

GUNTERSVILLE LAKE/MUD CREEK
AND
YATES RESERVOIR/SOUGAHATCHEE CREEK
SEDIMENT OXYGEN DEMAND STUDIES
JUNE 23-27, 2003



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INTRODUCTION/BACKGROUND

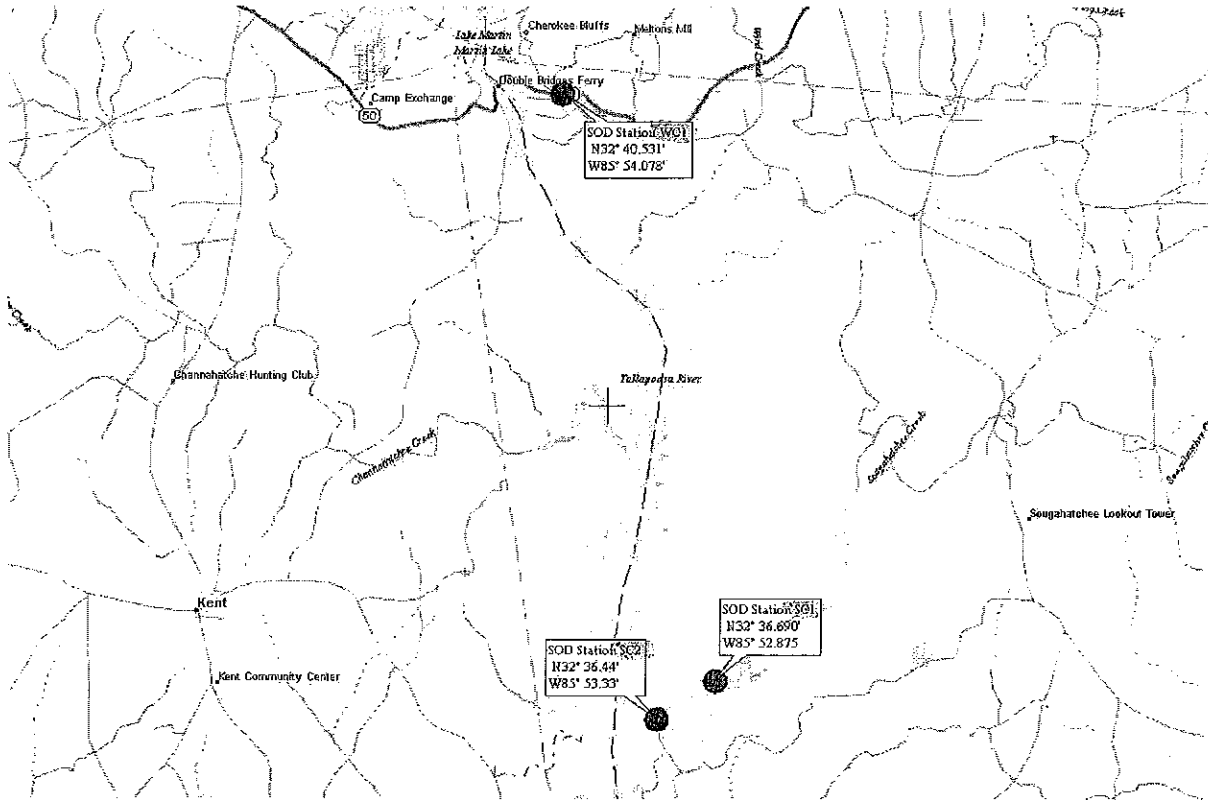
At the request of the US-EPA, R4, Water Management Division (WMD) and the Alabama Department of Environmental Management (ADEM), the Science and Ecosystem Support Division (SESD), Ecological Assessment Branch (EAB) conducted a Sediment Oxygen Demand (SOD) study on the Mud Creek Embayment of Guntersville Lake near Hollywood, Alabama (Figure 1) and Sougahatchee Creek and Embayment located of Yates Reservoir, near Tallassee, Alabama (Figure 2) the week of June 23-28, 2003.

Mud Creek and Embayment as well as Sougahatchee Creek and Embayment have been on the State of Alabama's 303(d) list since 1996 for Nutrients and Organic Enrichment/Low Dissolved Oxygen impairments. Due to a 1998 citizen lawsuit against EPA, a 5-year schedule for Total Maximum Daily Load (TMDL) development was established for the State of Alabama to complete 289 TMDLs for 115 waterbodies. The SOD data collected by EPA will be used to develop models necessary for the Yates Reservoir/Sougahatchee Embayment TMDL.

OBJECTIVE

The objective of the survey was to collect Sediment Oxygen Demand (SOD) data to determine a rate of utilization of oxygen by the sediment at each station. The SOD rate is expressed as grams of oxygen per meter squared per day ($g/O_2/m^2/day$). The data will be used to verify the water quality/hydrodynamic model at a confidence level that will lend credibility to the use of the model and thereby enhance model defensibility. The model will be used to establish a TMDL for Mud Creek and Sougahatchee Creek. Modeling will be performed by ADEM.

FIGURE 2
 YATES RESERVOIR/SOUGAHATCHEE CREEK SOD STATIONS



STUDY DESIGN AND METHODS

ADEM requested two stations be completed on Mud Creek (Figure 1) and two stations on Sougahatchee Creek with a control on Wind Creek(Figure 2).

Once on station, the boat was anchored on a secure three or four point anchorage out of the main channel and away from boat traffic as much as possible. Divers then deployed six SOD chambers (four replicate sediment contact chambers and two enclosed replicate water column chambers). The chambers were sealed in place for approximately 20-30 minutes to allow time for settling of sediments inside the contact chambers and to allow for the ambient bottom water to fully displace any trapped surface water inside the blank chambers via the chamber pumps. The chambers were then closed and divers installed a calibrated YSI multiparameter sonde into each of the six chambers. The sondes logged an oxygen reading every five minutes for approximately two hours. Data was backed up to a notebook computer approximately every 20 minutes. Once sufficient time had elapsed, divers retrieved the sondes and the chambers for deployment at the next station. The SOD rate was determined according to the EAB SOP Sections 20.2.1-20.2.6.

Station locations for Mud Creek are as follows:

<u>STA</u>	<u>LATITUDE</u>	<u>LONGITUDE</u>
M3	N 34° 44.48'	W -085° 53.33'
M4	N 34° 46.16'	W -085° 54.15'

Station locations for Sougahatchee Creek are as follows:

<u>STA</u>	<u>LATITUDE</u>	<u>LONGITUDE</u>
SC1	N 32° 36.69'	W -085° 52.88'
SC2	N 32° 36.44'	W -085° 53.33'
WC1	N 32° 40.53'	W -085° 54.07'

QA/QC

All dissolved oxygen monitoring equipment were calibrated according to section 20.2.6 of the US-EPA, EAB Standard Operating Procedure (SOP) Manual. An azide modified Winkler titration with interim air calibrations was utilized for dissolved oxygen calibration. Calibration checks of YSI multiparameter probes occurred at the beginning and end of each monitoring run by storing instruments in an oxygen saturated environment as determined by ambient barometric pressure and temperature and checking instrument data output. This information was stored as part of the logged file. If the instrument response was greater than $\pm 2\%$ from what it should have read based upon ambient barometric pressure and temperature, then the instrument was re-calibrated. If the instrument was more than $\pm 10\%$ out of calibration, then an azide modified Winkler titration was used for re-calibration and the dissolved oxygen probe evaluated to determine if further maintenance was required. ~~Instruments must read ± 0.2 mg/L of the Winkler~~ titrated DO in the calibration water to be considered within calibration.

RESULTS

Following are the data summaries for each of the stations:

MUD CREEK SOD

6/23/2003

STATION M03

Latitude: 34° 44.447'

Longitude: -085° 53.330'

SUMMARY

Mean Adj. D.O. (mg/l/min)	-0.0052
Mean Adj. SOD rate (gr O2/m2/day)	-1.7915

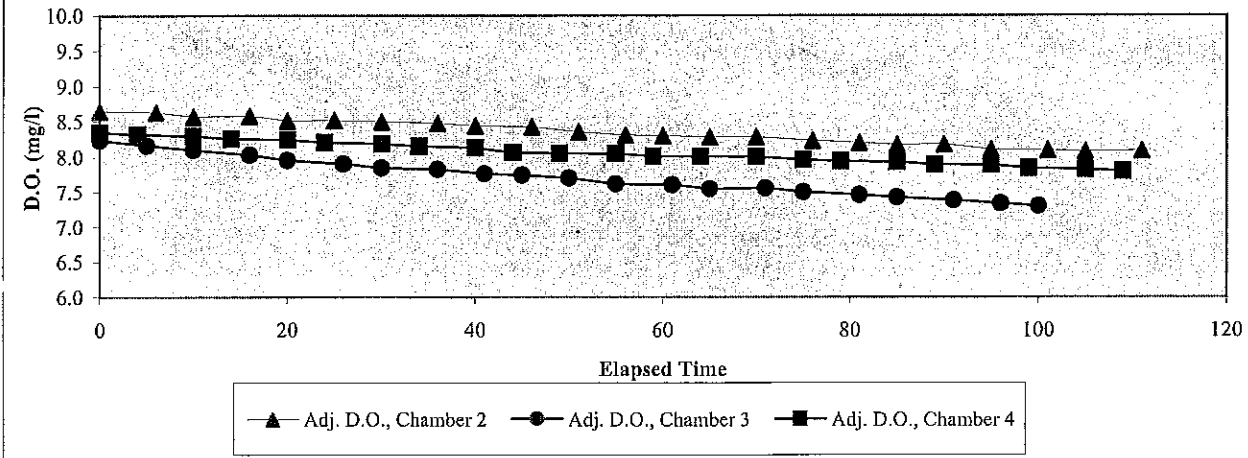
Blank SOD chambers

Chamber	D.O. rate (mg/l/min)	Mean Water Column Respiration Rate
0	-0.001265035	-0.00120
00	-0.001144346	

Contact SOD chambers

Chamber	Unadjusted D.O. rate (mg/l/min)	Adjusted D.O. rate (mg/l/min)	Adjusted SOD rate (gr O2/m2/day)
1	Chamber 1 not utilized due to malfunction.		
2	-0.006664482	-0.005459792	-1.876421
3	Chamber 3 data not utilized in calculations due to suspended sediment inside chamber		
4	-0.006170136	-0.004965445	-1.706524

MUD CREEK SOD - June 23, 2003
STATION M03 SUMMARY, Chambers 2-4



MUD CREEK SOD

6/24/2003

STATION M04

Latitude: 34° 46.160'

Longitude: -085° 54.145'

SUMMARY

Mean Adj. D.O. (mg/l/min)	-0.0049
Mean Adj. SOD rate (gr O2/m2/day)	-1.6884

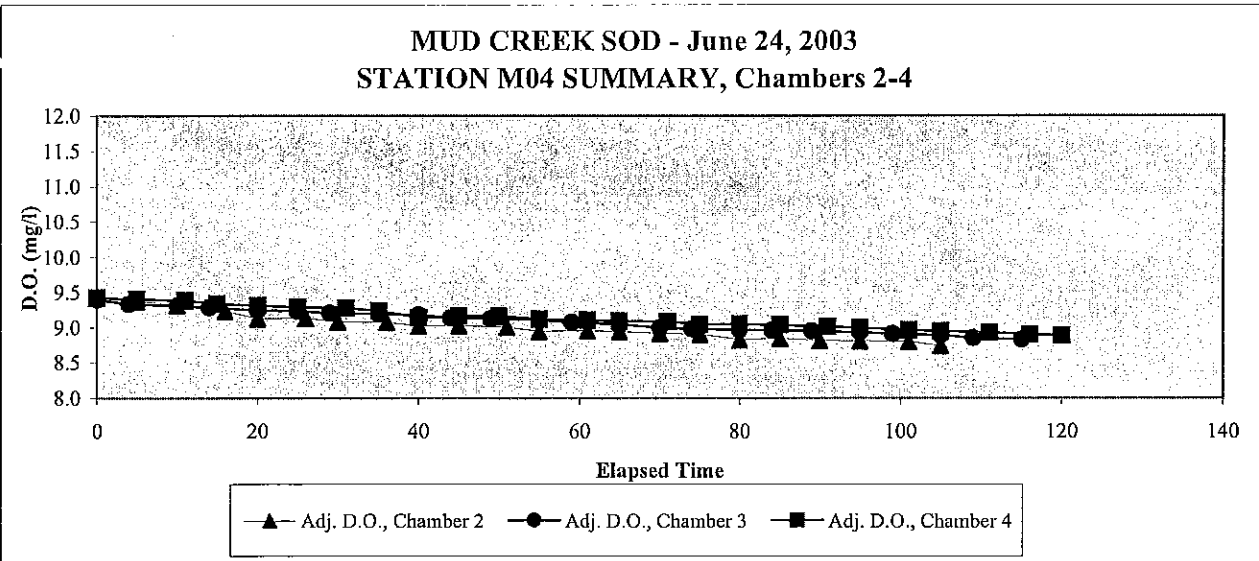
Blank SOD chambers

Chamber	D.O. rate (mg/l/min)	Mean Water Column Respiration Rate
0	-0.001334451	-0.00124
00	-0.001145399	

Contact SOD chambers

Chamber	Unadjusted D.O. rate (mg/l/min)	Adjusted D.O. rate (mg/l/min)	Adjusted SOD rate (gr O2/m2/day)
1	Chamber 1 not utilized due to malfunction.		
2	-0.007015465	-0.005775540	-1.984938
3	-0.005847792	-0.004607867	-1.583632
4	-0.005594728	-0.004354803	-1.496659

MUD CREEK SOD - June 24, 2003
STATION M04 SUMMARY, Chambers 2-4



SOUGAHATCHEE CREEK SOD

6/25/2003

STATION S01
SUMMARY

Latitude: 32° 36.690'

Longitude: -085° 52.875'

Mean Adj. D.O. (mg/l/min)	-0.0040
Mean Adj. SOD rate (gr O2/m2/day)	-1.3601

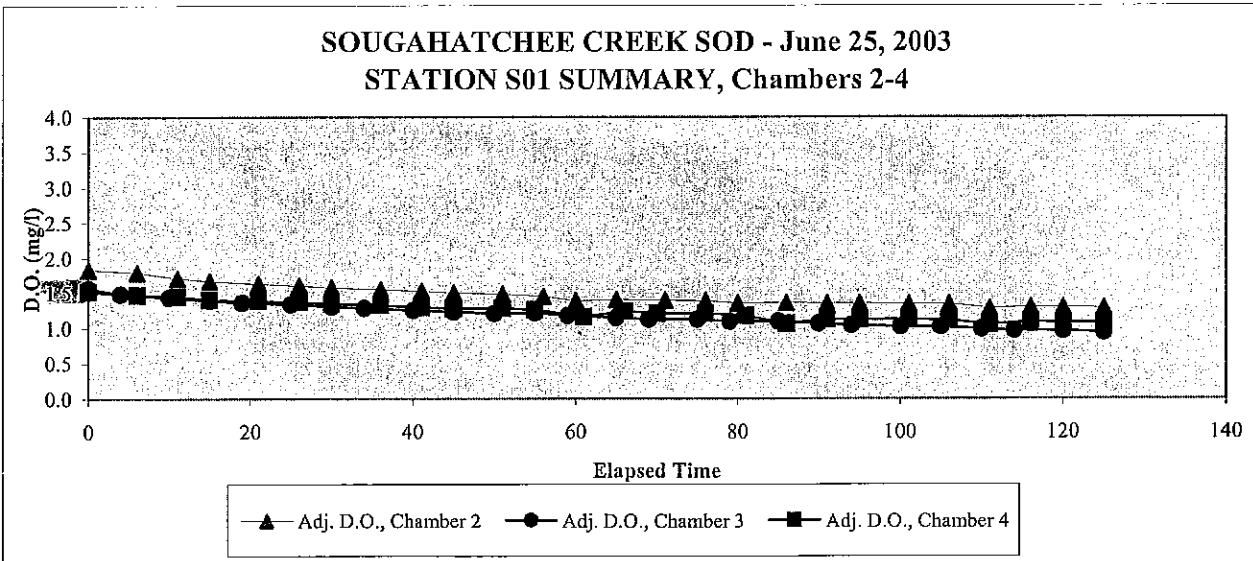
Blank SOD chambers

Chamber	D.O. rate (mg/l/min)	Mean Water Column Respiration Rate
0	-0.001759654	-0.00182
00	-0.001881602	

Contact SOD chambers

Chamber	Unadjusted D.O. rate (mg/l/min)	Adjusted D.O. rate (mg/l/min)	Adjusted SOD rate (gr O2/m2/day)
1	Chamber 1 not utilized due to malfunction.		
2	-0.005757510	-0.003936882	-1.353028
3	-0.006266089	-0.004445461	-1.527816
4	-0.005310881	-0.003490253	-1.19953

SOUGAHATCHEE CREEK SOD - June 25, 2003
STATION S01 SUMMARY, Chambers 2-4



SOUGAHATCHEE CREEK SOD

6/25/2003

STATION S02

Latitude: 32° 36.440'

Longitude: -085° 53.333'

SUMMARY

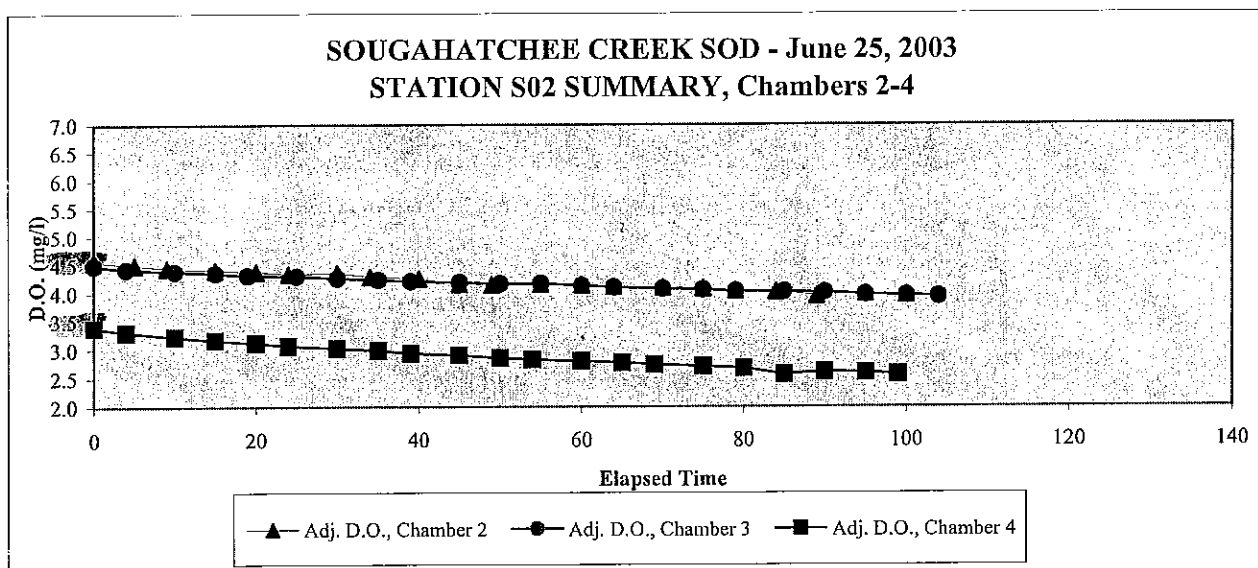
Mean Adj. D.O. (mg/l/min)	-0.0053
Mean Adj. SOD rate (gr O2/m2/day)	-1.8850

Blank SOD chambers

Chamber	D.O. rate (mg/l/min)	Mean Water Column Respiration Rate
0	-0.000489991	-0.00059
00	-0.000693163	

Contact SOD chambers

Chamber	Unadjusted D.O. rate (mg/l/min)	Adjusted D.O. rate (mg/l/min)	Adjusted SOD rate (gr O2/m2/day)
1	Chamber 1 not utilized due to malfunction.		
2	-0.006391846	-0.005800269	-1.993436
3	-0.005469914	-0.004878337	-1.676587
4	Chamber 4 data not utilized in calculations due to suspended sediment inside chamber		



WIND CREEK SOD

6/26/2003

STATION WC1

Latitude: 32° 40.530'

Longitude: -085° 54.070'

SUMMARY

Mean Adj. D.O. (mg/l/min)	-0.0056
Mean Adj. SOD rate (gr O2/m2/day)	-1.9398

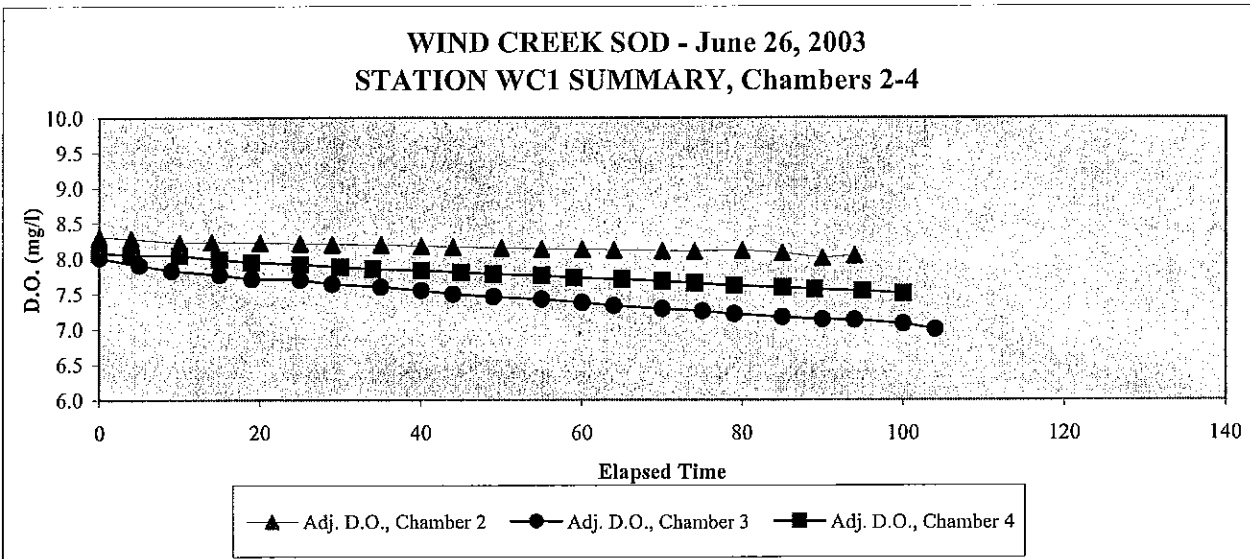
Blank SOD chambers

Chamber	D.O. rate (mg/l/min)
0	-0.000956328

Contact SOD chambers

Chamber	Unadjusted D.O. rate (mg/l/min)	Adjusted D.O. rate (mg/l/min)	Adjusted SOD rate (gr O2/m2/day)
1	Chamber 1 not utilized due to malfunction.		
2	-0.003471900	-0.002515573	-0.864552
3	-0.009725846	-0.008769519	-3.013908
4	-0.006600549	-0.005644221	-1.939806

WIND CREEK SOD - June 26, 2003
STATION WC1 SUMMARY, Chambers 2-4



DATA SUMMARY
 SEDIMENT OXYGEN DEMAND RATES
 MUD CREEK SOD - JUNE 23-24, 2003

STATION	REP	TIME	UNADJ. D.O. RATE (mg/l/min)	ADJ. D.O. RATE (mg/l/min)	W. COLUMN RESP. (mg/l/min)	SOD* (gr O2/m2/d)	STND. DEV. (gr O2/m2/d)	CV (As Percent)	DIVER OBSERVATIONS
STA M03	1	6/23/2003	NOT UTILIZED	NOT UTILIZED (Pump not working)					7' DEEP. Very floecky muck. Used collars
	2	1835-2025	0.00666	0.00546		1.87642			
	3	1920-2025	DATA NOT UTILIZED (Resuspended sediment in chamber)						
	4	1840-2030	0.00617	0.00497	0.00127	1.70652			
	0	1845-2025			0.00144346				
	00	1840-2030							
STA MEAN			0.00642	0.00521	0.00120	1.79147	0.12014	6.70595	
STA M04	1	6/24/2003	NOT UTILIZED (Pump not working)						5' DEEP. Unconsolidated muck. Used Collars
	2	1200-1345	0.007015465	0.00578		1.98494			
	3	1150-1345	0.005847792	0.00461		1.58363			
	4	1150-1350	0.005594728	0.00435		1.49666			
	0	1150-1345			0.00133				
	00	1150-1350			0.001145399				
STA MEAN			0.00615	0.00491	0.00124	1.68841	0.26046	15.42617	

DATA SUMMARY
 SEDIMENT OXYGEN DEMAND RATES
 SOUGAHATCHEE CREEK SOD - JUNE 25-26, 2003

STATION	REP	TIME	UNADJ. D.O. RATE (mg/l/min)	ADJ. D.O. RATE (mg/l/min)	W. COLUMN RESP. (mg/l/min)	SOD* (gr O2/m2/d)	STND. DEV. (gr O2/m2/d)	CV (As Percent)	DIVER OBSERVATIONS
STA S01	1	6/25/2003	NOT UTILIZED	NOT UTILIZED (Pump not working)					17' DEEP. Soft floecky sediment. Used collars.
	2	1135-1340	0.00576	0.00394		1.35303			
	3	1140-1345	0.00627	0.00445		1.52782			
	4	1135-1340	0.00531	0.00349		1.19953			
	0	1135-1335			0.00176				
	00	1135-1340			0.00188				
STA MEAN			0.00578	0.00396	0.00182	1.36012	0.16426	12.07669	
STA S02	1	6/25/2003	NOT UTILIZED (Pump not working)						16' DEEP. Soft floecky sediment. Used collars.
	2	1645-1825	0.00639	0.00580		1.99344			
	3	1645-1830	0.00547	0.00488		1.67659			
	4	1650-1830	DATA NOT UTILIZED (Resuspended sediment in chamber)						
	0	1630-1820			0.00049				
	00	1635-1825			0.00069				
STA MEAN			0.00593	0.00534	0.00059	1.83501	0.22405	12.20953	
STA WC1	1	6/26/2003	NOT UTILIZED (Pump not working)						3' DEEP. Firm mucky substrate with organic detrital material.
	2	1350-1525	0.00347	0.00252		0.86455			
	3	1345-1530	0.00973	0.00877		3.01391			
	4	1350-1530	0.00660	0.00564		1.93981			
	0	1345-1525			0.00056				
	00		NOT UTILIZED						
STA MEAN			0.00660	0.00564	0.00096	1.93942	1.07468	55.41229	

* ADJUSTED FOR WATER COLUMN RESPIRATION