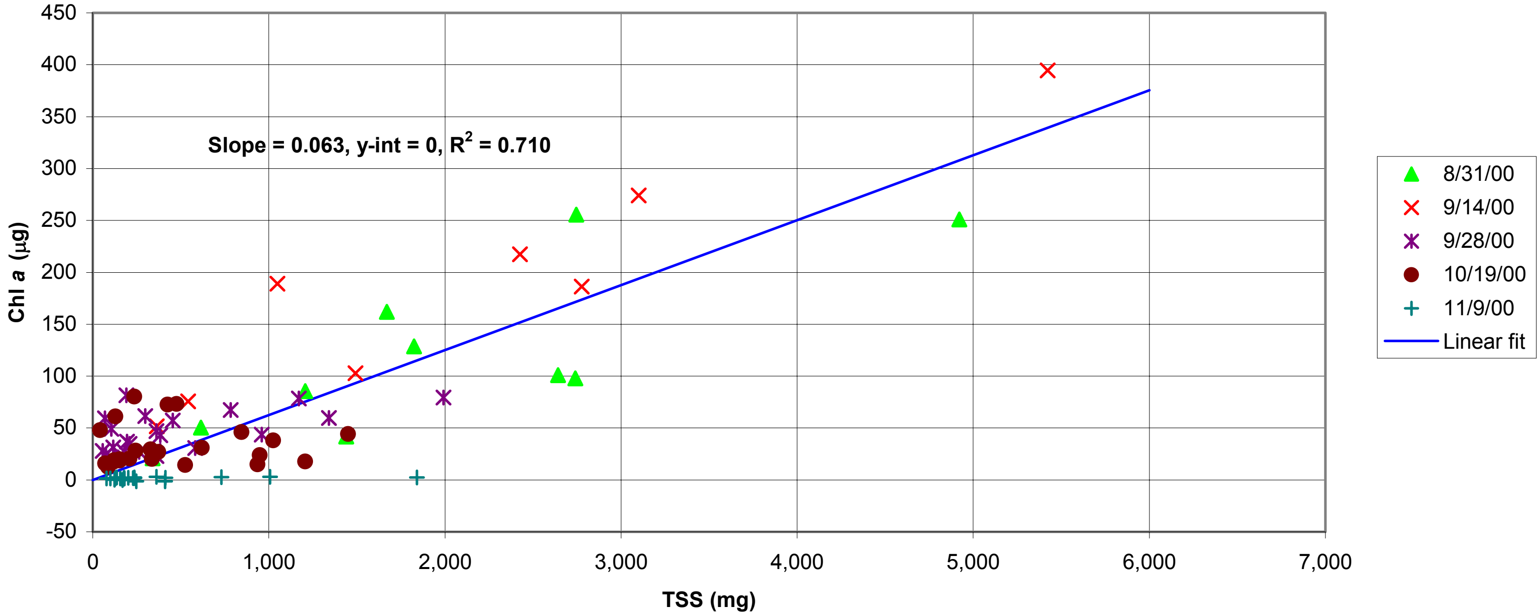

Figure IV-18: Chlorophyll *a* vs. TSS for sediments trapped in the DWSC.

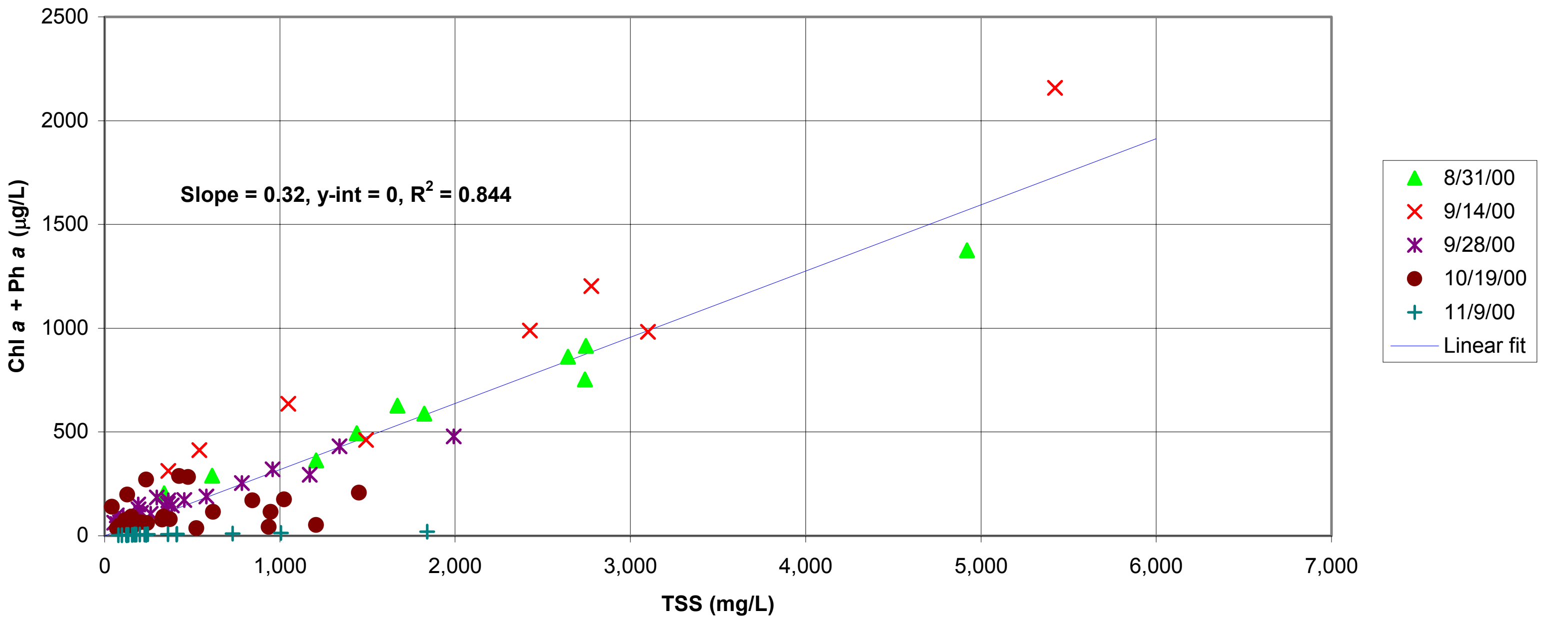

Figure IV-19: Chlorophyll *a* + pheophytin *a* vs. TSS for sediments trapped in the DWSC.

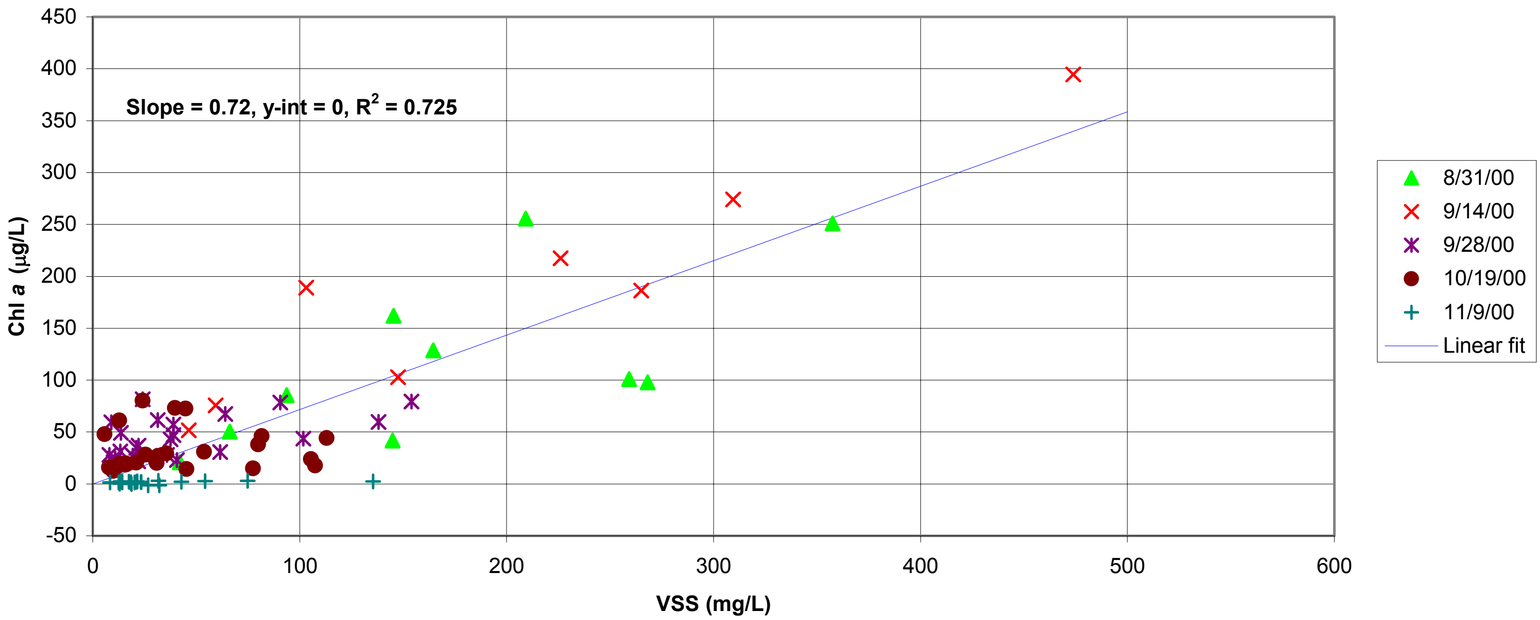

Figure IV-20: Chlorophyll *a* vs. VSS for sediments trapped in the DWSC.

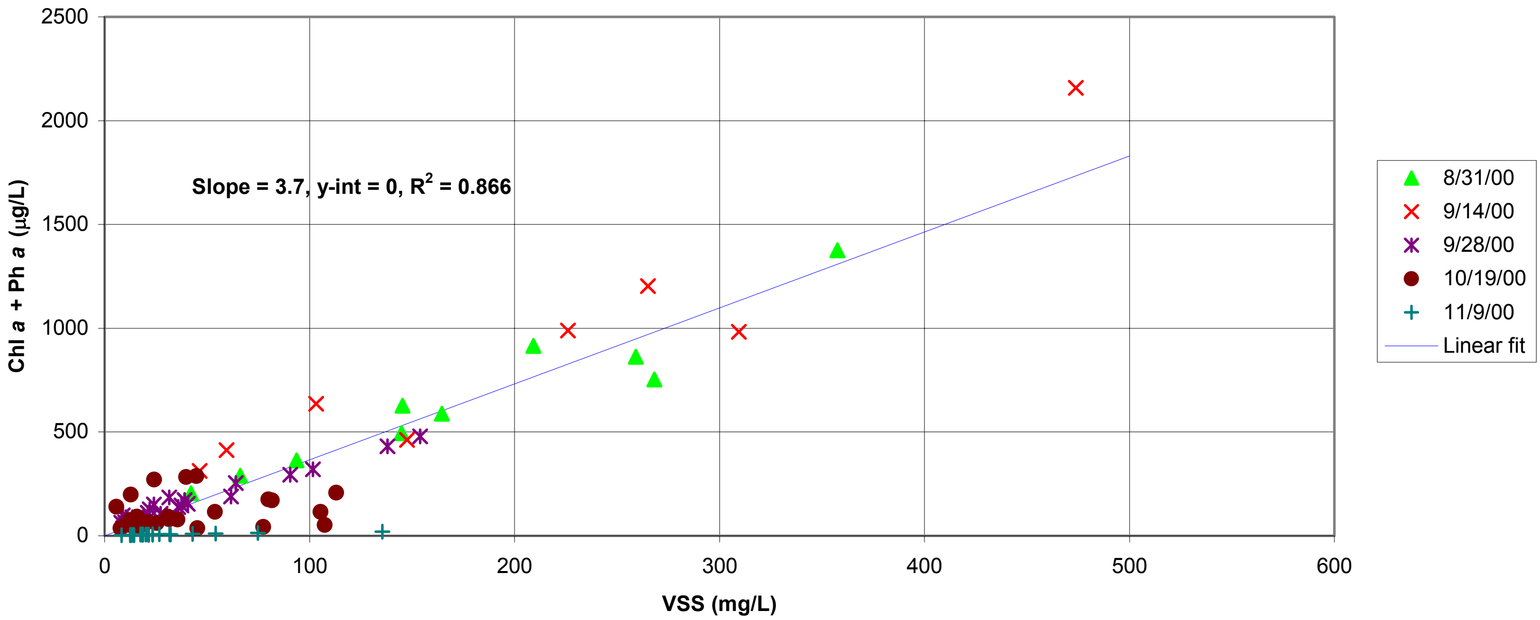

Figure IV-21: Chlorophyll *a* + pheophytin vs. VSS for sediments trapped in the DWSC.

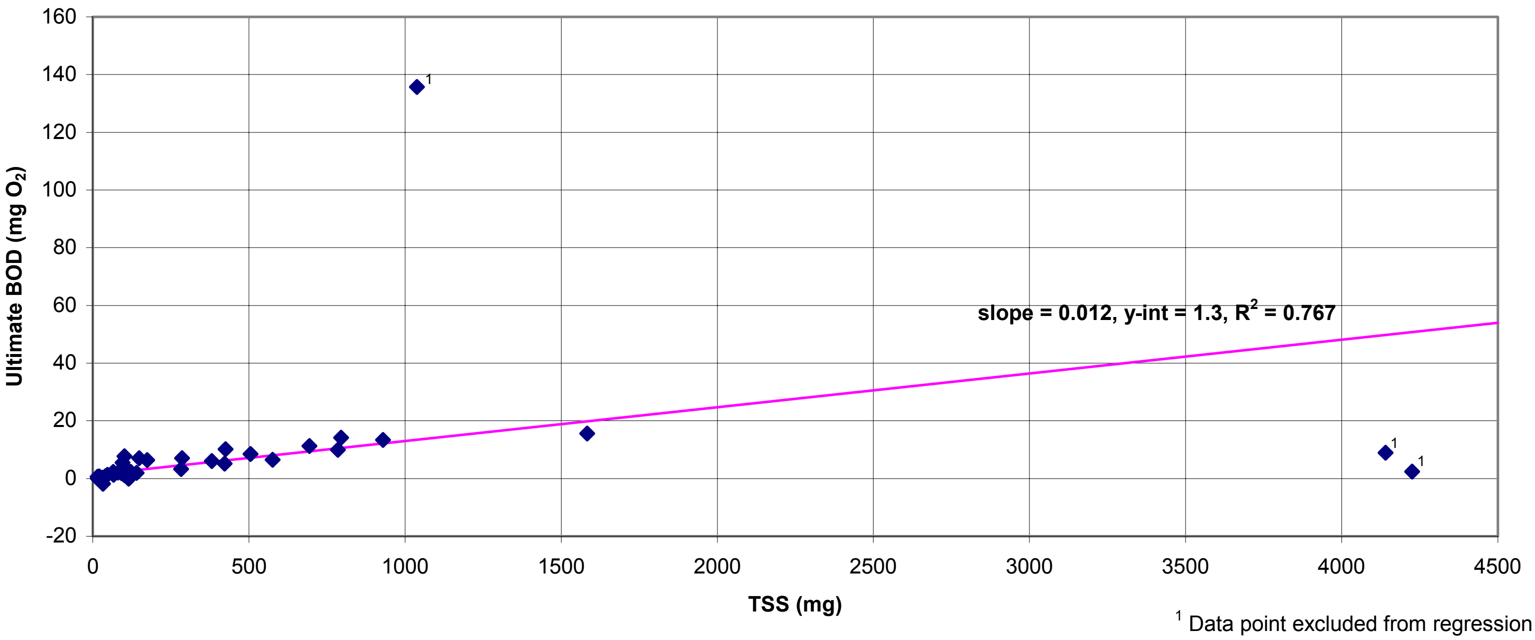

Figure IV-22: Ultimate BOD vs. TSS for sediments trapped in the DWSC.

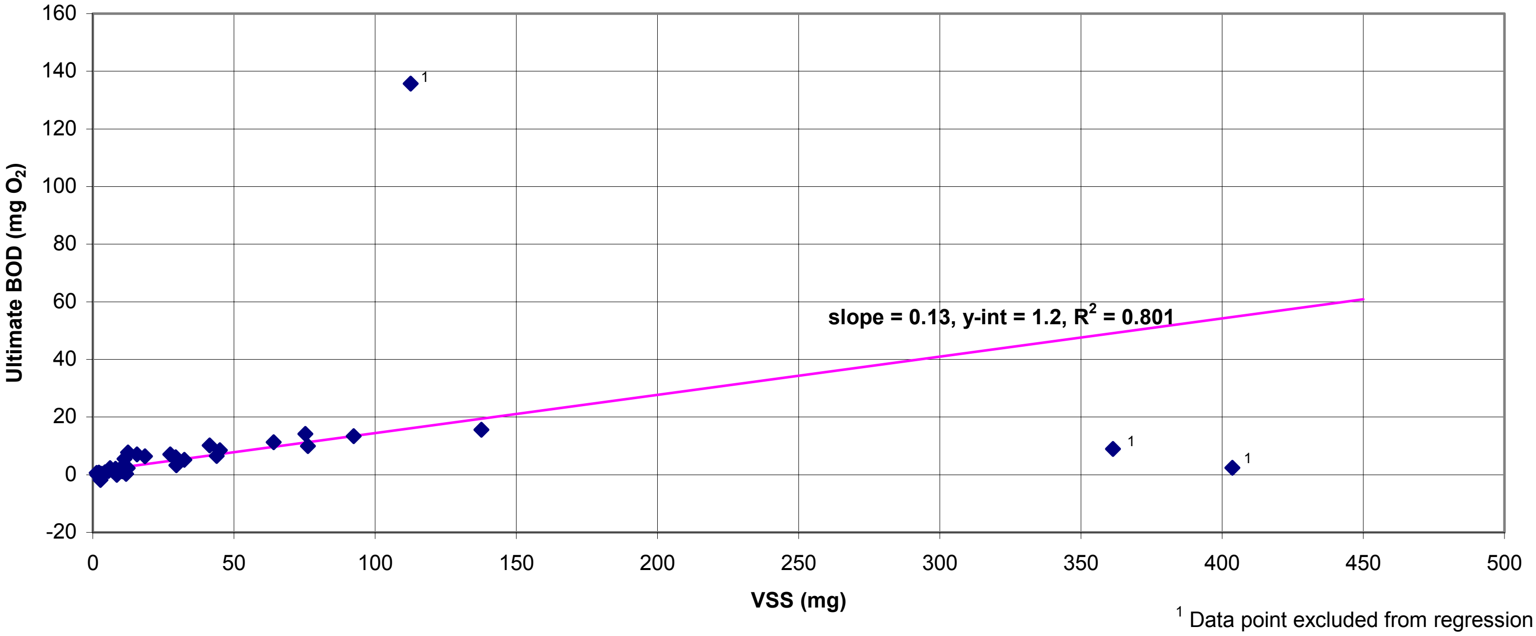

Figure IV-23: Ultimate BOD vs. VSS for sediments trapped in the DWSC.

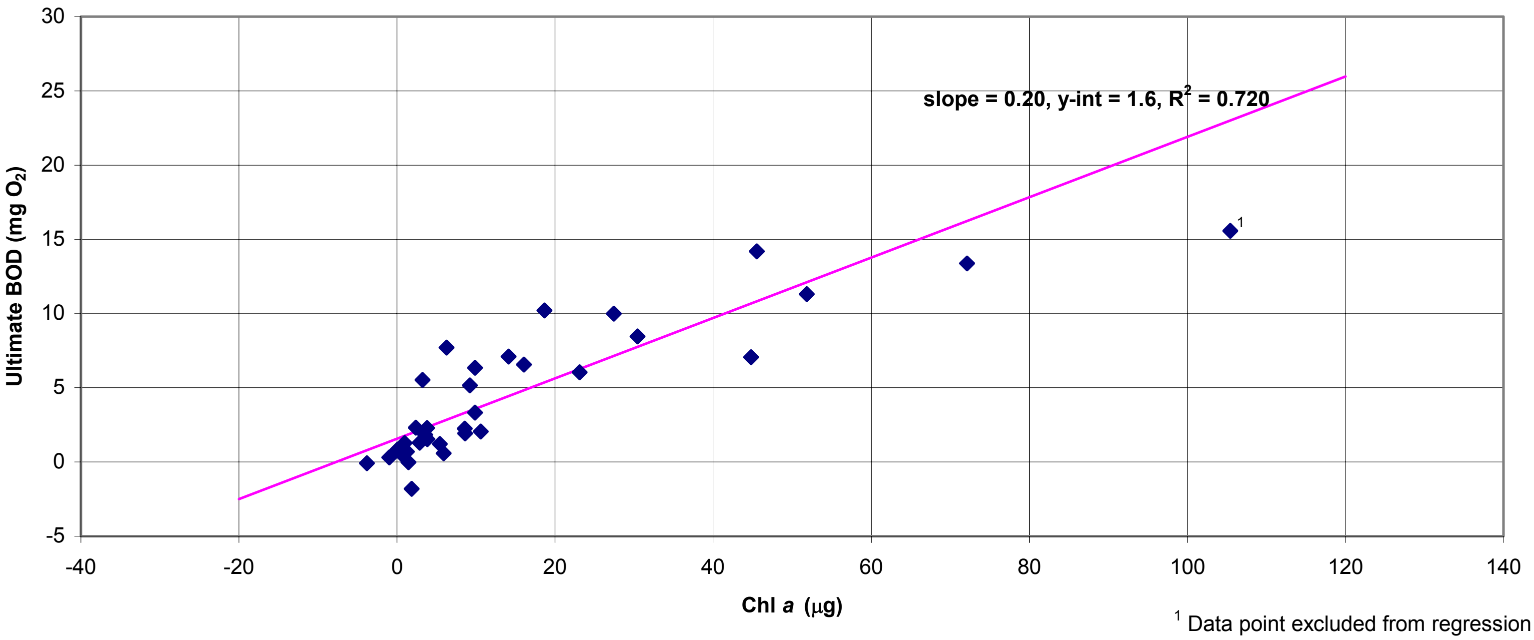

Figure IV-24: Ultimate BOD vs. chlorophyll *a* for sediments trapped in the DWSC.

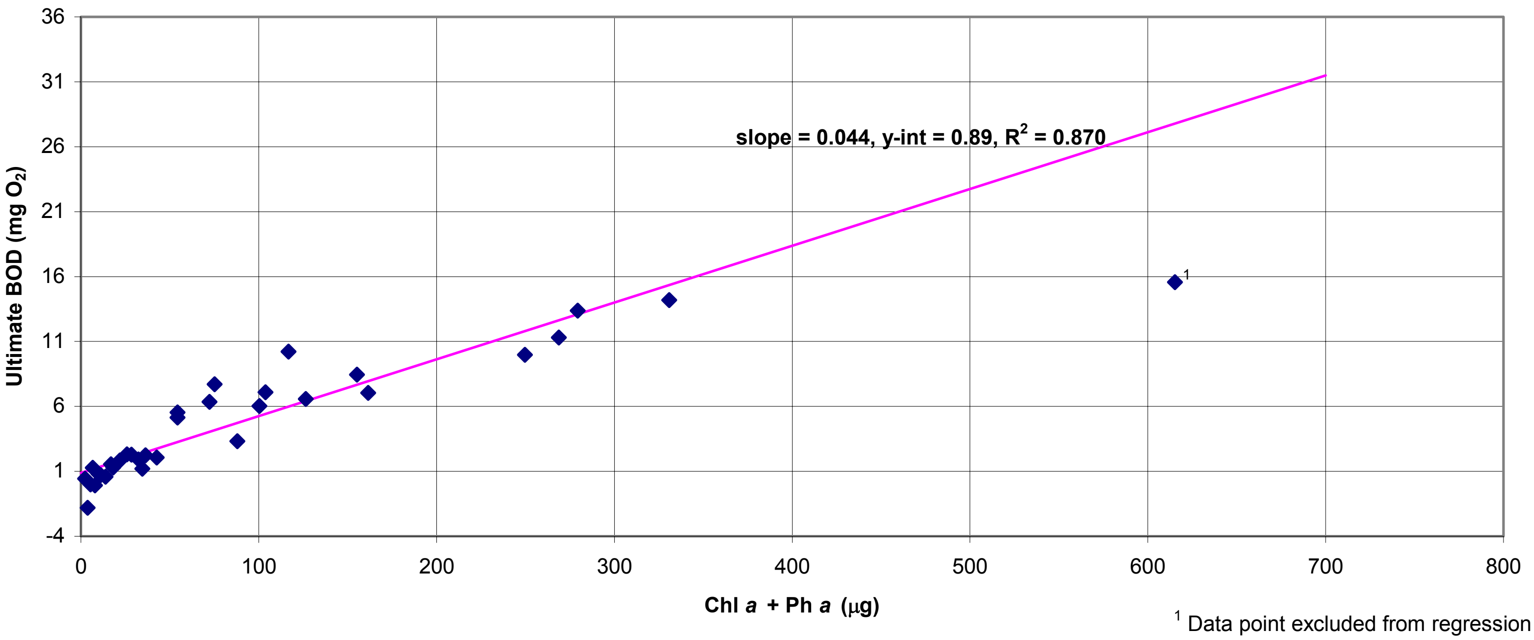

Figure IV-25: Ultimate BOD vs. chlorophyll *a* + pheophytin *a* for sediments trapped in the DWSC

V. Conclusions

Concentrations of water and sediment deposition fluxes measured in the San Joaquin River suggest that settling and resuspension rates are similar for much of the DWSC. Most of the sediment burial occurs between within the first mile of the DWSC below the Port of Stockton. Beyond Rough and Ready Island it appears that a dynamic steady-state condition exists between particle settling and resuspension. A mass balance analysis is currently underway to quantify burial and resuspension rates. These results will be incorporated in the final draft of this report.

Calculated settling rates of TSS, VSS, chlorophyll *a* and pheophytin *a* are relatively high. The high estimated settling velocities appear to be caused by resuspension and overtrapping and/or aggregation of particles in the DWSC. Strong correlations between chlorophyll *a*, pheophytin *a*, and VSS with TSS for the trapped sediments suggest that this lighter organic matter is associated with inorganic soils that settle more rapidly. Relatively heavy mineral soil grains may be collecting organic matter in route to the channel bottom.

The data presented here also show that chlorophyll *a* concentrations decrease rapidly upon entry to the DWSC. The phytoplankton associated with the chlorophyll *a* decay may exert a significant oxygen demand while in the DWSC. The trapped sediments exhibit good correlations between the ultimate BOD and the sum of chlorophyll *a* and pheophytin *a* suggesting that algae decomposition is responsible for much of the oxygen demand associated with the suspended matter entering the DWSC.

Correlations of the ultimate BOD with phytoplankton pigments were poor for waters of the DWSC. This appears to be associated with the relatively high soluble fraction of BOD in the DWSC. However, a limited number of measurements performed in the San Joaquin River above the DWSC exhibit much better correlations with chlorophyll *a* concentrations and the sum of chlorophyll *a* and pheophytin *a* concentrations. These observations may suggest that phytoplankton decomposition in the DWSC results in a transformation of BOD from a particulate form associated with intact algae cells to a soluble form. Additional BOD measurements of water collected from the San Joaquin River and DWSC are needed to verify this hypothesis.

V. References

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VI. Appendices

Appendix A. Water quality data

Appendix B. Deposition flux data

Appendix C. Settling velocity data

Appendix A. Water quality data

Table A-1: Approximate measurement times

Location	Date						
	7/27/00 (Spring - 3)	8/16/00 (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1]	13:30	9:35	11:00	9:05	9:30	9:10	6:25
LT. 38[2]	18:55	16:25	17:15	17:00	16:40	14:35	12:45
LT. 38[3]	0:30	23:10	11:35	23:45			
LT. 38[4]	6:30	16:40	5:00	4:30			
LT. 43[1]	13:55	9:55	11:20	9:25	9:55	9:40	6:45
LT. 43[2]	19:20	16:50	17:40	17:20	17:20	15:00	13:05
LT. 43[3]	0:55	23:35	0:05	0:10			
LT. 43[4]	6:45	17:00	5:25	4:50			
LT. 48[1]	14:30	10:15	11:45	9:50	10:25	10:05	7:05
LT. 48[2]	17:35	17:15	18:05	17:45	17:35	15:20	13:30
LT. 48[3]	1:20	23:55	0:30	0:35			
LT. 48[4]	7:10	17:25	5:45	5:15			

Hatched area indicate composite samples or experiment not performed for that date.

Table A-2: Field water temperature measurements
Units = °C

Location	Depth (ft)	Date						
		7/26/00 (Spring - 3)	8/16/00 (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1]	8.2	25.20	25.37	22.72	22.66	21.94	18.27	14.03
	16.4	25.12	25.36	22.64	22.45	21.89	18.23	14.01
	24.6	25.13	25.36	22.52	22.43	21.89	18.22	14.01
	B	25.12	25.36	22.51	22.42	21.89	18.00	14.01
LT. 38[2]	8.2	25.58	25.44	22.48	22.96	22.36	18.46	14.10
	16.4	25.26	25.41	22.49	22.79	22.24	18.40	14.16
	24.6	25.21	25.40	22.47	22.54	22.08	18.39	14.13
	B	25.18	25.40	22.43	22.48	21.97	18.36	14.14
LT. 38[3]	8.2	25.35	25.58	22.94	22.70			
	16.4	25.25	25.47	22.43	22.69			
	24.6	25.09	25.45	22.43	22.68			
	B	25.08	25.44	22.42	22.69			
LT. 38[4]	8.2	25.47	25.67	22.65	22.58			
	16.4	25.28	25.53	22.88	22.57			
	24.6	25.09	25.47	22.85	22.57			
	B	25.09	25.46	22.85	22.58			
LT. 43[1]	8.2	25.60	25.48	22.38	22.71	21.87	18.35	13.96
	16.4	25.27	25.45	22.36	22.53	21.82	18.34	13.90
	24.6	25.02	25.47	22.20	22.43	21.81	18.36	13.89
	B	---	25.46	22.06	22.38	21.81	18.36	13.90
LT. 43[2]	8.2	25.60	25.63	22.44	23.02	22.40	18.67	14.03
	16.4	25.40	25.56	22.49	22.86	22.01	18.49	14.07
	24.6	25.30	25.54	22.23	22.60	21.73	18.46	13.93
	B	---	25.54	22.65	22.40	21.59	18.46	13.83
LT. 43[3]	8.2	25.77	25.69	22.24	22.77			
	16.4	25.35	25.63	22.23	22.77			
	24.6	25.02	25.60	21.65	22.74			
	B	---	25.59	21.47	22.67			
LT. 43[4]	8.2	25.59	25.74	22.09	22.59			
	16.4	25.30	25.64	22.11	22.59			
	24.6	25.16	25.60	21.96	22.61			
	B	---	25.56	21.78	22.61			
LT. 48[1]	8.2	25.17	25.40	27.29	22.44	21.48	18.48	13.63
	16.4	25.03	25.64	22.29	22.43	21.52	18.48	13.61
	24.6	24.86	25.67	21.88	22.45	21.49	18.48	13.60
	B	24.86	25.62	---	22.42	21.49	18.45	13.60
LT. 48[2]	8.2	25.67	25.66	22.40	23.05	22.06	18.65	13.79
	16.4	25.28	25.69	21.50	22.79	21.49	18.58	13.77
	24.6	25.07	25.66	21.26	23.60	21.35	18.58	13.76
	B	---	25.66	21.33	22.45	21.33	18.58	13.69
LT. 48[3]	8.2	25.47	25.81	21.74	22.06			
	16.4	25.27	25.79	21.84	22.60			
	24.6	25.19	25.78	21.63	22.67			
	B	---	25.71	21.57	22.67			
LT. 48[4]	8.2	25.54	26.19	21.72	22.57			
	16.4	25.38	25.84	21.58	22.58			
	24.6	25.30	25.78	21.43	22.56			
	B	25.28	25.77	21.24	22.54			

[1,2,3,4] – See tidal stage chart.
Hatched area indicate composite samples or experiment not performed for that date

Table A-3: Field electrical conductivity measurements in the DWSC.
Units = μmho/cm (not adjusted for temperature)

Location	Depth (ft)	Date 7/26/00 (Spring - 3)	8/16/00 (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1]	8.2	625	605	420	509	435	489	562
	16.4	628	606	419	507	435	503	562
	24.6	627	606	418	505	435	501	562
	B	630	606	418	504	435	501	561
LT. 38[2]	8.2	629	612	420	511	449	491	530
	16.4	624	611	420	510	447	490	531
	24.6	625	611	420	510	446	490	531
	B	626	611	421	509	445	492	534
LT. 38[3]	8.2	628	618	421	505			
	16.4	627	613	420	504			
	24.6	627	612	436	503			
	B	627	612	441	503			
LT. 38[4]	8.2	628	608	422	498			
	16.4	629	607	424	500			
	24.6	632	609	424	500			
	B	633	609	423	500			
LT. 43[1]	8.2	630	616	414	500	428	502	610
	16.4	624	614	414	496	427	504	606
	24.6	636	616	416	493	427	509	604
	B	---	615	410	493	425	516	605
LT. 43[2]	8.2	630	662	427	506	447	528	578
	16.4	626	621	431	501	445	533	584
	24.6	620	613	433	496	429	532	596
	B	---	611	422	493	418	531	609
LT. 43[3]	8.2	628	623	416	498			
	16.4	622	623	416	498			
	24.6	611	626	408	498			
	B	---	626	407	498			
LT. 43[4]	8.2	625	616	418	498			
	16.4	620	621	419	498			
	24.6	615	623	419	497			
	B	---	614	419	498			
LT. 48[1]	8.2	612	620	424	502	407	533	643
	16.4	604	596	423	502	408	533	665
	24.6	581	619	413	495	407	532	662
	B	581	585	---	495	407	533	671
LT. 48[2]	8.2	620	638	434	492	428	554	655
	16.4	608	660	407	486	424	554	654
	24.6	600	664	403	485	426	553	653
	B	---	661	402	481	426	551	655
LT. 48[3]	8.2	587	618	411	475			
	16.4	578	621	411	476			
	24.6	574	627	413	475			
	B	---	623	416	476			
LT. 48[4]	8.2	598	647	417	492			
	16.4	588	646	428	492			
	24.6	578	643	429	490			
	B	579	649	423	490			

[1,2,3,4] - See tidal stage chart.
Hatched area indicate composite samples or experiment not performed for that date

Table A-4: Field pH measurements in the DWSC

Location	Depth (ft)	Date						
		7/26/00 (Spring - 3)	8/16/00 (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1]	8.2	7.2	7.5	7.1	7.3	7.4	7.5	7.6
	16.4	7.2	7.3	7.4	7.2	7.3	7.4	7.6
	24.6	---	7.3	7.4	7.0	7.3	7.4	7.5
	B	---	7.3	7.3	7.6	7.2	7.4	7.5
LT. 38[2]	8.2	6.9	7.5	7.6	7.7	7.6	7.5	7.5
	16.4	---	7.4	7.7	7.6	7.5	7.5	7.5
	24.6	---	7.3	7.6	7.5	7.3	7.5	7.5
	B	---	7.3	7.6	7.5	7.3	7.5	7.5
LT. 38[3]	8.2	---	7.5	7.5	7.8			
	16.4	---	7.3	7.6	7.7			
	24.6	---	7.3	7.5	7.7			
	B	---	7.3	7.5	7.6			
LT. 38[4]	8.2	---	7.5	7.4	7.9			
	16.4	---	7.3	7.6	7.8			
	24.6	---	7.2	7.6	7.7			
	B	---	7.2	7.5	7.7			
LT. 43[1]	8.2	---	7.6	7.5	7.6	7.6	7.6	7.6
	16.4	---	7.4	6.4	7.7	7.5	7.5	7.6
	24.6	---	7.3	6.9	7.7	7.4	7.5	7.5
	B	---	7.3	7.1	7.7	7.4	7.5	7.5
LT. 43[2]	8.2	---	7.5	7.7	8.0	7.7	7.6	7.6
	16.4	---	7.4	7.7	8.0	7.6	7.5	7.5
	24.6	---	7.4	7.6	7.9	7.5	7.5	7.5
	B	---	7.4	7.6	7.8	7.5	7.5	7.5
LT. 43[3]	8.2	---	7.7	7.7	8.0			
	16.4	---	7.4	7.8	7.9			
	24.6	---	7.4	7.7	7.8			
	B	---	7.3	7.6	7.8			
LT. 43[4]	8.2	---	7.6	7.6	7.8			
	16.4	---	7.3	7.7	7.8			
	24.6	---	7.3	7.6	7.7			
	B	---	7.3	7.6	7.7			
LT. 48[1]	8.2	---	7.5	0.0	7.5	7.7	7.7	7.7
	16.4	---	7.4	7.6	7.5	7.6	7.7	7.6
	24.6	---	7.4	7.6	7.6	7.6	7.6	7.6
	B	---	7.2	0.0	7.6	7.5	7.6	7.5
LT. 48[2]	8.2	---	7.7	7.3	8.0	8.9	7.6	7.6
	16.4	---	7.4	7.7	7.9	7.8	7.6	7.5
	24.6	---	7.3	7.7	7.6	7.7	7.5	7.5
	B	---	7.3	7.7	7.4	7.7	7.5	7.5
LT. 48[3]	8.2	---	7.9	7.6	8.0			
	16.4	---	7.7	8.0	8.0			
	24.6	---	7.7	7.9	7.9			
	B	---	7.5	7.8	7.9			
LT. 48[4]	8.2	---	7.7	8.0	7.8			
	16.4	---	7.3	7.8	7.8			
	24.6	---	7.3	7.7	7.7			
	B	---	7.3	7.6	7.7			

[1,2,3,4] - See tidal stage chart.

Hatched area indicate composite samples or experiment not performed for that date

Table A-5: Field dissolved oxygen measurements in the DWSC
Units = mg/L

Location	Depth (ft)	7/26/00 (Spring - 3)	8/16/00 (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1]	8.2	5.04	4.80	5.60	7.60	6.44	6.98	7.93
	16.4	4.80	4.60	5.60	7.50	6.36	6.87	7.84
	24.6	4.70	4.60	5.60	7.50	6.33	6.85	7.83
	B	4.60	4.50	5.50	6.90	6.31	6.85	7.83
LT. 38[2]	8.2	5.70	4.70	5.70	6.80	6.75	6.75	8.03
	16.4	5.00	4.50	5.60	6.70	6.64	6.64	7.94
	24.6	4.80	4.40	5.50	6.50	6.36	6.36	7.87
	B	4.60	4.40	5.50	6.50	6.16	6.16	7.86
LT. 38[3]	8.2	5.00	5.20	5.70	7.00			
	16.4	4.70	4.80	5.60	6.80			
	24.6	4.40	4.70	5.50	6.70			
	B	4.35	4.60	5.50	6.70			
LT. 38[4]	8.2	5.40	4.90	5.40	6.40			
	16.4	4.60	4.50	5.80	6.30			
	24.6	4.20	4.30	5.70	6.30			
	B	4.20	4.30	5.70	6.30			
LT. 43[1]	8.2	5.70	5.00	6.20	8.70	7.24	7.24	7.88
	16.4	4.80	4.90	6.10	8.20	7.28	7.28	7.88
	24.6	4.30	4.60	6.10	7.60	7.18	7.18	7.86
	B	---	4.60	6.05	7.20	6.65	6.65	7.85
LT. 43[2]	8.2	5.50	5.60	6.10	8.50	8.33	8.33	7.85
	16.4	5.00	5.40	6.10	8.20	7.44	7.44	7.82
	24.6	4.60	5.20	5.80	8.00	7.12	7.12	7.78
	B	---	5.30	5.40	7.80	7.28	7.28	7.70
LT. 43[3]	8.2	6.20	5.70	6.20	8.10			
	16.4	4.70	5.20	6.20	8.10			
	24.6	4.10	4.60	6.80	7.90			
	B	---	4.50	6.80	7.60			
LT. 43[4]	8.2	5.80	5.80	5.80	7.30			
	16.4	4.90	5.10	5.80	7.30			
	24.6	4.00	4.70	5.90	7.20			
	B	---	4.50	6.10	7.20			
LT. 48[1]	8.2	5.20	6.30	6.35	8.40	7.84	7.84	8.32
	16.4	5.10	5.80	6.27	8.30	7.81	7.81	8.34
	24.6	5.60	5.80	6.48	8.30	7.79	7.79	8.35
	B	5.60	4.60	---	8.30	7.74	7.74	8.30
LT. 48[2]	8.2	6.20	5.90	7.00	9.40	8.74	8.74	8.37
	16.4	5.40	6.10	7.70	8.90	8.27	8.27	8.21
	24.6	4.10	6.00	7.90	8.50	8.27	8.27	8.21
	B	---	6.00	7.70	8.20	8.18	8.18	8.18
LT. 48[3]	8.2	6.70	8.20	7.30	8.40			
	16.4	6.10	8.05	7.20	8.30			
	24.6	6.00	7.80	7.50	8.30			
	B	---	6.50	7.60	8.30			
LT. 48[4]	8.2	6.80	7.60	6.70	7.80			
	16.4	6.70	6.80	7.20	7.80			
	24.6	6.40	7.20	7.30	7.70			
	B	6.20	6.80	7.50	7.70			

[1,2,3,4] - See tidal stage chart.
Hatched area indicate composite samples or experiment not performed for that date

Table A-6: Field measurements of turbidity in the DWSC.

Units = NTU

Location	Depth (ft)	Date 7/26/00 (Spring - 3)	8/16/00 (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1]	8.2	18	22	60	25	21	20	14
	16.4	26	25	37	23	22	20	15
	24.6	28	29	35	30	22	20	16
	B	28	33	31	41	32	22	17
LT. 38[2]	8.2	24	23	27	22	19	20	16
	16.4	22	29	24	23	21	18	14
	24.6	20	34	23	29	19	20	14
	B	25	37	25	31	23	23	15
LT. 38[3]	8.2	22	20	27	25			
	16.4	21	25	26	27			
	24.6	27	28	28	31			
	B	27	29	33	38			
LT. 38[4]	8.2	22	23	40	22			
	16.4	21	22	33	20			
	24.6	24	24	31	18			
	B	28	24	35	19			
LT. 43[1]	8.2	20	25	23	18	21	21	18
	16.4	20	24	26	20	19	19	17
	24.6	29	47	34	36	20	23	17
	B	---	48	60	56	38	26	18
LT. 43[2]	8.2	20	18	22	20	17	16	17
	16.4	19	28	24	21	18	16	17
	24.6	20	30	40	26	23	22	18
	B	---	33	40	36	36	30	24
LT. 43[3]	8.2	18	21	20	22			
	16.4	20	33	19	20			
	24.6	41	51	30	23			
	B	---	65	50	30			
LT. 43[4]	8.2	15	17	22	21			
	16.4	18	23	23	21			
	24.6	29	31	27	23			
	B	---	40	34	26			
LT. 48[1]	8.2	22	24	17	26	27	19	20
	16.4	24	30	18	30	23	20	26
	24.6	32	40	35	25	28	23	24
	B	29	57	36	38	28	33	24
LT. 48[2]	8.2	18	23	18	20	16	21	20
	16.4	18	25	20	18	18	20	20
	24.6	25	28	23	20	19	22	19
	B	---	31	26	21	23	25	24
LT. 48[3]	8.2	24	28	24	29			
	16.4	26	32	22	31			
	24.6	32	32	22	34			
	B	---	32	28	42			
LT. 48[4]	8.2	18	18	20	20			
	16.4	22	21	19	20			
	24.6	26	23	22	22			
	B	32	29	37	25			

[1,2,3,4] - See tidal stage chart.

Hatched area indicate composite samples or experiment not performed for that date

Table A-7: Secchi depth measurements in the DWSC.
Units = ft

Location	Depth (ft)	Date						
		7/26/00 (Spring - 3)	8/16/00 (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1]	---	1.8	1.6	1.4	1.5	1.7	2.0	2.8
LT. 38[2]	---	1.8	1.9	---	1.6	1.8	2.2	---
LT. 38[3]	---	1.8	1.8	1.3	---			
LT. 38[4]	---	---	1.4	0.0	1.4			
LT. 43[1]	---	2.0	1.7	1.6	2.0	1.8	2.0	2.0
LT. 43[2]	---	1.8	2.0	1.6	1.8	1.7	2.4	---
LT. 43[3]	---	1.8	1.8	---	---			
LT. 43[4]	---	---	1.4	1.5	---			
LT. 48[1]	---	1.7	1.5	1.6	1.7	1.7	2.0	1.5
LT. 48[2]	---	1.9	1.8	---	1.5	1.8	1.6	2.0
LT. 48[3]	---	1.8	1.4	---	---			
LT. 48[4]	---	---	1.8	1.5	---			

[1,2,3,4] - See tidal stage chart.
Hatched area indicate composite samples or experiment not performed for that date

Table A-8: TSS concentrations (mg/L) in the DWSC.

Location	Depth (ft)	Date						
		7/27/00 (Spring - 3)	8/16/00 (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1]	8.2	18.4	19.6	28.0	20.6	18.4	16.4	13.3
	16.4	21.6	24.4	30.4	32.8	20.6	20.0	13.8
	24.6	24.8	28.8	32.8	30.8	25.0	22.4	15.1
	B	30.4	30.0	38.8	33.6	26.6	23.4	15.4
LT. 38[2]	8.2					9.2	15.4	13.5
	16.4					15.0	18.2	13.9
	24.6					18.6	19.0	15.9
	B					22.0	21.0	19.0
LT. 43[1]	8.2	16.8	19.2	21.2	19.8	17.2	12.1	15.3
	16.4	20.4	25.2	23.2	20.4	16.4	18.4	16.9
	24.6	---	38.4	35.2	29.2	18.4	25.6	15.8
	B	34.8	46.8	57.6	38.2	40.6	39.8	22.1
LT. 43[2]	8.2					14.6	14.4	16.8
	16.4					17.2	17.0	17.5
	24.6					26.4	24.2	20.1
	B					39.0	29.0	27.6
LT. 48[1]	8.2	21.6	22.0	17.2	27.6	25.0	20.5	21.3
	16.4	28.4	27.2	12.4	26.8	23.4	26.8	32.6
	24.6	40.4	35.2	18.0	33.6	27.8	25.2	25.8
	B	43.2	45.2	30.8	38.2	49.4	34.6	29.4
LT. 48[2]	8.2					15.4	17.0	25.1
	16.4					17.0	19.8	26.3
	24.6					19.0	27.2	27.5
	B					22.0	39.4	32.1

[1] 7/27, 8/16, 8/31, 9/14 sampling started on these dates and was completed on the following day; 9/28, 10/19, & 11/9 data were collected during an ebb tide on these dates.

[2] 9/28,10/19, & 11/9 data were collected during a flood tide on these dates

[3] Size 10 Sediment Trap

[4] 9/14 Trap lost

Hatched area indicate composite samples or experiment not performed for that date

Table A-9: VSS concentrations (mg/L) in the DWSC.

Location	Depth (ft)	Date						
		7/27/00 (Spring - 3)	8/16/00 (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1]	8.2	4.4	4.8	5.2	4.0	3.2	2.5	2.3
	16.4	5.2	4.4	4.0	4.8	3.8	3.1	2.0
	24.6	4.8	4.8	4.0	4.0	4.4	3.6	2.4
	B	5.2	5.6	6.4	5.0	4.2	3.2	2.5
LT. 38[2]	8.2					1.4	1.8	2.8
	16.4					2.6	2.0	2.8
	24.6					3.6	2.0	3.0
	B					3.6	2.8	3.2
LT. 43[1]	8.2	2.8	5.6	4.8	4.0	3.6	2.1	2.4
	16.4	3.6	6.0	3.6	4.4	3.4	2.9	2.6
	24.6	---	6.4	5.2	5.0	4.0	3.6	2.4
	B	6.4	6.8	7.2	5.8	6.6	5.0	2.9
LT. 43[2]	8.2					3.6	2.4	3.0
	16.4					4.0	2.8	3.4
	24.6					5.0	3.8	3.3
	B					6.6	4.4	4.3
LT. 48[1]	8.2	3.6	3.2	3.6	5.0	4.0	3.2	3.1
	16.4	4.4	4.0	2.8	4.4	3.8	4.4	4.0
	24.6	8.0	6.4	4.4	4.6	4.2	4.2	3.5
	B	6.4	8.0	5.2	5.8	6.2	4.0	4.1
LT. 48[2]	8.2					4.0	2.4	4.1
	16.4					3.6	3.2	4.0
	24.6					4.2	3.8	4.2
	B					4.2	4.6	4.2

[1] 7/27, 8/16, 8/31, 9/14 sampling started on these dates and was completed on the following day; 9/28, 10/19, & 11/9 data were collected during an ebb tide on these dates.

[2] 9/28,10/19, & 11/9 data were collected during a flood tide on these dates

[3] Size 10 Sediment Trap

[4] 9/14 Trap lost

Hatched area indicate composite samples or experiment not performed for that date

Table A-10: Chlorophyll *a* concentrations (mg/L) in the DWSC.

Location	Depth (ft)	Date 7/27/00 (Spring - 3)	8/16/00 (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1]	8.2		13.9	9.1	10.7	11.7	11.2	2.8
	16.4		15.0	5.9	10.7	11.2	8.5	4.3
	24.6		13.9	6.9	11.2	10.7	8.5	3.9
	B		13.9	10.0	11.7	11.2	8.0	3.6
LT. 38[2]	8.2					16.0	12.3	4.8
	16.4					15.5	9.6	3.7
	24.6					12.3	10.1	4.3
	B					10.1	10.7	3.9
LT. 43[1]	8.2		20.3	10.0	29.9	19.2	12.3	4.5
	16.4		16.0	16.7	25.1	18.2	10.1	5.7
	24.6		17.1	21.4	27.8	18.7	10.1	5.1
	B		12.8	24.6	28.8	17.6	10.7	5.9
LT. 43[2]	8.2					26.2	12.3	5.1
	16.4					18.7	10.7	5.4
	24.6					18.2	11.2	5.4
	B					19.8	11.7	3.3
LT. 48[1]	8.2		32.0	21.4	37.4	26.2	16.0	5.1
	16.4		29.9	26.7	36.8	24.6	15.5	6.0
	24.6		28.8	31.0	36.3	25.6	18.2	6.2
	B		26.7	30.5	35.2	25.1	16.6	3.7
LT. 48[2]	8.2					37.9	12.8	6.0
	16.4					27.8	12.8	6.3
	24.6					26.2	13.4	5.3
	B					25.1	13.4	6.2

[1] 7/27, 8/16, 8/31, 9/14 sampling started on these dates and was completed on the following day; 9/28, 10/19, & 11/9 data were collected during an ebb tide on these dates.

[2] 9/28,10/19, & 11/9 data were collected during a flood tide on these dates

[3] Size 10 Sediment Trap

[4] 9/14 Trap lost

Hatched area indicate composite samples or experiment not performed for that date

Table A-11: Chlorophyll *a* and Pheophytin *a* concentrations in the DWSC.

Location	Depth (ft)	Date						
		7/27/00 (Spring - 3)	8/16/00 (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1]	8.2		32.9	34.8	35.9	28.0	18.7	5.0
	16.4		26.9	30.7	38.5	26.9	16.8	7.6
	24.6		37.4	39.2	37.0	26.9	16.8	8.9
	B		31.4	35.0	43.4	31.0	18.7	8.0
LT. 38[2]	8.2					25.0	17.9	7.0
	16.4					25.4	17.9	5.4
	24.6					26.9	18.3	6.5
	B					25.0	17.9	5.9
LT. 43[1]	8.2		41.1	23.8	55.7	40.7	17.9	9.2
	16.4		46.4	43.9	46.7	40.4	19.1	7.8
	24.6		47.1	45.3	56.4	34.4	21.3	7.4
	B		47.8	57.9	62.8	41.9	27.3	8.7
LT. 43[2]	8.2					39.2	18.3	7.2
	16.4					33.6	18.7	7.3
	24.6					35.5	19.4	7.6
	B					41.5	21.7	5.4
LT. 48[1]	8.2		59.1	43.4	57.2	43.4	23.2	8.1
	16.4		54.6	49.7	56.8	40.0	24.7	11.1
	24.6		62.1	52.3	60.9	44.5	27.7	10.9
	B		56.1	59.2	64.7	52.3	26.9	12.6
LT. 48[2]	8.2					49.0	20.2	9.1
	16.4					44.5	20.9	9.1
	24.6					45.2	22.8	8.1
	B					39.6	26.5	8.8

[1] 7/27, 8/16, 8/31, 9/14 sampling started on these dates and was completed on the following day; 9/28, 10/19, & 11/9 data were collected during an ebb tide on these dates.

[2] 9/28,10/19, & 11/9 data were collected during a flood tide on these dates

[3] Size 10 Sediment Trap

[4] 9/14 Trap lost

Hatched area indicate composite samples or experiment not performed for that date

Table A-12 San Joaquin River BOD regression data and other water quality parameters.

Parameters for San Joaquin River Samples									
Units = varying									
Parameter	Tide	Date							
		7/27/00	8/16/00	8/31/00	9/14/00	Tide	9/28/00	10/19/00	11/9/00
		(Spring - 3)	(Spring + 2)	(Spring + 3)	(Spring + 1)		(Spring + 1)	(Neap + 0)	(Spring - 2)
TSS (mg/L)		47.4	30.2	26.8	28.6	Ebb	28.0	---	32.0
VSS (mg/L)		8.1	6.3	5.1	4.9		4.2	---	3.4
Chl *a (mg/L)*			55.1	39.8	39.8		27.2	19.8	4.0
Chl *a* + Ph *a* (mg/L)			73.0	62.6	62.6		42.2	29.5	6.4
Turbidity (NTU)[1]		36	25	25	26		27	27	24
TSS (mg/L)						Flood	26.2	---	18.4
VSS (mg/L)							4.2	---	3.1
Chl *a (mg/L)*							34.2	15.5	5.4
Chl *a* + Ph *a* (mg/L)							48.2	22.8	8.2
Turbidity (NTU)[1]							23	21	19
Hatched area indicate composite samples or experiment not performed for that date									

[1]Average turbidity obtained from individual measurements.

Table: A-13: Photosynethically active radition intensities in the San Joaquin River and DWSC.

9/14/01	SJ River 11:45 AM			LT 48 12:30 PM			LT 43 1:05 PM			LT 38 1:40 PM		
Depth	Intensity	Secchi	Turbidity	Intensity	Secchi	Turbidity	Intensity	Secchi	Turbidity	Intensity	Secchi	Turbidity
ft	E	ft	NTU	E	ft	NTU	E	ft	NTU	E	ft	NTU
0	2330	1.6		2320	1.7		2350	2.0		2300	1.5	
1	900			1030			1285			1110		
2	410			530			600			540		
3	150			230			285			240		
4	64		24	88			140			120		
5	22			44			70			54		
6	8.5			17			31			23		
7	3.3			9.5			17			13		
8			29	3.8		26	7.7		18	6.0		25
9							4.1			3.5		

10/19/00	SJ River 11:35 AM			LT 48 11:50 PM			LT 43 12:05 PM			LT 38 12:15 PM		
Depth	Intensity	Secchi	Turbidity	Intensity	Secchi	Turbidity	Intensity	Secchi	Turbidity	Intensity	Secchi	Turbidity
ft	E	ft	NTU	E	ft	NTU	E	ft	NTU	E	ft	NTU
0	2320	2.0		2330	2.0		2340	2.0		2420	2.0	
1	1020			1280			1150			1120		
2	490			700			570			650		
3	225			390			310			350		
4	100			185			160			182		
5	45			95			84			97		
6	20			49			44			48		
7	10			26			25			27		
8	4.5			15			13			15.0		
9	2.2			8			7.4			8.5		
10	--			4.3			4.1			4.7		
11	--			---			--			2.7		

Appendix B. Trapped Sediment Deposition Fluxes.

Table B-1: Deposition flux of TSS in the DWSC.

Location	Depth (ft)	Date 7/26/00[3] (Spring - 3)	8/16/00 (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1,4]	8.2	8.2	11.1	14.6	---	10.1	8.3	8.9
	16.4	19.7	21.4	26.9	---	20.4	14.2	11.9
	24.6	23.8	252.3	51.3	---	32.8	24.4	14.1
	B	45.9	37.7	49.5	---	54.1	39.4	17.4
LT. 38[2]	8.2					8.8	10.3	8.5
	16.4					18.1	16.5	13.4
	24.6					26.5	22.3	15.4
	B					34.7	28.9	35.3
LT. 43[1]	8.2	4.6	6.4	6.4	6.8	3.4	3.8	8.5
	16.4	12.4	15.9	11.5	10.1	12.0	11.5	12.1
	24.6	---	---	34.3	19.6	22.4	21.2	15.7
	B	20.8	51.7	---	52.0	83.0	42.6	16.3
LT. 43[2]	8.2					7.3	6.9	6.7
	16.4					11.5	9.2	11.4
	24.6					20.6	12.0	15.1
	B					38.0	74.2	---
LT. 48[1]	8.2	19.0	18.7	22.7	27.7	30.4	37.9	28.9
	16.4	33.0	37.2	31.5	45.0	52.5	67.6	51.4
	24.6	---	64.7	51.7	57.5	78.5	87.2	70.9
	B	55.9	82.6	92.7	100.5	133.7	74.0	129.7
LT. 48[2]	8.2					6.8	34.4	11.6
	16.4					10.5	57.2	20.2
	24.6					18.9	78.0	30.8
	B					29.4	134.1	---

[1] 7/27, 8/16, 8/31, 9/14 sampling started on these dates and was completed on the following day; 9/28, 10/19, & 11/9 data were collected during an ebb tide on these dates.

[2] 9/28,10/19, & 11/9 data were collected during a flood tide on these dates

[3] Size 10 Sediment Trap

[4] 9/14 Trap lost

Hatched area indicate composite samples or experiment not performed for that date

Table B-2: Deposition Flux (g/ m^2hr)of VSS in the DWSC.

Location	Depth (ft)	Date						
		7/27/00[3] (Spring - 3)	8/16/00 (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1,4]	8.2	0.7	1.2	1.5	---	1.2	0.9	1.0
	16.4	1.9	2.1	2.7	---	2.3	1.5	1.3
	24.6	2.1	17.1	5.0	---	3.5	2.5	1.5
	B	3.6	3.3	4.9	---	5.7	3.6	1.9
LT. 38[2]	8.2					1.0	1.1	0.3
	16.4					2.0	1.7	0.3
	24.6					2.8	2.4	0.3
	B					3.6	3.0	0.3
LT. 43[1]	8.2	0.4	0.7	0.8	0.9	0.5	0.5	0.9
	16.4	1.6	1.5	1.2	1.1	1.4	1.1	1.3
	24.6	---	---	3.1	1.9	2.4	2.2	1.6
	B	1.7	4.4	---	5.0	8.5	3.6	1.6
LT. 43[2]	8.2					1.1	0.8	0.7
	16.4					1.3	1.0	1.2
	24.6					2.1	1.2	1.5
	B					3.7	8.3	---
LT. 48[1]	8.2	2.0	1.5	1.8	2.7	2.6	3.3	2.3
	16.4	3.1	3.4	2.7	4.2	4.3	5.6	3.8
	24.6	---	4.8	3.9	5.7	6.1	7.8	5.3
	B	4.5	7.3	6.7	8.8	10.3	5.8	9.5
LT. 48[2]	8.2					0.9	2.9	1.1
	16.4					1.3	5.0	1.8
	24.6					2.4	7.5	2.7
	B					3.1	10.4	---

[1] 7/27, 8/16, 8/31, 9/14 sampling started on these dates and was completed on the following day; 9/28, 10/19, & 11/9 data were collected during an ebb tide on these dates.

[2] 9/28,10/19, & 11/9 data were collected during a flood tide on these dates

[3] Size 10 Sediment Trap

[4] 9/14 Trap lost

Hatched area indicate composite samples or experiment not performed for that date

Table B-3: Chlorophyll *a* deposition fluxes (mg/m^2 hr) the DWSC.

Location	Depth (ft)	Date						
		7/27/00[3] (Spring - 3)	8/16/00 (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1,4]	8.2			---	---	1.2	1.9	0.10
	16.4			0.8	---	1.3	2.2	0.00
	24.6			1.8	---	1.7	2.4	0.14
	B			1.9	---	2.5	2.4	-0.09
LT. 38[2]	8.2					2.1	0.8	0.12
	16.4					2.8	1.2	0.13
	24.6					2.7	1.4	0.13
	B					2.8	1.6	0.17
LT. 43[1]	8.2			0.4	1.0	1.7	1.7	0.02
	16.4			0.9	1.4	2.3	2.5	0.10
	24.6			2.4	3.5	2.9	2.6	0.13
	B			---	3.5	3.7	6.5	0.13
LT. 43[2]	8.2					2.4	1.1	0.13
	16.4					3.1	1.2	0.17
	24.6					3.4	1.4	0.18
	B					4.3	3.0	---
LT. 48[1]	8.2			1.6	1.9	3.8	3.5	-0.10
	16.4			3.0	4.0	4.5	4.4	0.19
	24.6			4.8	5.1	5.3	5.8	0.20
	B			4.7	7.3	5.3	5.3	0.17
LT. 48[2]	8.2					5.9	2.5	0.20
	16.4					4.9	2.9	0.20
	24.6					8.1	4.3	0.25
	B					6.1	4.1	---

[1] 7/27, 8/16, 8/31, 9/14 sampling started on these dates and was completed on the following day; 9/28, 10/19, & 11/9 data were collected during an ebb tide on these dates.

[2] 9/28,10/19, & 11/9 data were collected during a flood tide on these dates

[3] Size 10 Sediment Trap

[4] 9/14 Trap lost

Hatched area indicate composite samples or experiment not performed for that date

Table B-4: Chlorophyll *a* and pheophytin *a* fluxes (mg/m^2hr) the DWSC.

Location	Depth (ft)	Date						
		7/27/00[3] (Spring - 3)	8/16/00 (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1,4]	8.2			---	---	5.1	4.3	0.25
	16.4			9.3	---	8.7	5.9	0.38
	24.6			14.1	---	10.7	7.8	0.43
	B			16.2	---	18.1	10.9	0.53
LT. 38[2]	8.2					6.5	3.5	0.31
	16.4					9.3	5.1	0.38
	24.6					10.7	6.2	0.48
	B					14.0	7.8	0.84
LT. 43[1]	8.2			3.9	5.9	3.9	3.2	0.27
	16.4			5.4	7.7	7.9	5.5	0.38
	24.6			11.1	11.9	10.6	7.0	0.38
	B			---	22.5	26.7	25.8	0.43
LT. 43[2]	8.2					5.6	2.9	0.25
	16.4					7.8	3.4	0.40
	24.6					11.0	4.1	0.48
	B					14.5	13.7	---
LT. 48[1]	8.2			6.8	8.6	11.6	10.2	0.47
	16.4			11.8	18.3	17.1	14.4	0.78
	24.6			17.2	18.2	19.7	19.6	0.99
	B			25.9	40.0	32.1	20.5	1.43
LT. 48[2]	8.2					9.7	7.4	0.36
	16.4					8.9	10.7	0.44
	24.6					14.9	15.9	0.72
	B					18.3	19.3	---

[1] 7/27, 8/16, 8/31, 9/14 sampling started on these dates and was completed on the following day; 9/28, 10/19, & 11/9 data were collected during an ebb tide on these dates.

[2] 9/28,10/19, & 11/9 data were collected during a flood tide on these dates

[3] Size 10 Sediment Trap

[4] 9/14 Trap lost

Hatched area indicate composite samples or experiment not performed for that date

Appendix C. Settling Velocities of Trapped Sediment.

Table C-1. Settling velocities of TSS (m/hr) in the DWSC.

Location	Depth (ft)	Date						
		7/27/00[3] (Spring - 3)	8/16/00[3] (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1,4]	8.2	0.4	0.6	0.5	---	0.5	0.5	0.7
	16.4	0.9	0.9	0.9	---	1.0	0.7	0.9
	24.6	1.0	8.8	1.6	---	1.3	1.1	0.9
	B	1.5	1.3	1.3	---	2.0	1.7	1.1
LT. 38[2]	8.2					1.0	0.7	0.6
	16.4					1.2	0.9	1.0
	24.6					1.4	1.2	1.0
	B					1.6	1.4	1.9
LT. 43[1]	8.2	0.3	0.3	0.3	0.3	0.2	0.3	0.6
	16.4	0.6	0.6	0.5	0.5	0.7	0.6	0.7
	24.6	---	---	1.0	0.7	1.2	0.8	1.0
	B	0.6	1.1	---	1.4	2.0	1.1	0.7
LT. 43[2]	8.2					0.5	0.5	0.4
	16.4					0.7	0.5	0.7
	24.6					0.8	0.5	0.8
	B					1.0	2.6	---
LT. 48[1]	8.2	0.9	0.8	1.3	1.0	1.2	1.8	1.4
	16.4	1.2	1.4	2.5	1.7	2.2	2.5	1.6
	24.6	---	1.8	2.9	1.7	2.8	3.5	2.8
	B	1.3	1.8	3.0	2.6	2.7	2.1	4.4
LT. 48[2]	8.2					0.4	2.0	0.5
	16.4					0.6	2.9	0.8
	24.6					1.0	2.9	1.1
	B					1.3	3.4	---

[1] 7/27, 8/16, 8/31, 9/14 sampling started on these dates and was completed on the following day; 9/28, 10/19, & 11/9 data were collected during an ebb tide on these dates.

[2] 9/28,10/19, & 11/9 data were collected during a flood tide on these dates

[3] Size 10 Sediment Trap

[4] 9/14 Trap lost

Hatched area indicate composite samples or experiment not performed for that date

Table C-2: Settling velocities (m/hr) of VSS in the DWSC

Location	Depth (ft)	Date						
		7/27/00[3] (Spring - 3)	8/16/00[3] (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1,4]	8.2	0.2	0.3	0.3	---	0.4	0.4	0.4
	16.4	0.4	0.5	0.7	---	0.6	0.5	0.7
	24.6	0.4	3.6	1.3	---	0.8	0.7	0.6
	B	0.7	0.6	0.8	---	1.4	1.1	0.8
LT. 38[2]	8.2					0.7	0.6	0.1
	16.4					0.8	0.9	0.1
	24.6					0.8	1.2	0.1
	B					1.0	1.1	0.1
LT. 43[1]	8.2	0.2	0.1	0.2	0.2	0.1	0.2	0.4
	16.4	0.4	0.2	0.3	0.3	0.4	0.4	0.5
	24.6	---	---	0.6	0.4	0.6	0.6	0.7
	B	0.3	0.6	---	0.9	1.3	0.7	0.6
LT. 43[2]	8.2					0.3	0.3	0.2
	16.4					0.3	0.3	0.4
	24.6					0.4	0.3	0.5
	B					0.6	1.9	---
LT. 48[1]	8.2	0.6	0.5	0.5	0.5	0.7	1.0	0.7
	16.4	0.7	0.8	1.0	1.0	1.1	1.3	1.0
	24.6	---	0.7	0.9	1.2	1.4	1.8	1.5
	B	0.7	0.9	1.3	1.5	1.7	1.4	2.3
LT. 48[2]	8.2					0.2	1.2	0.3
	16.4					0.4	1.6	0.5
	24.6					0.6	2.0	0.6
	B					0.7	2.3	---

[1] 7/27, 8/16, 8/31, 9/14 sampling started on these dates and was completed on the following day; 9/28, 10/19, & 11/9 data were collected during an ebb tide on these dates.

[2] 9/28,10/19, & 11/9 data were collected during a flood tide on these dates

[3] Size 10 Sediment Trap

[4] 9/14 Trap lost

Hatched area indicate composite samples or experiment not performed for that date

Table C-3: Chlorophyll *a* settling velocities (m/hr) in the DWSC.

Location	Depth (ft)	Date						
		7/27/00[3] (Spring - 3)	8/16/00[3] (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1,4]	8.2			---	---	0.104	0.168	0.034
	16.4			0.133	---	0.115	0.262	0.000
	24.6			0.264	---	0.162	0.283	0.036
	B			0.189	---	0.219	0.296	-0.026
LT. 38[2]	8.2					0.131	0.069	0.025
	16.4					0.178	0.123	0.036
	24.6					0.221	0.133	0.030
	B					0.278	0.151	0.043
LT. 43[1]	8.2			0.039	0.032	0.090	0.137	0.004
	16.4			0.057	0.056	0.126	0.248	0.018
	24.6			0.113	0.128	0.156	0.260	0.025
	B			---	0.121	0.210	0.609	0.022
LT. 43[2]	8.2					0.092	0.091	0.026
	16.4					0.166	0.110	0.032
	24.6					0.188	0.125	0.033
	B					0.215	0.253	---
LT. 48[1]	8.2			0.075	0.051	0.147	0.217	-0.020
	16.4			0.114	0.109	0.184	0.286	0.032
	24.6			0.155	0.140	0.205	0.319	0.033
	B			0.155	0.207	0.213	0.320	0.045
LT. 48[2]	8.2					0.155	0.195	0.034
	16.4					0.175	0.224	0.031
	24.6					0.308	0.320	0.048
	B					0.243	0.306	---

[1] 7/27, 8/16, 8/31, 9/14 sampling started on these dates and was completed on the following day; 9/28, 10/19, & 11/9 data were collected during an ebb tide on these dates.

[2] 9/28,10/19, & 11/9 data were collected during a flood tide on these dates

[3] Size 10 Sediment Trap

[4] 9/14 Trap lost

Hatched area indicate composite samples or experiment not performed for that date

Table C-4: Settling velocities of chlorophyll *a* and pheophytin *a* (m/hr) in the DWSC.

Location	Depth (ft)	Date						
		7/27/00[3] (Spring - 3)	8/16/00[3] (Spring + 2)	8/31/00 (Spring + 3)	9/14/00 (Spring + 1)	9/28/00 (Spring + 1)	10/19/00 (Neap + 0)	11/9/00 (Spring - 2)
LT. 38[1,4]	8.2			---	---	0.18	0.23	0.05
	16.4			0.30	---	0.32	0.35	0.05
	24.6			0.36	---	0.40	0.46	0.05
	B			0.46	---	0.58	0.59	0.07
LT. 38[2]	8.2					0.26	0.19	0.04
	16.4					0.37	0.28	0.07
	24.6					0.40	0.34	0.07
	B					0.56	0.43	0.14
LT. 43[1]	8.2			0.16	0.11	0.09	0.18	0.03
	16.4			0.12	0.17	0.20	0.29	0.05
	24.6			0.24	0.21	0.31	0.33	0.05
	B			---	0.36	0.64	0.95	0.05
LT. 43[2]	8.2					0.14	0.16	0.04
	16.4					0.23	0.18	0.05
	24.6					0.31	0.21	0.06
	B					0.35	0.63	---
LT. 48[1]	8.2			0.16	0.15	0.27	0.44	0.06
	16.4			0.24	0.32	0.43	0.58	0.07
	24.6			0.33	0.30	0.44	0.71	0.09
	B			0.44	0.62	0.61	0.76	0.11
LT. 48[2]	8.2					0.20	0.36	0.04
	16.4					0.20	0.51	0.05
	24.6					0.33	0.70	0.09
	B					0.46	0.73	---

[1] 7/27, 8/16, 8/31, 9/14 sampling started on these dates and was completed on the following day; 9/28, 10/19, & 11/9 data were collected during an ebb tide on these dates.

[2] 9/28,10/19, & 11/9 data were collected during a flood tide on these dates

[3] Size 10 Sediment Trap

[4] 9/14 Trap lost

Hatched area indicate composite samples or experiment not performed for that date

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