

FINAL

2004 Water Quality Monitoring

Mill River

Hamden and New Haven, CT

January 2005

Prepared for

Regional Water Authority

Prepared by



Introduction

This report presents results of ongoing studies by the Regional Water Authority (RWA) to document baseline dissolved oxygen (DO) and salinity concentrations in the Mill River downstream of the Lake Whitney water supply reservoir dam. Lake Whitney was used for public water supply from 1862 to 1991. The RWA will be resuming water withdrawals from the reservoir following construction of a new water treatment plant (WTP) scheduled for completion in early 2005.

As part of a comprehensive environmental assessment of the Whitney WTP project, prior baseline studies of DO and salinity patterns in the lower Mill River were conducted in 1998 and annually since 2000. Dissolved oxygen and salinity were both recognized as important parameters to be considered in developing an environmental management plan for the Whitney WTP (Lake Whitney WTP Environmental Evaluation Team, 1999). This was further emphasized by a July 25, 2000 resolution adopted by the RWA's Five-Member Authority Board that included the following obligation:

By November 30, 2003, the RWA shall undertake and complete a study of dissolved oxygen concentrations in the downstream Mill River Corridor from the Whitney dam to the Orange Street Bridge, for the purpose of determining the dissolved oxygen concentrations in the spillway plunge pool necessary for maintaining acceptable dissolved oxygen levels downstream.

Based on the analysis of data collected from 1998 to 2003, 7 mg/L was selected as a reasonable target DO for the plunge pool during downstream release situations (CH2M HILL, 2003). It is expected that under most circumstances this will result in a surface water DO concentration above 5 mg/L at the Orange Street Bridge during dry weather conditions, although surface water DO concentrations slightly below 5 mg/L are occasionally observed.

During the summer of 2004, conditions in the Mill River were documented while sustained elevated flows were released from Lake Whitney to draw the reservoir's water level down for construction work at the dam. From July 6 to August 16, water from the reservoir was discharged downstream through the dam via a blowoff in order to lower the reservoir's water level to an approximate maximum of 6 feet below spillway elevation. When opened fully, the blowoff has a flow capacity of approximately 100 MGD (155 cfs).

A second period of downstream flow manipulation occurred from August 16 to 27. After completion of the construction activity near the dam, the lake was allowed to refill while water was released through a 12-inch pipe that approximated the 4.2 MGD (6.5 cfs) minimum downstream release called for in the Whitney WTP Management Plan when the lake water level falls below spillway elevation. Both the blowoff and 12-inch pipe discharge downstream of the dam plunge pool to a blowoff channel such that the plunge pool only received water from dam leakage during the above periods. By August 28, water was again flowing over the Lake Whitney spillway. Attachment A contains pictures of the flow from the 12-inch pipe and the Mill River downstream of the flow release while the reservoir was refilling. The following water quality monitoring studies were conducted in 2004:

- From July 3 to September 3, the RWA conducted weekly dawn DO and salinity monitoring below the Lake Whitney dam (i.e., the plunge pool and/or the blowoff channel, the footbridge, the Orange Street Bridge, and both sides of the tide gates (Figure 1). The purpose of the monitoring was to assess relationships between flow and DO concentrations in the Mill River below the dam and the downstream reach to the Orange Street Bridge.
- A short-term monitoring effort was conducted from August 17 to 20 to assess river DO and salinity under conditions comparable to minimum releases during the Lake Whitney Water Treatment Plant operation. Monitoring was conducted twice a day at dawn and in the afternoon at high tide. In addition to the stations monitored during the weekly monitoring, the covered bridge station was also monitored. The same parameters were measured as the weekly sampling.

A summary of the Mill River monitoring data collected in 2004 is presented below in Table 1.

Weekly Monitoring

Weekly monitoring of Mill River water quality was conducted by the RWA from July 2 through September 3, 2004. The weekly data were collected using a Hydrolab Quanta multi-parameter meter that was calibrated prior to each set of water quality measurements. The weekly monitoring data were collected during the early morning when dissolved oxygen is expected to be at its minimum daily concentration. Measurements were collected at one depth at the plunge pool and the blowoff channel. At the footbridge, Orange Street Bridge, and the tide gates, measurements were taken near the surface (0.1 to 0.2 m depth) and near the bottom to account for the possible presence of distinct water layers due to salinity intrusion from Long Island Sound. All weekly DO monitoring data are presented in Appendix B.

Weekly Dissolved Oxygen Results

Weekly DO surface layer measurements from the Mill River below Lake Whitney dam, the footbridge, Orange Street Bridge, and the tide gates are shown in Figure 2. Measurements below Lake Whitney dam represent those taken at either the plunge pool or the blowoff channel, depending on which was most representative of the flow going downstream, as explained below. The 2004 average DO and DO ranges below Lake Whitney dam, footbridge, and Orange Street Bridge are summarized in Table 2. The DO in the river below Lake Whitney dam was always measured to be over 7.0 mg/L, while the DO measurements at the Orange Street Bridge always exceeded 5 mg/L. As has been occasionally observed in prior summers, one surface water reading at the footbridge station was slightly less than 5 mg/L (4.92 mg/L on August 27). DO concentrations near the bottom of the water column were generally lower than DO concentrations near the surface at the Orange Street monitoring locations, with one exception on September 3. On this date, the DO concentration in the bottom water was slightly higher than near the surface.

TABLE 1.
Mill River Monitoring Data Collected in 2004

Frequency/Dates	Locations	Parameters
Weekly—July 2–Sept. 3 (early morning)	Blowoff Channel	Temperature, DO, Salinity, specific conductance, pH
	Plunge Pool	
	Footbridge	
	Orange Street	
	Tide gates	
Daily—August 17–20 (early morning)	Blowoff Channel	Temperature, DO, Salinity, specific conductance, pH
	Plunge Pool	
	Covered Bridge	
	Footbridge	
	Orange Street	
	Tide gates	
Daily—August 17–19 (afternoon, high tide)	Blowoff Channel	Temperature, DO, Salinity, specific conductance, pH
	Plunge Pool	
	Covered Bridge	
	Footbridge	
	Orange Street	
	Tide gates	

The blowoff and 12-inch pipe outlets are located downstream of the plunge pool that lies beneath the Lake Whitney spillway. When there was no water going over the spillway, the plunge pool was isolated from the river and received flow only from dam leakage. As a result, DO concentration in the plunge pool during this period averaged 2.9 mg/L. However, this was not representative of downstream DO, as the vast majority of the flow downstream under these conditions was from the blowoff or 12-inch pipe.

Due to the increasing influence of tidal effects, stormwater runoff, and combined sewer overflows with increasing distance downstream, Orange Street has been established as the downstream limit for the target DO of 5 mg/L. However, to provide a broader understanding of downstream water quality, weekly monitoring was also conducted at the Mill River tide gates, including photographing the condition of the tide gates (Attachment A). Dissolved oxygen concentrations at the tide gates are sometimes influenced by turbulence and associated aeration as water flows through the gates. DO at the tide gates ranged from 4.77 mg/L to 7.27 mg/L in the surface layer of the upstream tide gate, and 3.93 mg/L to 6.62 mg/L in the bottom layer. DO on the downstream side of the tide gates

ranged from 3.26 mg/L to 7.88 mg/L in the surface layer, and 3.01 mg/L to 7.74 mg/L in the bottom layer. Average DO on the upstream side of the tide gates in 2004 was 6.08 mg/L in the surface layer and 5.34 mg/L in the bottom layer. Average DO on the downstream side of the gates was 6.25 and 5.76 mg/L in the surface and bottom layers, respectively. Visual observation and photographs of the tide gates in 2004 did not reveal any unusual conditions.

TABLE 2
Weekly Dissolved Oxygen Average and Range

Location	Average	Range
River at Lake Whitney	7.74	7.20–8.36
Footbridge (Surface)	6.01	4.92–7.14
Footbridge (Bottom)	5.79	4.83–7.05
Orange Street (Surface)	6.70	5.57–8.63
Orange Street (Bottom)	6.31	5.1–8.35

Weekly Salinity Results

The weekly salinity monitoring data are presented in Figure 4 (surface layer) and Figure 5 (bottom layer). Salinity was very low at Orange Street in 2004 with only one measurement in the surface layer exceeding 1 part per thousand (ppt). There was generally higher saltwater intrusion observed in the bottom layer with three dates exceeding 1 ppt, and the highest measurement of 12.81 ppt recorded on September 3. This increase usually coincided with dry weather and high tide. As expected, salinity levels were elevated at the tide gates with concentrations ranging from 1.62 to 23.06 ppt. On most occasions, surface water salinity in the Mill River down to the Orange Street Bridge was characteristic of fresh water (<0.5 ppt) during the 2004 monitoring period, with the exception of August 27 and September 3, when Orange Street Bridge surface water salinities were measured at 0.69 and 2.89 ppt, respectively. Periods of higher salinities do occur at the Orange Street Bridge as evidenced by measurements in prior years exceeding 6 ppt in surface water and 14 ppt in bottom water (CH2M HILL, 2002), and the presence of salinity tolerant macroinvertebrates (ENSR, 2004).

Short-Term Monitoring, August 17–August 20, 2004

A short-term monitoring effort was conducted from August 17 to August 20 to assess river DO and salinity under conditions comparable to future Whitney WTP Management Plan minimum releases during the Lake Whitney Water Treatment Plant operation. On August 16, the blowoff was closed to allow for refilling of the reservoir following a drawdown for construction activity at the Lake Whitney dam that began on July 6. Concurrent with this, a 12-inch pipe was opened to release water from Lake Whitney to the Mill River at an estimated rate of 4 MGD. Beginning on August 17, daily monitoring of Mill River water quality was conducted by CH2M HILL at dawn (between 6 and 7 a.m.) and in the afternoon coinciding with high tide at the footbridge station to assess salinity intrusion under minimum release type conditions. The daily data was collected with the same Hydrolab Quanta multi-parameter meter used in the weekly sampling. Measurements were generally

collected near the surface at the plunge pool, blowoff channel, covered bridge, and at two water depths at the footbridge, Orange Street Bridge and the tide gates, near the surface (0.1 to 0.2 m depth) and near the bottom. August 17 through 19 were considered “wet” weather days (more than 0.12 inches of rain over the last 72 hours) and August 20 was a dry weather day. There was no water flowing over the Lake Whitney spillway during this entire monitoring period. The short-term raw monitoring data are presented in Attachment C.

Dissolved Oxygen Results: Short-Term Study

The short-term dawn DO monitoring data are presented in Figure 6 (surface layer) and Figure 7 (bottom layer). In general the DO follows the same patterns as the weekly monitoring. The DO in the plunge pool ranged between 1.73 mg/L and 3.90 mg/L as a consequence of being isolated from the main flow due to the blowoff channel location. The DO in the blowoff channel, which was representative of the freshwater flow to the downstream Mill River, ranged between 7.61 mg/L and 8.05 mg/L. There was substantial turbulence and aeration in the water released from Lake Whitney via the 12-inch pipe as it entered the blowoff channel (see picture in Attachment A). The surface DO at Orange Street was between 5 mg/L and 6 mg/L every day except on August 17 when it was 4.16 mg/L. This was likely due to stormwater runoff-related oxygen demand from over two inches of rain that fell in the 72 hours prior to sampling (readings from RWA Lake Whitney rain gauge). Low DO in the lower Mill River has been shown to frequently coincide with storm events (CH2M HILL, 2003). The DO upstream of the tide gates ranged from 4.12 mg/L to 5.39 mg/L in the surface layer of the upstream tide gate, and 3.74 mg/L to 5.10 mg/L in the bottom layer. The DO was sometimes elevated on the downstream side of the tide gates due to turbulence and aeration as the water passed through the gates. The DO on the downstream side of the tide gates ranged from 5.52 mg/L to 7.28 mg/L. Due to turbulence, measurements were only taken at one depth downstream of the tide gates to avoid damage to the instrument.

Salinity Results: Short-Term Study

The short-term dawn salinity monitoring data are presented in Figure 8 (surface layer) and Figure 9 (bottom layer). During the dawn readings, which took place roughly between high and low tide, salinity at the Orange Street Bridge did not exceed 1 ppt in the surface layer or the bottom layer.

Salinity measurements were repeated in the afternoon of the short-term study dates at high tide to assess the extent of salinity intrusion during the simulated minimum downstream release scenario. These data are presented in Figure 12 (surface layer) and Figure 13 (bottom layer). Again, salinity did not exceed 1 ppt in surface waters at the Orange Street Bridge. Slightly higher readings were detected in the bottom layer at the Orange Street Bridge but were all below 3 ppt. The heavy rainfall that occurred in the days prior to the study likely influenced the low salinities observed during the short-term study. The weeks following the short-term study were dry and reflected in subsequent weekly downstream salinity measurements, which increased noticeably in late August and early September, even after flows over the Lake Whitney spillway resumed.

Conclusions

This report summarizes the final year of data collection prior to initiating operation of the Whitney WTP in 2005. Although there were no water supply withdrawals in 2004, downstream flows were altered by the intentional release of water from Lake Whitney to the Mill River, first to lower the reservoir water level for construction activity near the dam, and second, while the lake refilled, to study river dissolved oxygen and salinity under a simulated minimum downstream release scenario. The following conclusions can be drawn from the data collected in 2004:

- Dissolved oxygen concentrations at the Orange Street Bridge during the simulated minimum release scenario were consistent with the target levels established in prior studies (CH2M HILL, 2003). Only one Orange Street Bridge surface water DO reading from the short-term study was less than 5 mg/L. This was likely influenced by stormwater-related oxygen demand.
- Salinities downstream to the Orange Street Bridge were relatively low in 2004. This was likely the result of a moderately wet summer combined with a period of artificially sustained higher river flows caused by the drawdown of Lake Whitney for construction work near the dam. No substantial changes in salinity at the downstream monitoring stations were evident during simulated downstream release conditions, which followed a period of heavy precipitation.
- DO in the plunge pool dropped to low levels (average 2.9 mg/L) when isolated from flow directed from Lake Whitney to the Mill River during the reservoir drawdown. This condition will largely be alleviated by the installation of a downstream release outlet to the plunge pool scheduled for completion in 2005. The RWA will also have the ability to inject air into the plunge pool to increase DO downstream or supplement DO in the plunge pool when it becomes necessary to isolate the plunge pool from Lake Whitney flow releases for dam maintenance and/or inspection.

The RWA's DO and salinity monitoring program will continue beyond the anticipated start-up of the Whitney Water Treatment Plant in 2005. The baseline data that has been collected over multiple years will provide valuable information for assessing the degree of impact, if any, of future public water supply withdrawals on the environmental quality of the lower Mill River. Routine DO and salinity monitoring will be conducted during July and August. Additional monitoring may be conducted, as needed, during critical periods such as drought, when lower Mill River freshwater flows may depend on manual releases of water from Lake Whitney as outlined in the Management Plan. The data collected will be used to assess the success of the Management Plan measures in mitigating potential water supply withdrawal impacts on river DO. Potential alternatives to supplement downstream DO concentrations include plunge pool aeration, and/or changes in the downstream release schedule. Increased monitoring during low DO events in the plunge pool can be used to assess the degree and duration of impact at downstream river locations.

Literature Cited

Lake Whitney WTP Environmental Evaluation Team (1999). *Lake Whitney Water Treatment Plant Environmental Evaluation, Vol. 1: Environmental Evaluation Team Final Report*. Report prepared for the South Central Connecticut Regional Water Authority, New Haven, CT.

CH2M HILL, (2002). *2002 Water Quality Monitoring, Mill River, Hamden and New Haven, CT*. Report prepared for the South Central Connecticut Regional Water Authority, New Haven, CT.

CH2M HILL, 2003. *1998–2003 Comprehensive Dissolved Oxygen Monitoring in the Lower Mill River, Hamden and New Haven, CT*. Report prepared for the South Central Connecticut Regional Water Authority, New Haven, CT.

ENSR, 2004. *2000–2003 Benthic Biological Assessment of the Lower Mill River–Hamden/New Haven (CT)*. Report prepared for the South Central Connecticut Regional Water Authority, New Haven, CT.

Figures

FIGURE 1 Locations Sampled during the Mill River Monitoring.

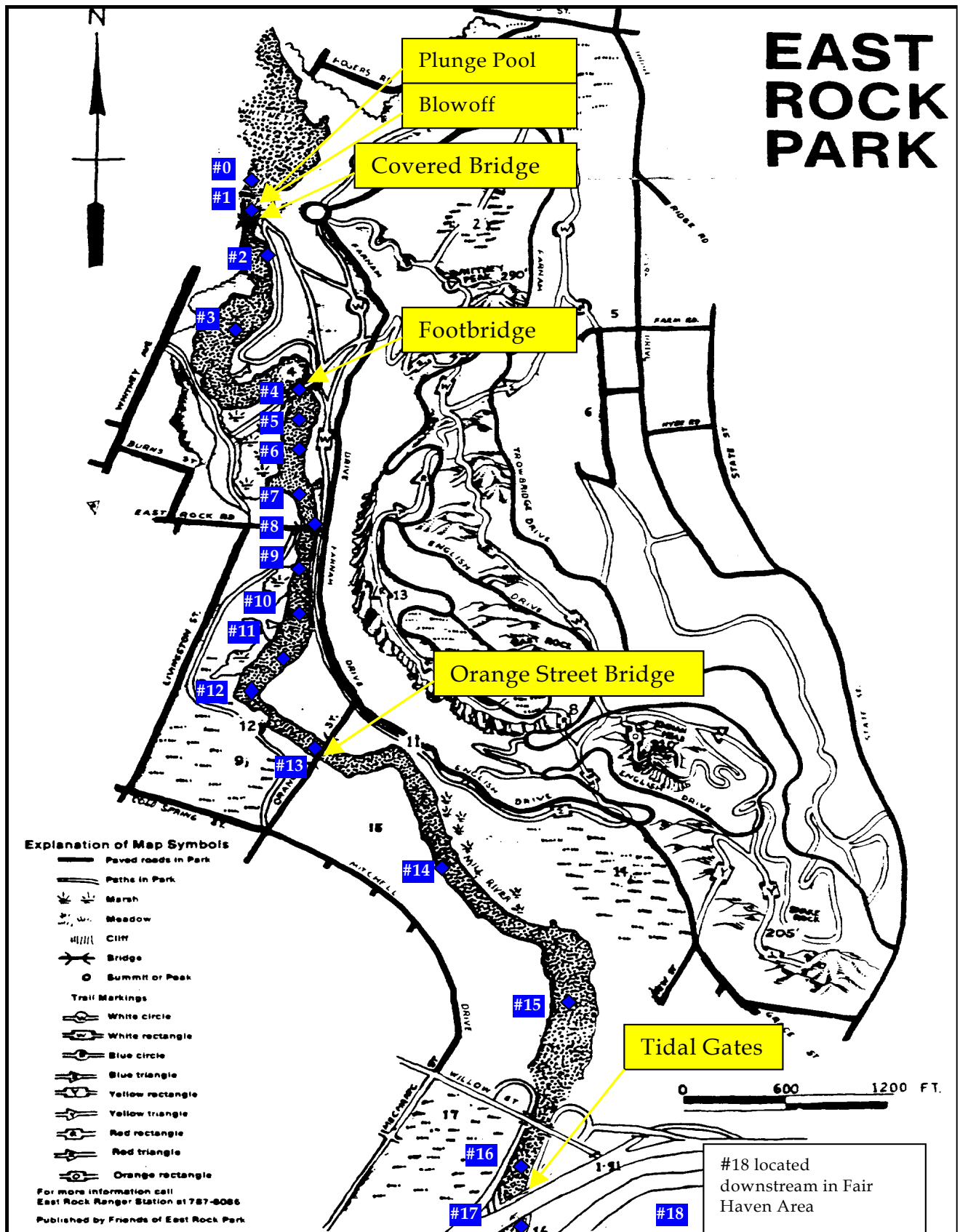


Figure 2
2004 Mill River Dissolved Oxygen Monitoring
Weekly Dissolved Oxygen Monitoring
Surface Data

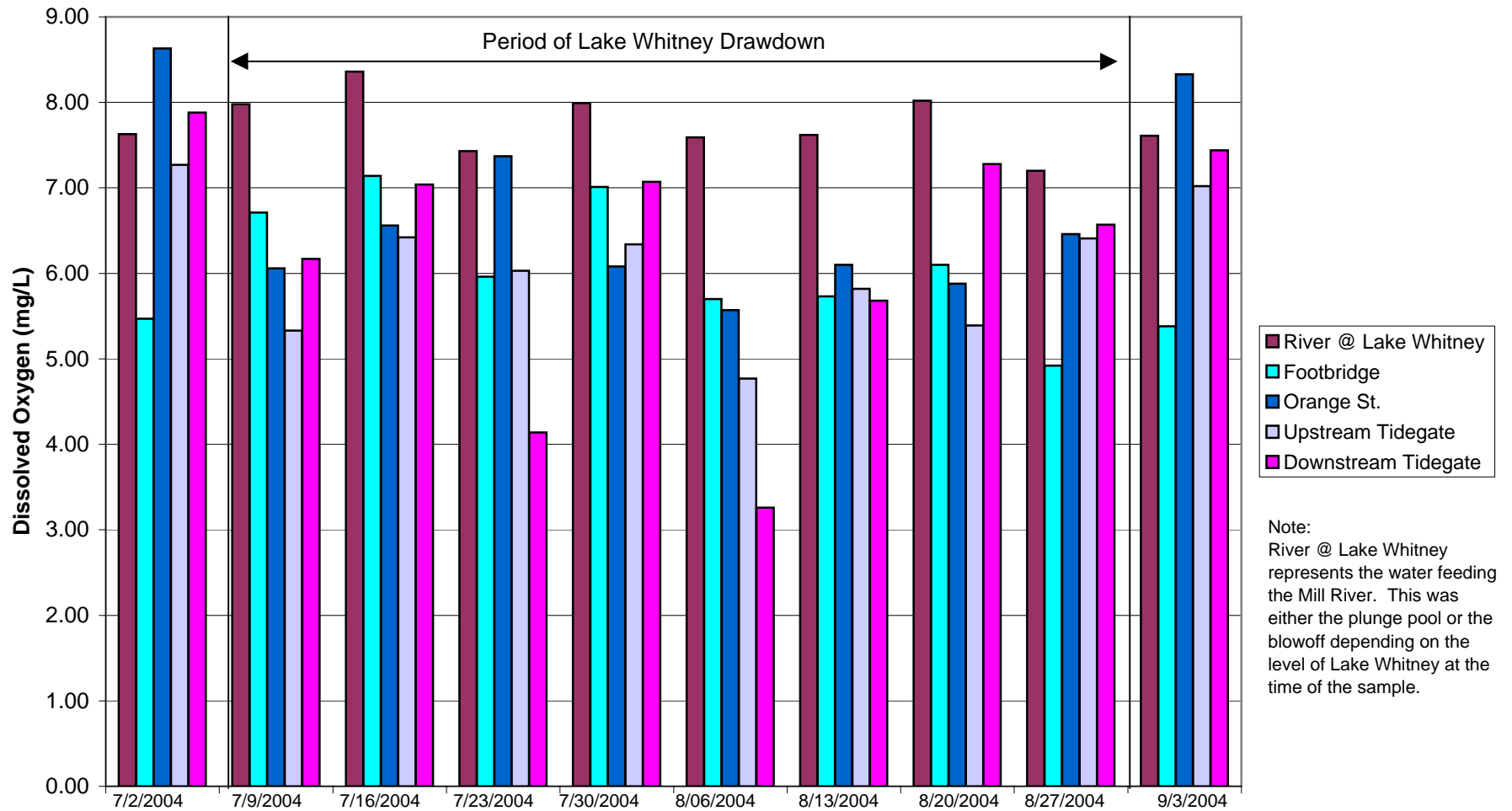


Figure 3
2004 Mill River Dissolved Oxygen Monitoring
Weekly Dissolved Oxygen Monitoring
Bottom Layer

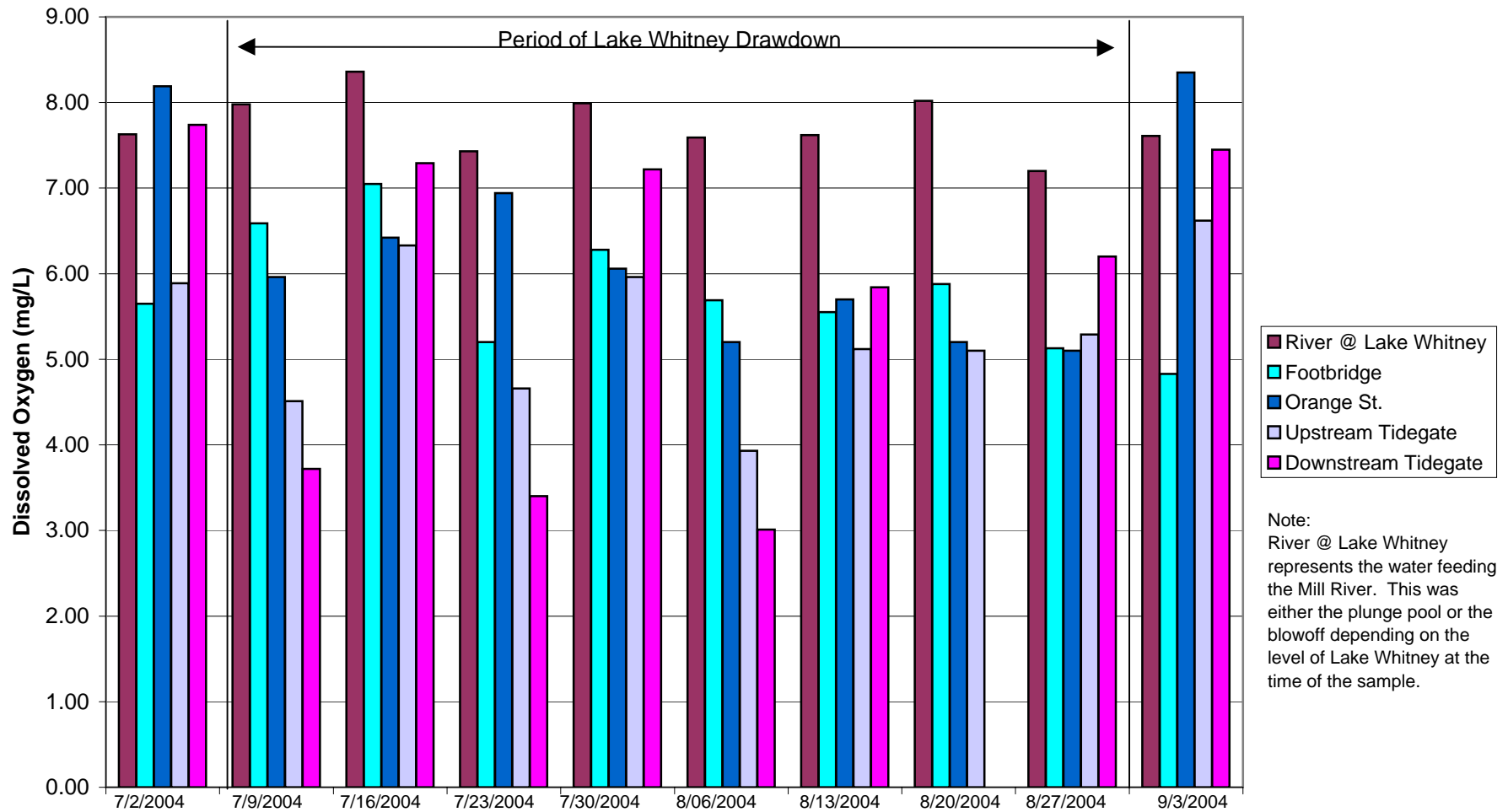


Figure 4
2004 Mill River Dissolved Oxygen Monitoring
Weekly Salinity Monitoring
Surface Layer

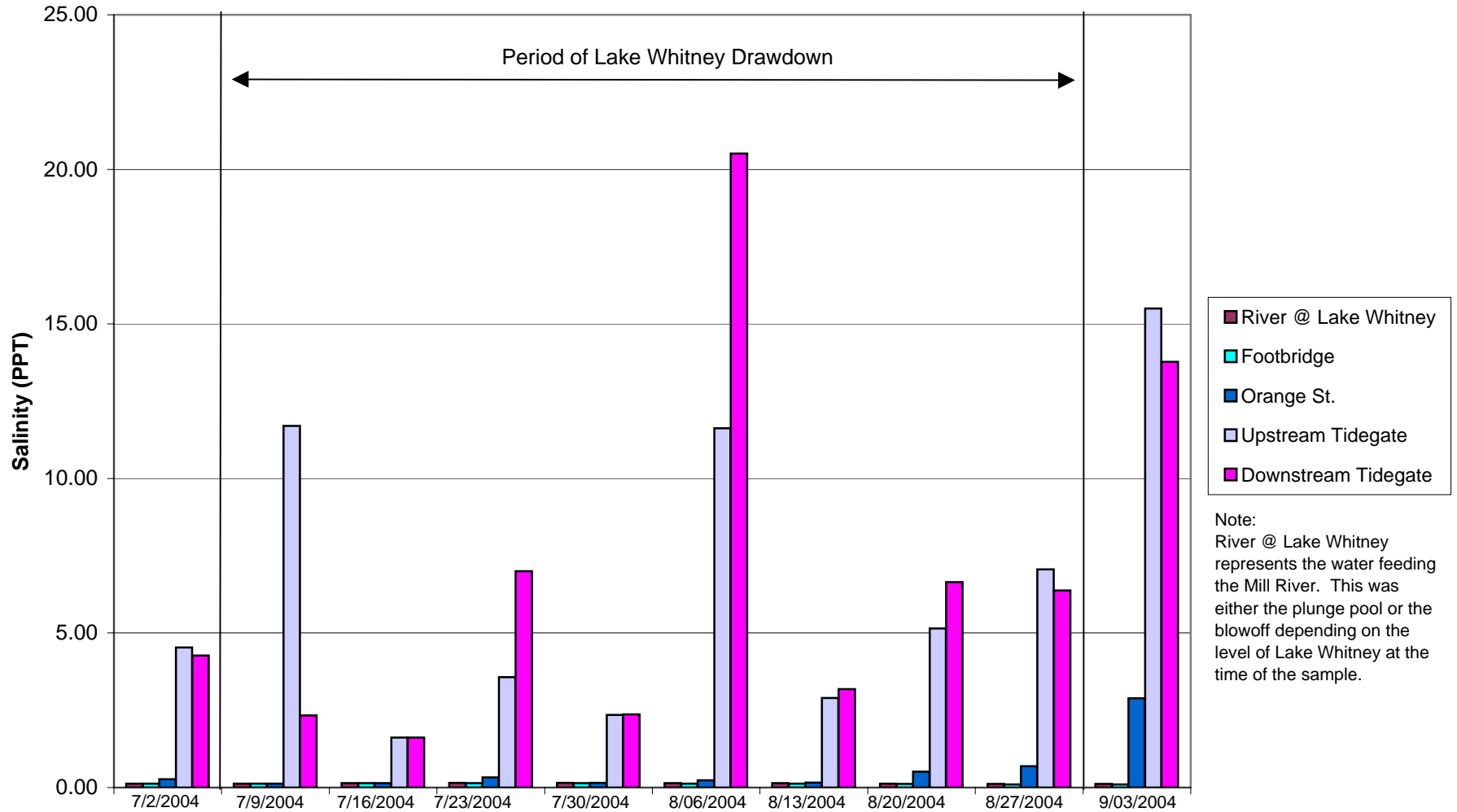


Figure 5
2004 Mill River Dissolved Oxygen Monitoring
Weekly Salinity Monitoring
Bottom Layer

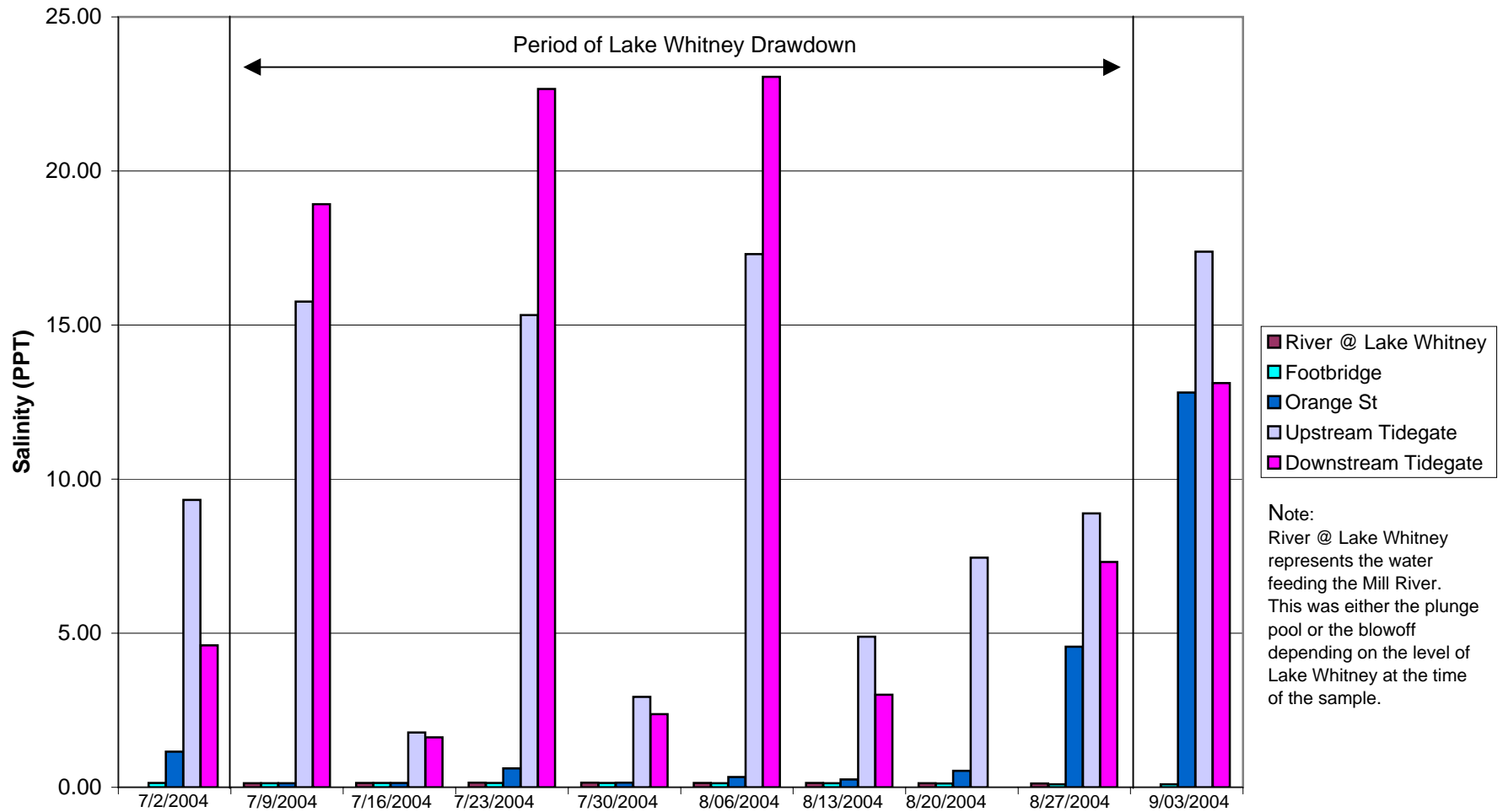


Figure 6
Mill River Dissolved Oxygen Short Term Monitoring
Surface Layer
Dawn Readings, Low Tide

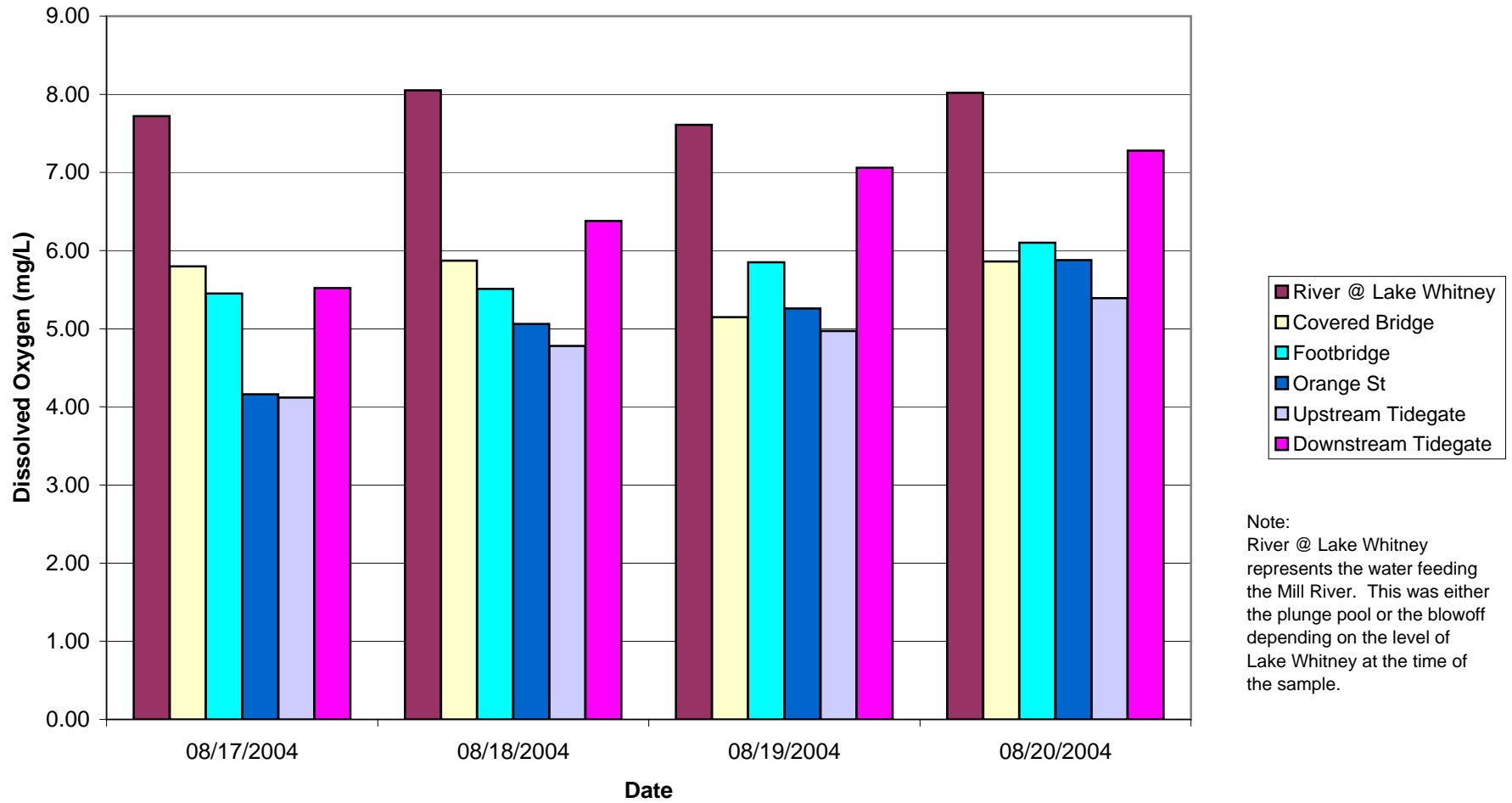


Figure 7
Mill River Dissolved Oxygen Short Term Monitoring
Bottom Layer
Dawn Readings, Low Tide

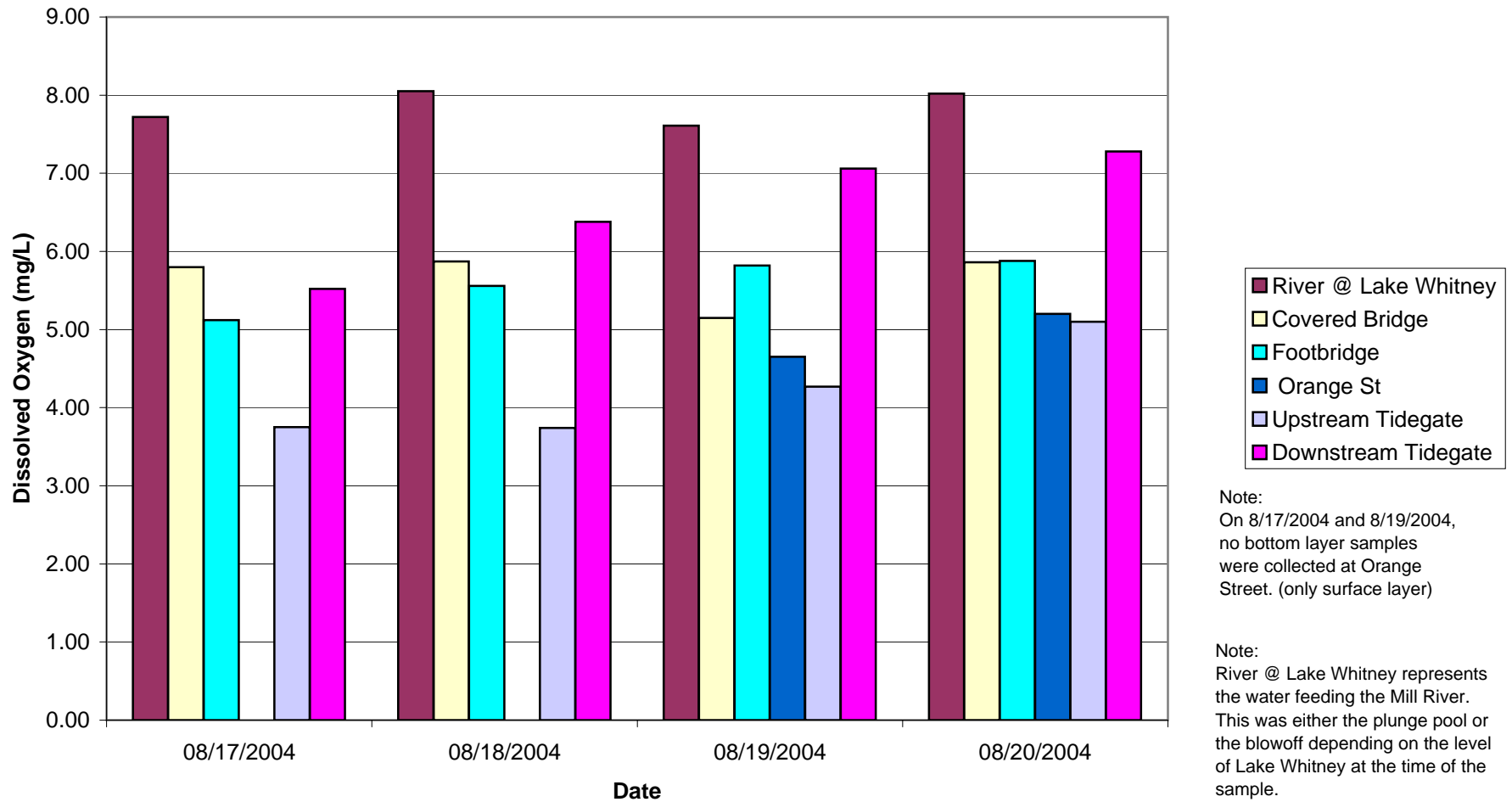


Figure 8
Mill River Salinity Short Term Monitoring
Surface Layer
Dawn Readings, Low Tide

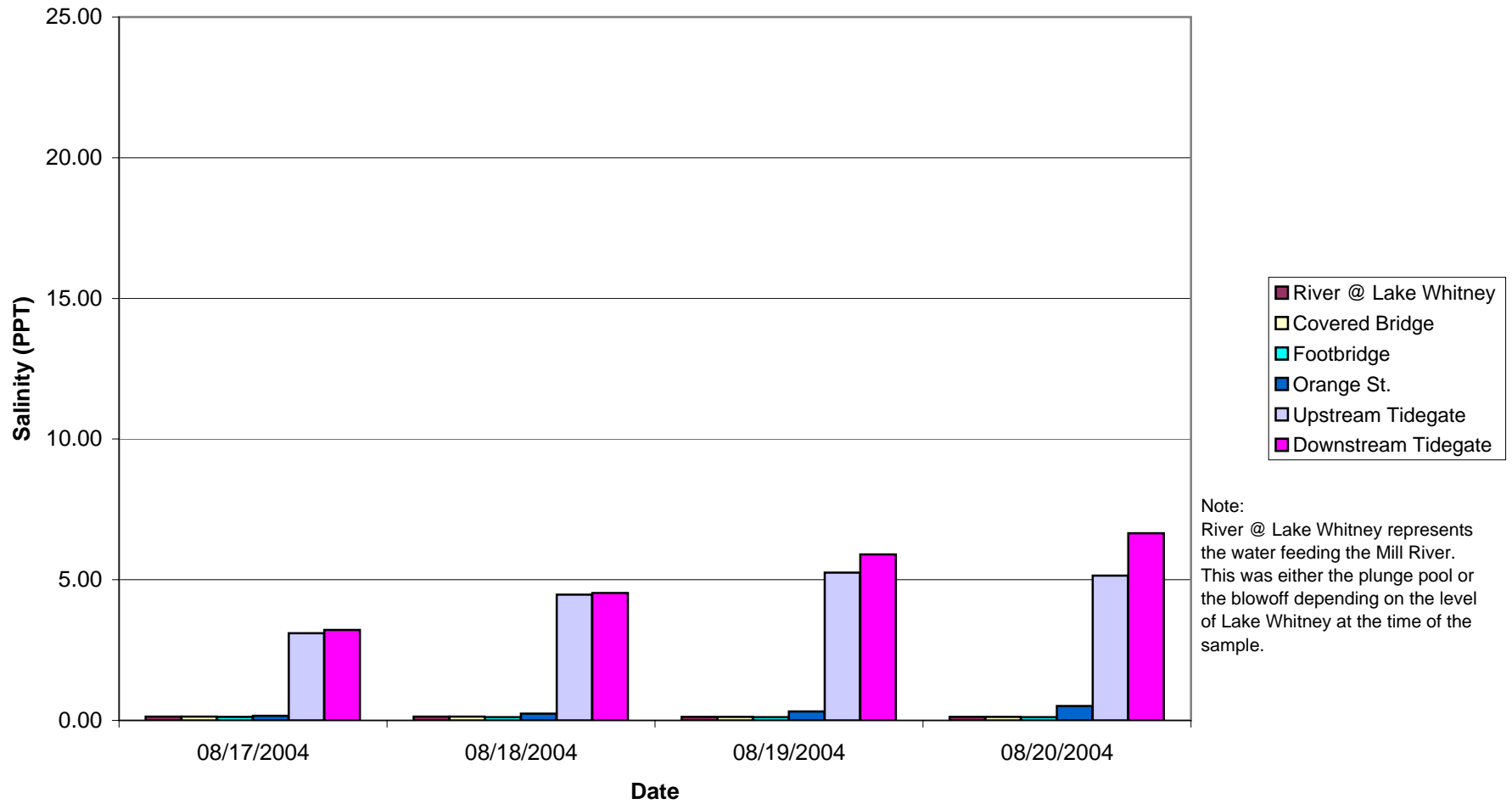
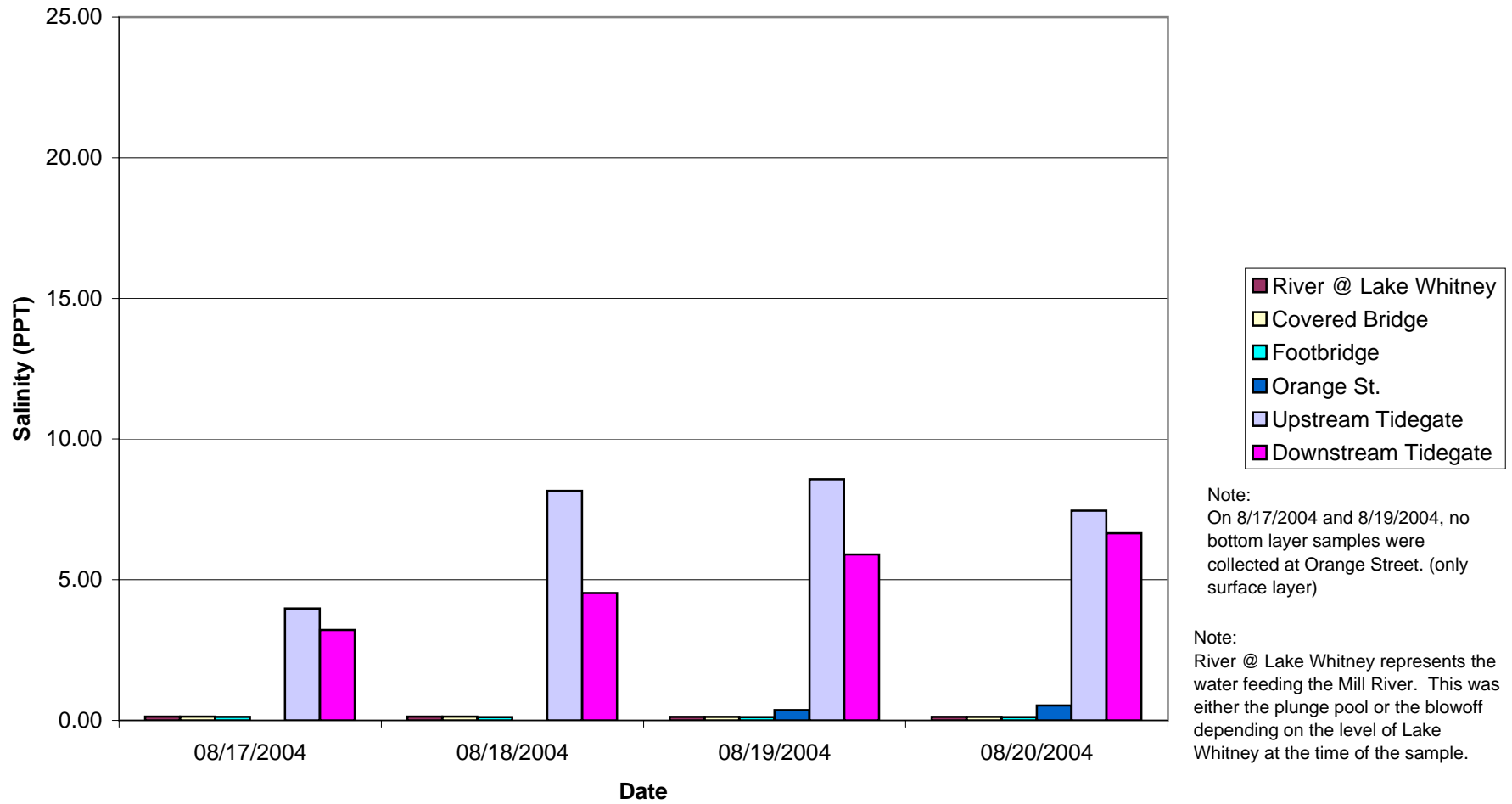


Figure 9
Mill River Salinity Short Term Monitoring
Bottom Layer
Dawn Readings, Low Tide



Attachment A:
Pictures of Sampling Locations and Conditions

Blowoff Channel (August 17, 2004)



Downstream from Plunge Pool (August 20, 2004)



Downstream from Covered Bridge
(August 17, 2004)



Upstream from Footbridge
(August 17, 2004)



Downstream from Footbridge (August 17, 2004)



Downstream side of Tidegates (no obstructions)
(August 17, 2004)



Attachment B:
Weekly Raw Monitoring Data

2004 Weekly Monitoring Data

DATE	Station	Time	Depth (m)	Temp (C)	SpC (mS/cm)	Salinity (PPT)	pH	DO (mg/l)	DO%	Tide Stage
7/2/2004	0	5:51	0.50	23.88	0.276	0.13	8.35	9.10	108.00	Low
7/2/2004	1	5:40	0.40	23.21	0.276	0.13	8.19	7.63	89.40	Low
7/2/2004	4	5:30	0.10	22.92	0.28	0.13	7.78	5.47	63.70	Low
7/2/2004	4	5:33	0.70	22.90	0.282	0.14	7.76	5.65	65.80	Low
7/2/2004	6	5:15	0.10	24.02	0.552	0.27	8.15	8.63	102.70	Low
7/2/2004	6	5:20	0.80	24.08	2.27	1.16	8.07	8.19	98.40	Low
7/2/2004	7	6:04	0.10	23.53	8.19	4.53	7.67	7.27	88.10	Low
7/2/2004	7	6:08	0.70	23.12	16	9.33	7.34	5.89	73.10	Low
7/2/2004	8	6:12	0.20	23.50	4.27	4.27	7.70	7.88	95.40	Low
7/2/2004	8	6:15	0.50	23.50	8.32	4.61	7.71	7.74	93.90	Low
7/9/2004	1	5:40	0.20	19.07	0.276	0.13	6.69	1.60	17.30	High
7/9/2004	1a	5:45	0.10	24.27	0.274	0.13	7.70	7.98	95.40	High
7/9/2004	4	5:25	0.10	23.80	0.275	0.13	7.41	6.71	79.50	High
7/9/2004	4	5:30	1.00	23.73	0.276	0.13	7.39	6.59	77.90	High
7/9/2004	6	5:05	0.10	23.42	0.279	0.13	7.08	6.06	71.40	High
7/9/2004	6	5:10	0.80	23.40	0.28	0.13	7.09	5.96	70.20	High
7/9/2004	7	6:00	0.10	23.38	19.7	11.70	6.94	5.33	67.30	High
7/9/2004	7	6:05	1.00	23.10	25.9	15.76	6.90	4.51	58.10	High
7/9/2004	8	6:10	0.20	23.99	4.38	2.33	7.30	6.17	74.40	High
7/9/2004	8	6:13	1.20	22.88	30.6	18.92	6.81	3.72	48.70	High
7/16/2004	1	5:45	0.30	17.25	0.272	0.13	6.75	3.03	31.50	Low
7/16/2004	1a	5:50	0.20	22.17	0.285	0.14	7.29	8.36	96.00	Low
7/16/2004	4	6:00	0.30	21.76	0.284	0.14	7.20	7.14	81.40	Low
7/16/2004	4	6:01	0.90	21.77	0.285	0.14	7.19	7.05	80.30	Low
7/16/2004	6	6:14	0.20	21.21	0.288	0.14	7.14	6.56	73.90	Low
7/16/2004	6	6:15	0.80	21.38	0.29	0.14	7.11	6.42	72.60	Low
7/16/2004	7	6:27	0.20	21.73	3.12	1.62	7.08	6.42	73.90	Low
7/16/2004	7	6:29	0.90	21.76	3.4	1.78	7.09	6.33	72.90	Low
7/16/2004	8	6:31	0.20	21.71	3.12	1.62	7.14	7.04	81.00	Low
7/16/2004	8	6:33	0.60	21.71	3.12	1.62	7.14	7.29	83.80	Low
7/23/2004	1	5:50	0.30	18.58	0.28	0.13	6.77	1.38	14.70	High
7/23/2004	1a	5:53	0.20	25.15	0.308	0.15	7.70	7.43	90.40	High
7/23/2004	4	5:35	0.20	23.39	0.29	0.14	7.28	5.96	70.10	High

2004 Weekly Monitoring Data

DATE	Station	Time	Depth (m)	Temp (C)	SpC (mS/cm)	Salinity (PPT)	pH	DO (mg/l)	DO%	Tide Stage
7/23/2004	4	5:40	1.10	23.93	0.29	0.14	7.14	5.20	60.60	High
7/23/2004	6	5:15	0.20	25.25	0.684	0.33	7.40	7.37	89.80	High
7/23/2004	6	5:21	0.80	25.37	1.23	0.61	7.37	6.94	84.90	High
7/23/2004	7	6:05	0.10	24.77	6.55	3.57	7.37	6.03	74.40	High
7/23/2004	7	6:10	1.00	24.16	25.2	15.32	7.03	4.66	61.10	High
7/23/2004	8	6:15	0.20	24.66	12.26	7.00	7.11	4.14	52.10	High
7/23/2004	8	6:19	0.80	23.77	36	22.66	6.94	3.40	46.20	High
7/30/2004	1	5:45	0.20	17.51	0.288	0.14	6.63	5.60	58.60	Low
7/30/2004	1a	5:49	0.30	23.01	0.304	0.15	7.67	7.99	93.30	Low
7/30/2004	4	5:30	0.20	21.68	0.29	0.14	7.26	7.01	79.80	Low
7/30/2004	4	5:35	0.70	21.55	0.29	0.14	7.17	6.28	71.30	Low
7/30/2004	6	5:15	0.20	21.86	0.31	0.15	7.03	6.08	69.40	Low
7/30/2004	6	5:20	0.80	21.80	0.309	0.15	7.03	6.06	69.20	Low
7/30/2004	7	6:05	0.20	22.94	4.42	2.35	7.12	6.34	75.00	Low
7/30/2004	7	6:10	0.80	22.98	5.44	2.93	7.07	5.96	71.00	Low
7/30/2004	8	6:15	0.20	22.91	4.47	2.37	7.15	7.07	83.60	Low
7/30/2004	8	6:21	0.40	22.93	4.46	2.37	7.13	7.22	85.30	Low
8/6/2004	1	5:50	0.20	17.56	0.275	0.13	6.83	3.67	38.50	High
8/6/2004	1a	5:55	0.30	24.62	0.283	0.14	8.07	7.59	91.30	High
8/6/2004	4	5:40	0.20	22.78	0.271	0.13	7.47	5.70	66.20	High
8/6/2004	4	5:44	1.00	22.72	0.273	0.13	7.44	5.69	64.90	High
8/6/2004	6	5:20	0.20	23.11	0.504	0.24	7.36	5.57	65.20	High
8/6/2004	6	5:30	0.70	23.18	0.688	0.33	7.35	5.20	61.00	High
8/6/2004	7	6:10	0.20	22.66	19.6	11.62	7.03	4.77	59.50	High
8/6/2004	7	6:15	0.90	22.99	2802	17.30	6.94	3.93	51.20	High
8/6/2004	8	6:20	0.20	23.33	32.9	20.51	6.90	3.26	43.30	High
8/6/2004	8	6:25	0.80	23.27	36.6	23.06	6.90	3.01	40.70	High
8/13/2004	1	5:58	0.20	19.83	0.279	0.13	6.67	1.98	21.80	Low
8/13/2004	1a	6:02	0.20	23.96	0.293	0.14	7.94	7.62	90.60	Low
8/13/2004	4	5:40	0.20	22.28	0.272	0.13	7.23	5.73	66.00	Low
8/13/2004	4	5:45	0.80	22.22	0.269	0.13	7.20	5.55	63.80	Low
8/13/2004	6	5:20	0.30	23.57	0.327	0.16	7.19	6.10	72.00	Low
8/13/2004	6	5:28	0.80	23.59	0.523	0.25	7.15	5.70	67.30	Low

2004 Weekly Monitoring Data

DATE	Station	Time	Depth (m)	Temp (C)	SpC (mS/cm)	Salinity (PPT)	pH	DO (mg/l)	DO%	Tide Stage
8/13/2004	7	6:20	0.80	23.97	8.79	4.89	7.01	5.12	63.80	Low
8/13/2004	8	6:23	0.20	23.88	5.88	3.18	7.10	5.68	68.70	Low
8/13/2004	8	6:28	0.60	23.87	5.57	3.00	7.11	5.84	70.60	Low
8/14/2004	7	6:15	0.20	23.88	5.39	2.90	7.13	5.82	70.30	Low
8/27/2004	1	5:50	0.20	20.77	0.26	0.12	6.82	4.77	53.30	Low
8/27/2004	1a	6:01	0.30	23.23	0.247	0.12	8.31	7.20	84.40	Low
8/27/2004	4	5:30	0.20	20.11	0.208	0.10	6.91	4.92	54.30	Low
8/27/2004	4	5:40	0.80	20.01	0.207	0.10	6.91	5.13	56.50	Low
8/27/2004	6	5:10	0.20	21.95	1.382	0.69	7.20	6.46	74.10	Low
8/27/2004	6	5:18	0.80	22.86	8.24	4.56	6.89	5.10	61.10	Low
8/27/2004	7	6:15	0.10	22.83	12.37	7.06	7.09	6.41	77.90	Low
8/27/2004	7	6:20	0.80	23.11	15.3	8.89	6.98	5.29	65.40	Low
8/27/2004	8	6:30	0.20	22.71	11.26	6.38	7.09	6.57	79.40	Low
8/27/2004	8	6:34	0.60	22.92	12.77	7.31	7.04	6.20	75.70	Low
9/3/2004	0	6:15	0.50	24.52	0.241	0.12	8.20	7.25	87.10	Mid
9/3/2004	1	6:25	0.40	22.78	0.244	0.12	8.02	7.61	88.40	Mid
9/3/2004	4	6:00	0.20	20.91	0.214	0.10	7.26	5.38	60.30	Mid
9/3/2004	4	6:05	0.90	20.71	0.215	0.10	7.11	4.83	53.90	Mid
9/3/2004	6	5:40	0.20	22.24	5.38	2.89	7.62	8.33	97.60	Mid
9/3/2004	6	5:51	0.70	24.11	21.4	12.81	7.59	8.35	107.70	Mid
9/3/2004	7	6:35	0.20	23.21	25.5	15.50	7.47	7.02	90.50	Mid
9/3/2004	7	6:40	0.60	23.39	28.3	17.38	7.42	6.62	86.70	Mid
9/3/2004	8	6:45	0.20	22.98	22.9	13.77	7.53	7.44	94.50	Mid
9/3/2004	8	6:50	0.70	22.90	21.9	13.12	7.54	7.45	94.10	Mid

Attachment C:
Short Term Raw Monitoring Data

2004 Mill River DO Sampling

Tuesday - Morning
Date: August 17, 2004

Station Number	1	1A	2	4	4	6	6	7	7	8
Station Name	Plunge Pool	Blowoff	Covered Bridge	Bottom Footbridge	Top Footbridge	Bottom Orange	Top Orange	Top Upstream Tidegate	Bottom Upstream Tidegate	Downstream Tidegate
Time	6:15 AM	6:26 AM	6:32 AM	6:55 AM	6:45 AM		7:10 AM	7:25 AM	7:30 AM	7:37 AM
Temperature (C)	17.30	22.18	20.95	20.05	20.06		20.40	20.68	20.89	20.73
Specific Conductance (mS/cm)	0.276	0.286	0.286	0.263	0.263		0.335	5.76	7.27	5.96
Dissolved Oxygen (mg/L)	1.73	7.72	5.80	5.12	5.45		4.16	4.12	3.75	5.52
pH	6.59	7.54	7.23	7.09	7.11		7.04	6.86	6.82	6.93
Depth (m)	0.2	0.2	0.1	0.7	0.1		0.1	0.1	0.5	0.1
Salinity (PPT)	0.13	0.14	0.14	0.13	0.13		0.16	3.10	3.98	3.22
Dissolved Oxygen (%)	18.4	88.6	64.6	56.3	60.1		46.6	46.9	43.2	62.9
ORP(mV)	649	591	602	582	578		578	587	585	592

Tuesday - Afternoon
Date: August 17, 2004

Station Number	1	1A	2	4	4	6	6	7	7	8
Station Name	Plunge Pool	Blowoff	Covered Bridge	Bottom Footbridge	Top Footbridge	Bottom Orange	Top Orange	Top Upstream Tidegate	Bottom Upstream Tidegate	Downstream Tidegate
Time	4:43 PM	4:57 PM	5:04 PM	5:20 PM	5:15 PM		5:35 PM	5:45 PM	5:50 PM	5:55 PM
Temperature (C)	27.36	27.47	22.57	24.06	24.5		22.46	23.35	23.03	23.3
Specific Conductance (mS/cm)	0.276	0.276	0.287	0.260	0.257		0.836	11.04	15.00	10.77
Dissolved Oxygen (mg/L)	6.62	7.84	6.20	8.28	8.23		6.18	5.33	4.70	6.43
pH	7.00	7.57	7.28	7.74	7.95		7.34	6.97	6.90	7.01
Depth (m)	0.1	0.1	0.1	0.4	0.1		0.1	0.1	0.4	0.1
Salinity (PPT)	0.13	0.13	0.14	0.13	0.12		0.41	6.25	8.70	6.08
Dissolved Oxygen (%)	76.3	90.5	71.7	98.6	98.8		71.4	65.2	58.0	78.6
ORP(mV)	616	562	583	534	527		541	569	584	588

2004 Mill River DO Sampling

Wednesday- Morning

Date: August 18, 2004

Station Number	1	1A	2	4	4	6	6	7	7	8
Station Name	Plunge Pool	Blowoff	Covered Bridge	Bottom Footbridge	Top Footbridge	Bottom Orange	Top Orange	Top Upstream Tidegate	Bottom Upstream Tidegate	Downstream Tidegate
Time	6:22 AM	6:30 AM	6:38 AM	6:55 AM	7:00 AM		7:20 AM	7:38 AM	7:30 AM	7:43 AM
Temperature (C)	18.79	22.51	21.29	20.14	20.21		21.23	21.62	22.16	21.60
Specific Conductance (mS/cm)	0.280	0.282	0.284	0.256	0.256		0.503	809	14.16	8.20
Dissolved Oxygen (mg/L)	2.80	8.05	5.87	5.56	5.51		5.06	4.78	3.74	6.38
pH	6.78	7.96	7.42	7.15	7.17		7.14	6.95	6.85	7.01
Depth (m)	0.2	0.2	0.1	0.6	0.1		0.2	0.1	0.6	0.1
Salinity (PPT)	0.13	0.14	0.14	0.12	0.12		0.24	4.47	8.16	4.53
Dissolved Oxygen (%)	30.1	93.1	66.3	61.3	61.0		57.1	55.9	45.2	74.7
ORP(mV)	630	523	552	551	556		558	567	558	576

Wednesday- Afternoon

Date: August 18, 2004

Station Number	1	1A	2	4	4	6	6	7	7	8
Station Name	Plunge Pool	Blowoff	Covered Bridge	Bottom Footbridge	Top Footbridge	Bottom Orange	Top Orange	Top Upstream Tidegate	Bottom Upstream Tidegate	Downstream Tidegate
Time	3:37 PM	16:02	16:10	16:22	16:20	16:42	16:40	16:55		17:00
Temperature (C)	22.40	22.23	22.74	22.90	23.90	23.03	23.49	23.42		23.17
Specific Conductance (mS/cm)	0.285	0.271	0.278	0.256	0.254	5.41	1.321	8.46		18.7
Dissolved Oxygen (mg/L)	5.63	7.44	6.19	8.14	8.18	6.32	6.4	5.69		5.45
pH	6.98	7.32	7.24	7.74	8.04	7.06	7.30	6.99		6.9
Depth (m)	0.2	0.2	0.1	0.6	0.1	0.4	0.1	0.1		0.1
Salinity (PPT)	0.14	0.13	0.13	0.12	0.12	2.91	0.66	4.49		11.05
Dissolved Oxygen (%)	64.9	73.2	71.9	94.8	97.1	75.2	75.6	69.1		68.3
ORP(mV)	630	602	590	538	532	565	540	557		56.8

**Unable to sample bottom of Upstream Tidegate due to high flow. (The probe kept going under the tidegate and not to the bottom.)

2004 Mill River DO Sampling

Thursday - Morning

Date: August 19, 2004

Station Number	1	1A	2	4	4	6	6	7	7	8
Station Name	Plunge Pool	Blowoff	Covered Bridge	Bottom Footbridge	Top Footbridge	Bottom Orange	Top Orange	Top Upstream Tidegate	Bottom Upstream Tidegate	Downstream Tidegate
Time	6:29 AM	6:38 AM	6:43 AM	7:04 AM	7:00 AM	7:20 AM	7:14 AM	7:35 AM	7:40 AM	7:45 AM
Temperature (C)	20.31	22.79	22.14	21.15	21.16	22.28	22.27	22.69	22.83	22.73
Specific Conductance (mS/cm)	0.292	0.272	0.274	0.248	0.249	0.751	0.661	9.4	14.8	10.48
Dissolved Oxygen (mg/L)	3.90	7.61	5.15	5.82	5.85	4.65	5.26	4.97	4.27	7.06
pH	6.72	7.59	7.29	7.21	7.22	7.19	7.22	7.03	6.94	7.06
Depth (m)	0.1	0.2	0.1	0.7	0.1	0.5	0.1	0.1	0.6	0.1
Salinity (PPT)	0.14	0.13	0.13	0.12	0.12	0.37	0.32	5.25	8.57	5.9
Dissolved Oxygen (%)	43.2	88.4	58.4	65.5	65.9	53.6	60.6	59.5	52.5	85.1
ORP(mV)	650	606	593	584	582	562	552	543	556	555

Thursday - Afternoon

Date: August 19, 2004

Station Number	1	1A	2	4	4	6	6	7	7	8
Station Name	Plunge Pool	Blowoff	Covered Bridge	Bottom Footbridge	Top Footbridge	Bottom Orange	Top Orange	Top Upstream Tidegate	Bottom Upstream Tidegate	Downstream Tidegate
Time	4:02 PM	4:09 PM	4:16 PM	4:36 PM	4:32 PM	4:56 PM	4:51 PM	5:11 PM	5:15 PM	5:20 PM
Temperature (C)	22.68	22.55	23.22	22.50	23.90	23.51	24.2	24.64	23.43	24.24
Specific Conductance (mS/cm)	0.290	0.264	0.270	0.247	0.245	2.12	1.101	7.11	27.7	11.2
Dissolved Oxygen (mg/L)		7.46	6.50	6.40	6.76	5.9	6.36	5.82	4.00	5.82
pH	7.00	7.37	7.25	7.36	7.10	7.11	7.26	7.10	6.89	7.08
Depth (m)	0.3	0.3	0.1	0.8	0.1	0.4	0.1	0.1	0.6	0.1
Salinity (PPT)	0.14	0.13	0.13	0.12	0.12	1.08	0.54	3.9	16.97	6.35
Dissolved Oxygen (%)	67.0	86.2	76.1	74.0	80.2	70.0	76.1	71.9	52.2	72.3
ORP(mV)	639	6.05	592	556	546	559	547	530	552	561

Friday - Morning

Date: August 20, 2004

Station Number	1	1A	2	4	4	6	6	7	7	8
Station Name	Plunge Pool	Blowoff	Covered Bridge	Bottom Footbridge	Top Footbridge	Bottom Orange	Top Orange	Top Upstream Tidegate	Bottom Upstream Tidegate	Downstream Tidegate
Time	6:25 AM	6:32 AM	6:37 AM	6:52 AM	6:49 AM	7:08 AM	7:03 AM	7:21 AM	7:25 AM	7:30 AM
Temperature (C)	20.58	23.47	22.75	21.47	21.56	22.52	22.56	23.06	23.14	23.11
Specific Conductance (mS/cm)	0.296	0.270	0.274	0.248	0.249	1.07	1.033	9.22	13.0	11.7
Dissolved Oxygen (mg/L)	2.90	8.02	5.86	5.88	6.10	5.20	5.88	5.39	5.10	7.28
pH	6.78	7.84	7.36	7.19	7.24	7.16	7.15	7.02	6.96	7
Depth (m)	0.1	0.3	0.1	0.7	0.1	0.5	0.1	0.1	0.5	0.1
Salinity (PPT)	0.14	0.13	0.13	0.12	0.12	0.53	0.51	5.15	7.45	6.65
Dissolved Oxygen (%)	32.3	94.5	67.8	66.6	69.3	60.3	68.2	65.1	62.6	88.8
ORP(mV)	652	601	596	573	568	554	542	543	559	566