FINAL

2007 Water Quality Monitoring

Mill River

Hamden and New Haven, CT

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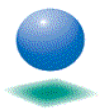
Prepared for

Regional Water Authority

Prepared by



CH2MHILL

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2007 Mill River Water Quality Monitoring

Introduction

This report presents results of continuing studies by the Regional Water Authority (RWA) to document dissolved oxygen (DO) and salinity concentrations in the Mill River downstream of the Lake Whitney water supply reservoir. The objective of these studies, which began in 1998, is to monitor DO and salinity in the Mill River as it relates to potential impacts from reactivating Lake Whitney as a public water supply. The lake served as a water supply from 1862 until its use was temporarily discontinued in 1991. The Regional Water Authority resumed water withdrawals from the reservoir during the summer of 2005 concurrent with completion of the new Lake Whitney Water Treatment Plant (WTP).

As part of a comprehensive environmental assessment of the WTP project, prior 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 Lake Whitney water withdrawals (Lake Whitney WTP Environmental Evaluation Team, 1999).

Based on the analysis of data collected from 1998 to 2003, 7.0 mg/L was selected as a reasonable target DO for the plunge pool in the Mill River immediately below the Lake Whitney Dam (CH2M HILL, 2003). Based on analysis of data collected during the period, under most circumstances this will result in a surface water DO concentration above 5.0 mg/L at the Orange Street Bridge during dry weather conditions, although DO concentrations slightly below 5.0 mg/L are occasionally observed.

Past monitoring has identified negative effects on Orange Street Bridge DO resulting from input of organic matter during storm events and not related to Lake Whitney withdrawals. In order to more directly evaluate the effects of lake withdrawals, DO and salinity have been regularly monitored at the footbridge in East Rock Park since the summer of 2003.

Summer 2007 dissolved oxygen and salinity sampling was performed weekly from July 6 to November 2 as part of the continuing monitoring and assessment effort. Due to low dissolved oxygen concentrations during the late summer and early fall, the normal monitoring period of July through August was extended through the first week of November.

Rainfall patterns during 2007 were unusual compared to previous years' sampling efforts. There were extended periods of no rainfall during the monitoring period. When there was rainfall it was short very intense storms which produced high amounts of precipitation (Figure 1). The recorded precipitation from June to September was 10.9 inches at the Lake Whitney rain gauge, which was the second driest summer since monitoring began in the river. The only summer that was drier was 2005 with only 9.3 inches of precipitation recorded. The average precipitation from June to September over the 9 year sampling period is 15.0 inches.

Figure 2 presents the rainfall in the 72 hours prior to each sampling event. When analyzing the dissolved oxygen data it is important to note any influences due to stormwater runoff. Rainfall accumulation greater than 0.12 inches is considered as a wet weather sampling event. Rainfall that is less than or equal to 0.12 inches is considered a dry weather event (in the 72 hours prior to each sampling event). Wet weather events occurred on July 6, July 20, August 10, August 24, September 14, October 12 and October 26 with rainfall ranging from 0.28-1.2 inches. The remaining events had no rainfall (July 27, August 3, August 17, August 31, September 7, September 21, October 5, October 19 and November 2) or very little rainfall (July 13 = 0.08 inches) in the 72 hours prior to measurements.

The WTP became operational in April 2005 and continued operation through 2007. Overall water withdrawals were low in 2007 (Figure 3). From January 1 through December 31, water withdrawals averaged only 28% of the maximum Connecticut Department of Environmental Protection (DEP) registered maximum daily diversion amount and ranged from 0% to 88%. During November and December an exception to the Management Plan was exercised because the total system storage was less than the long-term average and lake levels were between 0.1 and 0.2 feet above spillway elevation. The exception was exercised for 33 days in November and December, drawing up to 86% of the DEP registered daily maximum.

Figure 4 presents the Lake Whitney Dam Downstream Flow in the Mill River from January 2007 to December 2007. Flows ranged from an estimated 2.3 to 1500 MGD with an average of 69 MGD. Flow is calculated based on the lake level at the spillway and when applicable, measured or estimated downstream releases via the artificial waterfall and/or the blowoff. The Management Plan specifies the initial minimum release is 4.2 MGD when the lake level falls below spillway elevation. Figure 5 presents the estimated flow in the Mill River for each of the sampling dates in 2007. There was one minimum downstream release sampling event (October 26) due to a manual reservoir drawdown for dam maintenance. Sampling date flows ranged from 4.2 MGD on October 26 to 166.4 MGD on July 20.

Monitoring Methods

From July 6 to November 2, 2007, the RWA conducted weekly dawn DO and salinity monitoring at and below the Lake Whitney dam (i.e., the spillway, plunge pool, the footbridge, the Orange Street Bridge and both sides of the tidegates) (Figure 6). Table 1 presents a summary of the Mill River monitoring data collected in 2007.

TABLE 1
Mill River Monitoring Data collected in 2007

Frequency/Dates	Locations	Parameters
Weekly – July 6 through November 2 (early morning)	Spillway	Temperature, DO, Salinity, specific conductance, pH
	Plunge Pool	
	Footbridge	
	Orange St.	
	Tidegates (North and South)	

As in the previous several years, 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 spillway and plunge pool. At the footbridge, Orange Street Bridge, and the tidegates, 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 monitoring data are presented in Attachment A.

Monitoring Results

Salinity

The weekly salinity monitoring data are presented in Figure 7 (surface layer) and Figure 8 (bottom layer). Salinity was elevated at Orange Street in 2007 compared with other years with 9 of 17 measurements in the surface layer exceeded 1 part per thousand (ppt). In the bottom layer at Orange St, 8 of 17 dates exceeding 10 ppt. Salinity was also elevated at the footbridge in 2007 with 4 out of 17 measurements in the surface layer exceeding 1 ppt. In the bottom layer at the footbridge, 5 of 17 measurements exceeded 10 ppt. Most of the elevated salinity measurements at the footbridge were observed from September 21 to October 19. During this time the flow in the river was low to moderate, with average daily flows estimated below the spillway ranging from 2.2 to 33 MGD. Greater salinity concentrations usually coincide with low flow in the river.

As expected, salinity levels were elevated at the tide gates with concentrations ranging from 3.3 to 26.3 ppt in the bottom waters and from 2.3 to 26.0 ppt at the surface.

Figure 9 presents surface salinities at Orange Street and the footbridge with river flow as measured at Lake Whitney dam (spillway overflow). The salinity steadily increased as the flow gradually decreased through October.

Dissolved Oxygen

Weekly surface layer DO measurements from the Mill River at the spillway, the plunge pool, the footbridge, Orange St. Bridge, and the tide gates are shown in Figure 10. Bottom layer measurements are shown in Figure 11. Table 2 summarizes all of the 2007 DO concentrations at the spillway; plunge pool, footbridge, Orange St. Bridge, and tidegates including average DO concentrations, minimum and maximum. Average DO readings for all weekly monitoring from 2001 to 2007 are shown in Table 3.

TABLE 2

Weekly Dissolved Oxygen Concentrations

Date	Spillway	Plunge Pool	Footbridge Surface	Footbridge Bottom	Orange Ave Surface	Orange Ave Bottom	North Tidegate Surface	North Tidegate Bottom	South Tidegate Surface	South Tidegate Bottom
7/6/2007	7.1	7.4	5.5	5.5	6.0	5.6	6.6	**4.5**	**4.6**	**3.3**
7/13/2007	6.9	6.6	**4.3**	**4.1**	6.4	5.8	6.4	4.9	6.6	6.6
7/20/2007	6.2	8.5	6.7	6.8	6.6	6.5	6.1	6.3	6.8	6.7
7/27/2007	8.8	7.8	5.4	5.0	7.5	6.2	6.5	5.8	6.2	5.7
8/3/2007	10.7	7.7	**4.2**	**3.8**	5.1	**3.7**	**4.7**	**4.6**	5.4	5.2
8/10/2007	8.7	7.2	**4.5**	**4.5**	5.3	**4.7**	**4.4**	**4.3**	**4.6**	**4.1**
8/17/2007	8.1	6.8	**3.9**	**3.4**	**4.6**	**3.3**	**4.8**	**4.5**	**4.8**	**4.9**
8/24/2007	5.6	6.8	**4.5**	**4.5**	5.4	**4.9**	**4.5**	**4.2**	**4.4**	**3.8**
8/31/2007	8.9	7.9	**4.1**	**4.6**	6.6	**4.2**	6.2	5.2	7.1	7.0
9/7/2007	7.0	6.9	**4.9**	5.5	6.8	6.2	5.5	5.4	5.5	5.2
9/14/2007	6.3	7.4	5.3	5.3	5.6	3.8	**4.5**	**3.9**	5.4	5.7
9/21/2007	5.6	6.2	**4.4**	**3.4**	5.6	**4.3**	**4.7**	**4.5**	**4.5**	**4.2**
10/5/2007	7.5	6.2	**4.6**	**3.8**	**4.9**	**4.3**	**4.8**	**4.7**	**4.6**	**4.2**
10/12/2007	6.9	7.7	**2.3**	**1.3**	**2.7**	**2.6**	**4.2**	**3.9**	5.6	5.0
10/19/2007	5.5	6.9	5.9	**4.8**	6.2	5.2	5.1	5.2	5.4	**4.8**
10/26/2007	7.4	9.1	7.2	7.2	7.0	**3.8**	7.4	6.6	6.4	6.2
11/2/2007	7.0	8.4	6.9	**3.7**	7.3	5.0	7.2	7.0	6.7	6.0
Average	7.3	7.4	5.0	**4.5**	5.9	**4.7**	5.5	5.0	5.6	5.2
Min	5.5	6.2	2.3	**1.3**	**2.7**	**2.6**	**4.2**	**3.9**	**4.4**	**3.3**
Max	10.7	9.1	7.2	7.2	7.5	6.5	7.4	7.0	7.1	7.0

Notes:

Bold represents DO concentrations less than the Connecticut DEP water quality standard of 5.0 mg/L.

TABLE 3
2001 – 2007 Weekly Sampling Average Mill River Surface Dissolved Oxygen

Station	2001	2002	2003	2004*	2005	2006	2007
Spillway	8.0	8.0	8.0	8.2	7.6	8.4	7.3
Plunge Pool	7.7	7.9	7.9	4.1	7.5	7.7	7.4
Footbridge	NA	NA	6.5	6.0	5.2	5.5	5.0
Orange St. Bridge	5.9	6.2	6.4	6.8	5.3	6.7	5.9
Tide Gates Upstream	NA	NA	6.2	6.2	5.1	6.1	5.5
Tide Gates Downstream	NA	NA	6.6	6.1	5.6	5.8	5.6

* Flow bypassed around plunge pool July 6 - August 27, 2004 for lake drawdown

NA = No data available

In general, DO concentrations near the bottom of the water column were lower than DO concentrations near the surface at the footbridge and Orange Street monitoring locations. The DO concentration at the footbridge (surface) was below 5.0 mg/L during the July 13 sampling event, all of the August sampling events, September 21, October 5 and October 12. In total the DO at the surface of the footbridge was less than 5.0 mg/L for 10 of the 17 sampling events and 11 of 17 sampling events at the bottom. The DO was below 5.0 mg/L at Orange St surface only on August 17 (4.6 mg/L), October 5 (4.9 mg/L) and October 12 (2.7 mg/L). The DO was below 5.0 mg/L at Orange St Bridge bottom during all of the sampling events in August, September 14 and 21, and October 12 and 26th.

Figure 12 presents the DO at the plunge pool, Orange St (surface and bottom), and the footbridge (surface and bottom) along with the flow in the river as measured at the Lake Whitney dam. The DO at the plunge pool always measured 6.2 mg/L or greater. Fourteen (14) of seventeen (17) DO measurements at the Orange St. Bridge were 5 mg/L or greater at the surface for the monitoring period. Fifteen (15) of seventeen (17) surface DO measurements at the footbridge were greater than 4 mg/L.

Substantially lower DO values at these locations were observed on October 12, with surface DO measurements of 2.7 and 2.3 mg/L at the Orange St. Bridge and the footbridge, respectively. Surface salinity was also very high, with values of 15.1 and 11.8 ppt at Orange St. and the footbridge, respectively. These measurements, which were the lowest surface DO values observed at these locations in the multi-year study period, coincided with a storm event that occurred following the lowest river flows of 2007 (low of 2.2 MGD on October 9). It is postulated that these low DO values were heavily influenced by a sudden influx of poor quality water from urban runoff when there was minimal river flow available for dilution.

Surface DO concentrations at the footbridge station were less than surface concentrations at Orange St. Bridge during the August, September and October 2007 low river flow periods. This suggests that the DO at the footbridge is more impacted by low flows in the river than the DO at Orange St Bridge. The lower DO at the footbridge is most likely due to a combination

of factors; all exacerbated by low river flow. The river is relative flat and broad in the vicinity of the footbridge and natural aeration is limited due to the low velocity. The area is heavily vegetated and the bottom sediments are organically enriched which exerts considerable benthic oxygen demand. If there is less water present the demand lowers the DO to a greater extent. Similarly, the source water in this stretch has a high oxygen demand from the organically enriched lake waters and the longer the water is in this stretch, the more DO is reduced.

Due to the increasing influence of tidal effects, stormwater runoff, and combined sewer overflows with increasing distance downstream, Orange St. has been established as the downstream monitoring limit. However, to provide a broader understanding of downstream water quality, weekly monitoring is also conducted at the footbridge and Mill River tide gates, including recording the condition of the tide gates. Dissolved oxygen concentrations at the tide gates are sometimes influenced by turbulence and associated aeration as water flows through the gates. Debris that partially blocked open the tide gates was noted on August 3, August 10 and October 12. The blockages were no longer evident in the following weeks' monitoring. Average DO in 2007 at the tidegates was lower than concentrations seen in previous years monitoring efforts (Table 3).

Conclusions

This report summarizes the third year of data collection during operation of the new Lake Whitney WTP. Rainfall in 2007 was mostly seen in short intense rainfall events between periods of dry weather. This was the second driest summer since monitoring began in 1998. The following conclusions can be drawn from the data collected in 2007:

- Low flows in September and October resulted in greater salinity concentrations at the footbridge and Orange St Bridge than observed during July and most of August.
- At the tidally influenced stations (footbridge and Orange St) average DO was lower (Table 3) than observed in previous years. The footbridge station was more severely affected during the low flow period and experienced its lowest average DO since weekly monitoring began in 2003. The Orange St. station experienced its second lowest average DO concentration since routine weekly monitoring began in 2001.
- The Management Plan downstream release of 4.2 MGD through the artificial waterfall (operated during a drawdown for dam maintenance) was effective at meeting and exceeding the plunge pool DO performance standard of 7.0 mg/L on October 26. DO in the plunge pool on this date was 7.4 mg/L.
- In the past monitoring efforts, low DO concentrations have been associated with stormwater events, low flow and tidal influences. During the 2007 monitoring period the water treatment plant was operating at low withdrawal rates (Figure 3) in accordance with Management Plan restrictions. Although these water withdrawals incrementally affected downstream flows, the extended dry weather pattern, is believed to be the major factor affecting the observed downstream conditions in summer 2007.

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, 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.

Figures

Figure 1: Precipitation at Lake Whitney
January - December 2007

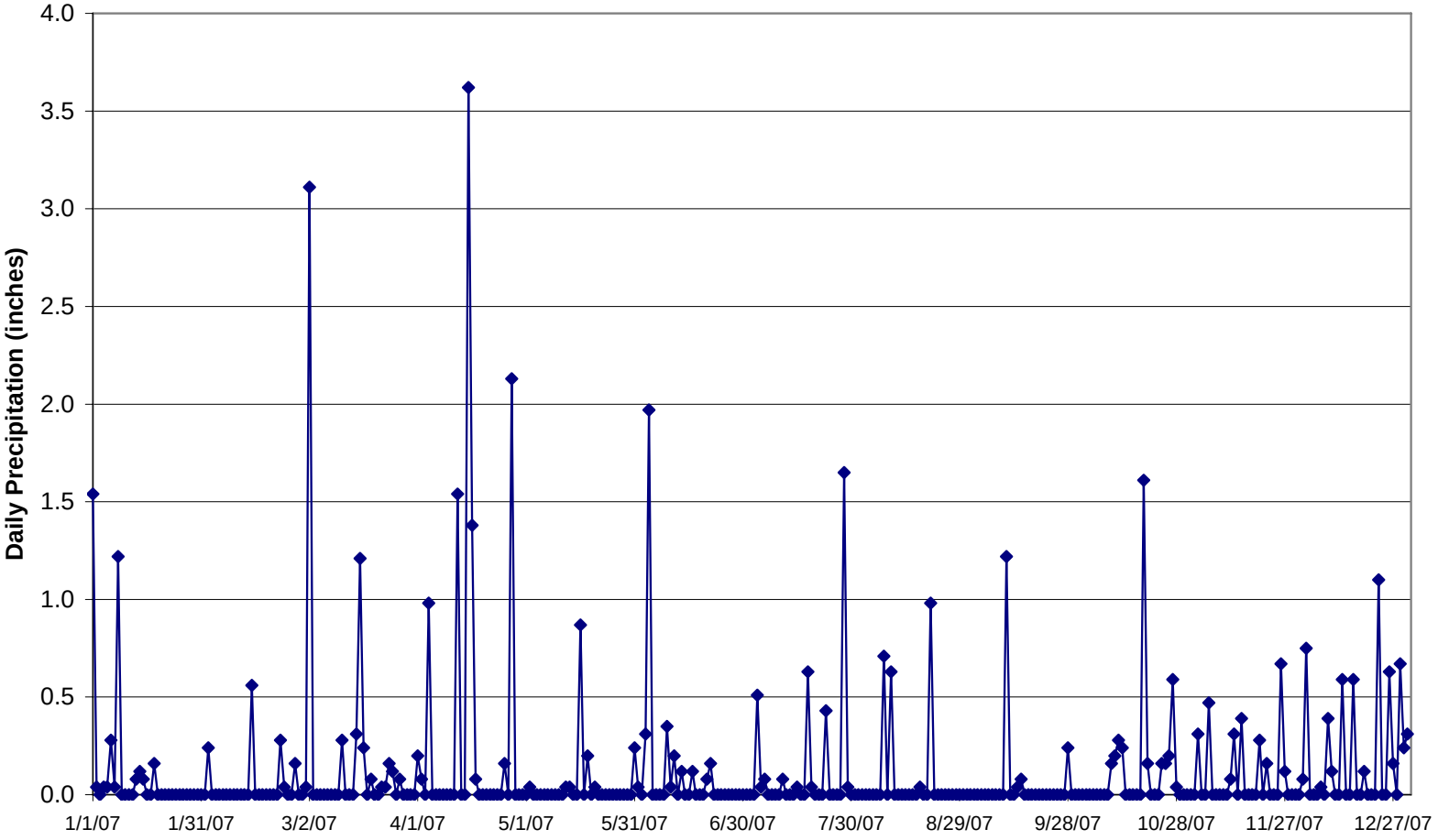


Figure 2: 2007 Sampling Event Precipitation
(72 hours Prior to each Sampling Event)

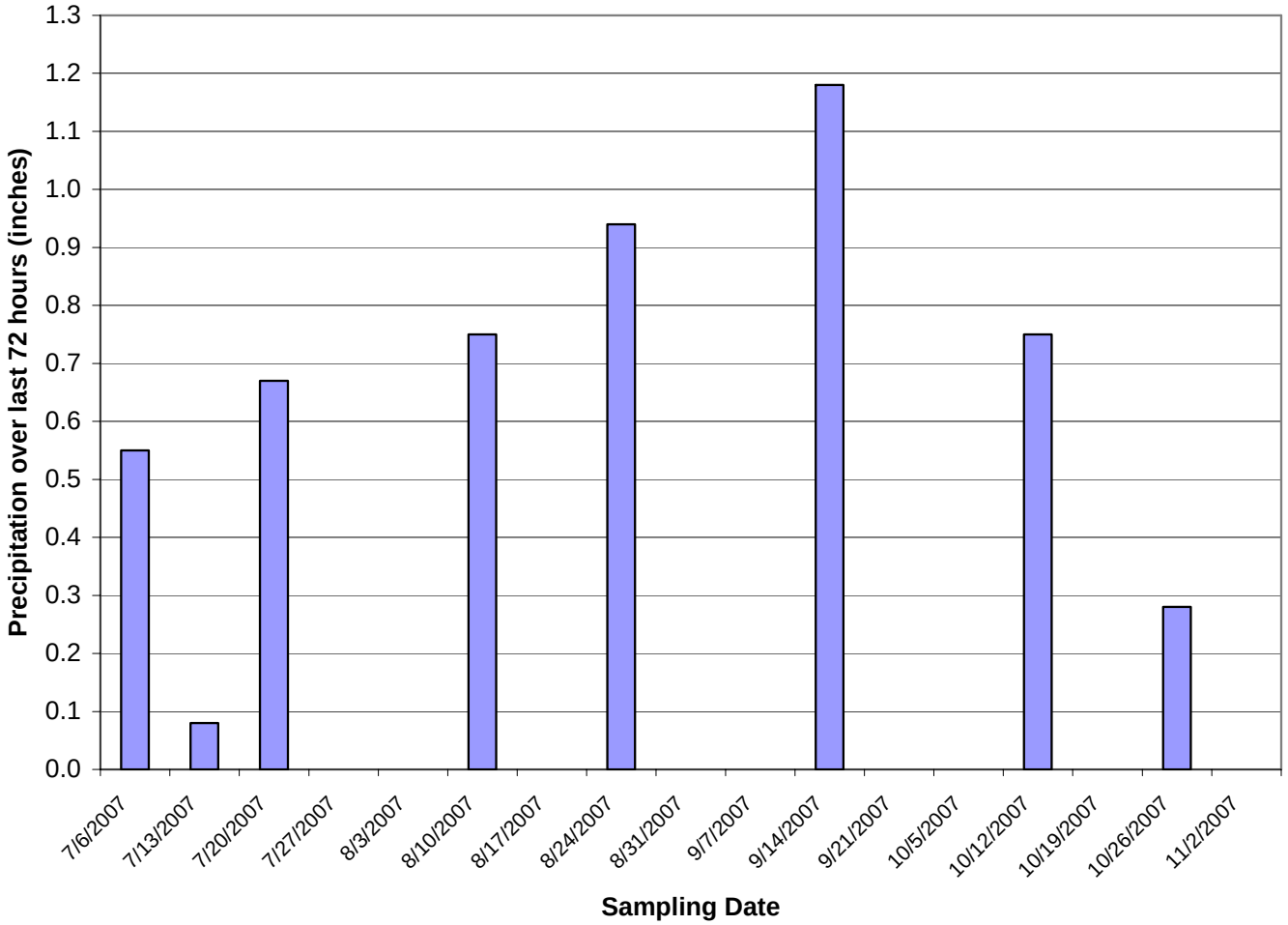


Figure 3: Lake Whitney Water Treatment Plant Daily Withdrawals
January - December, 2007

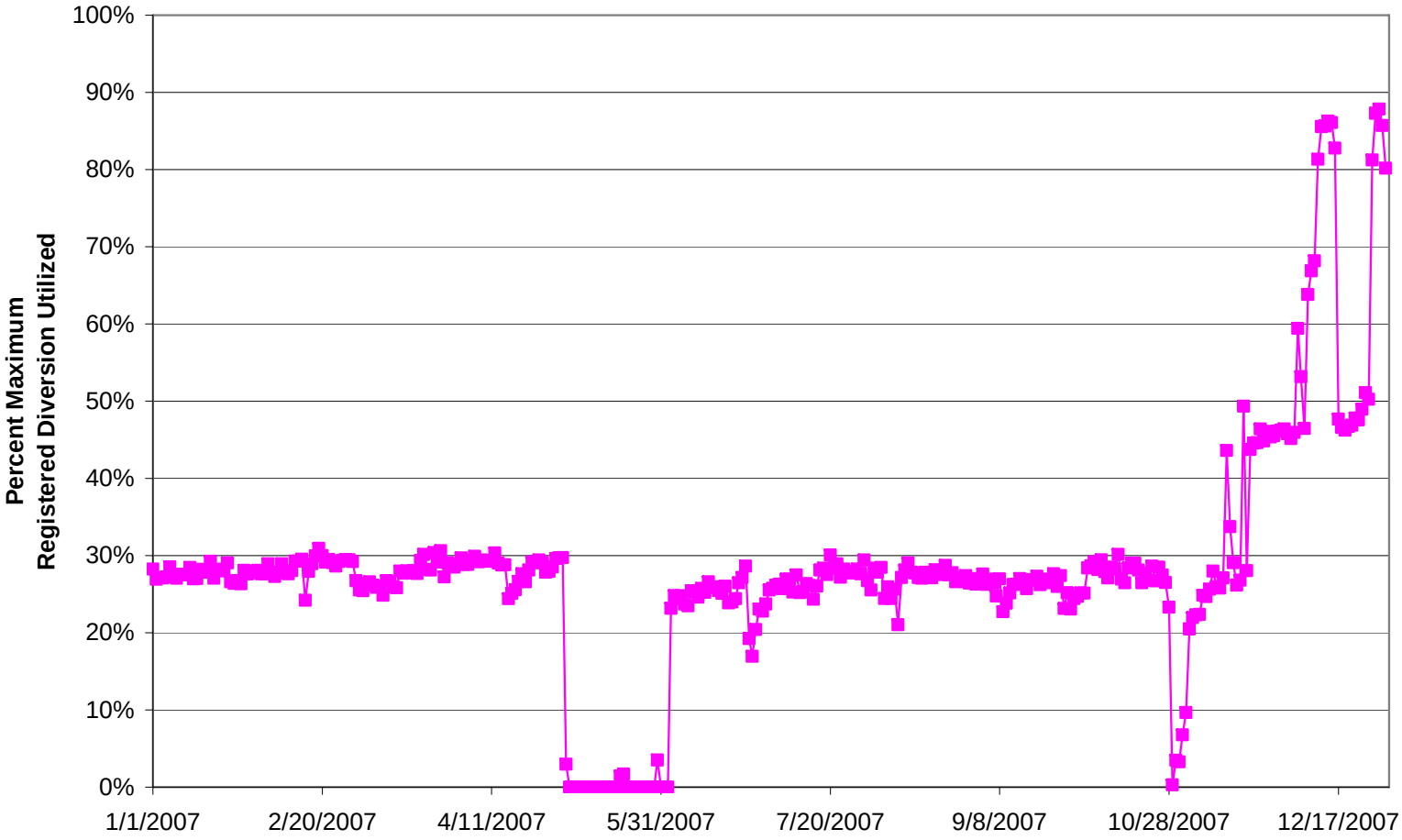


Figure 4: Lake Whitney Dam Downstream Flow
January - December 2007

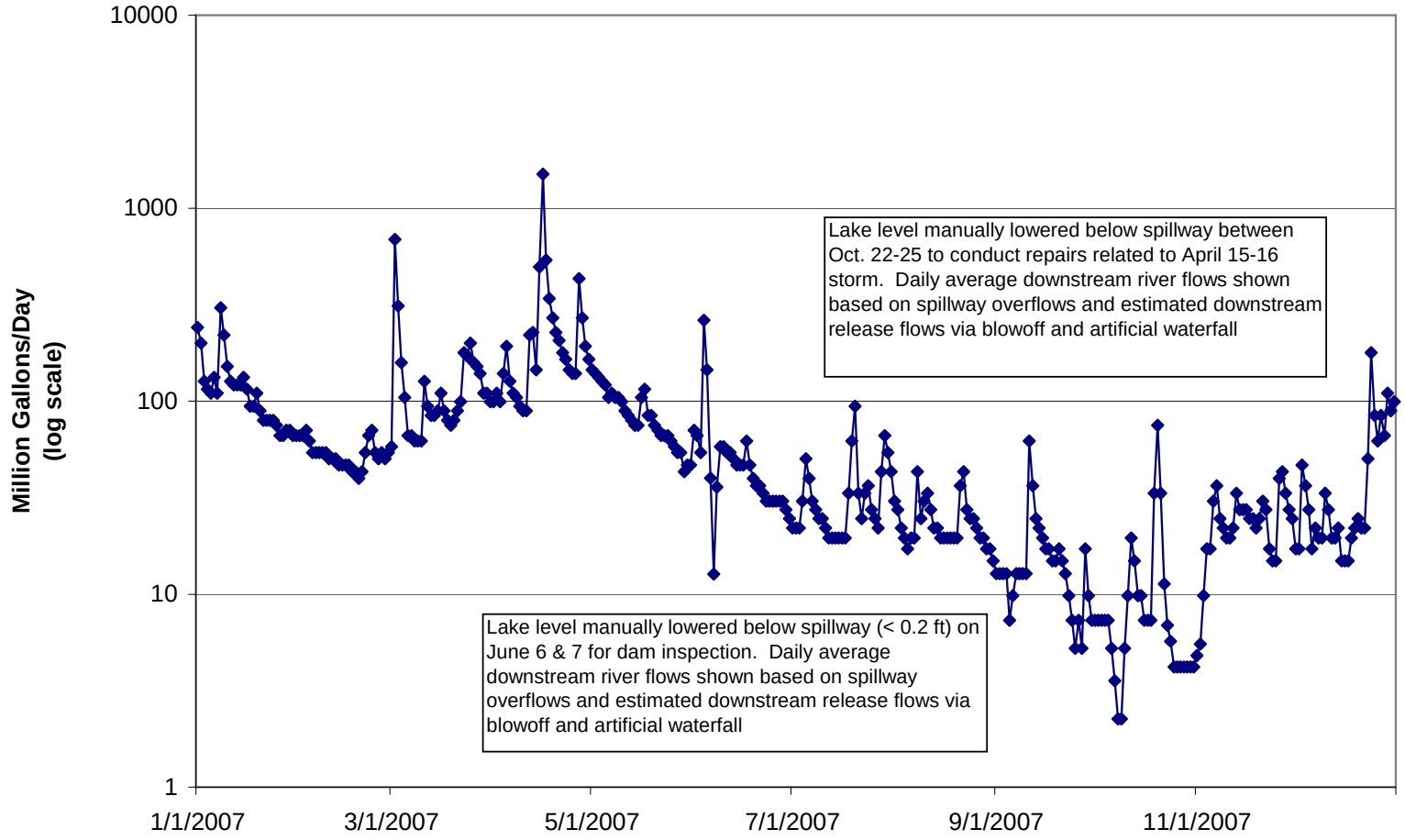


Figure 5: 2007 Mill River Sampling Event Daily Average Flow

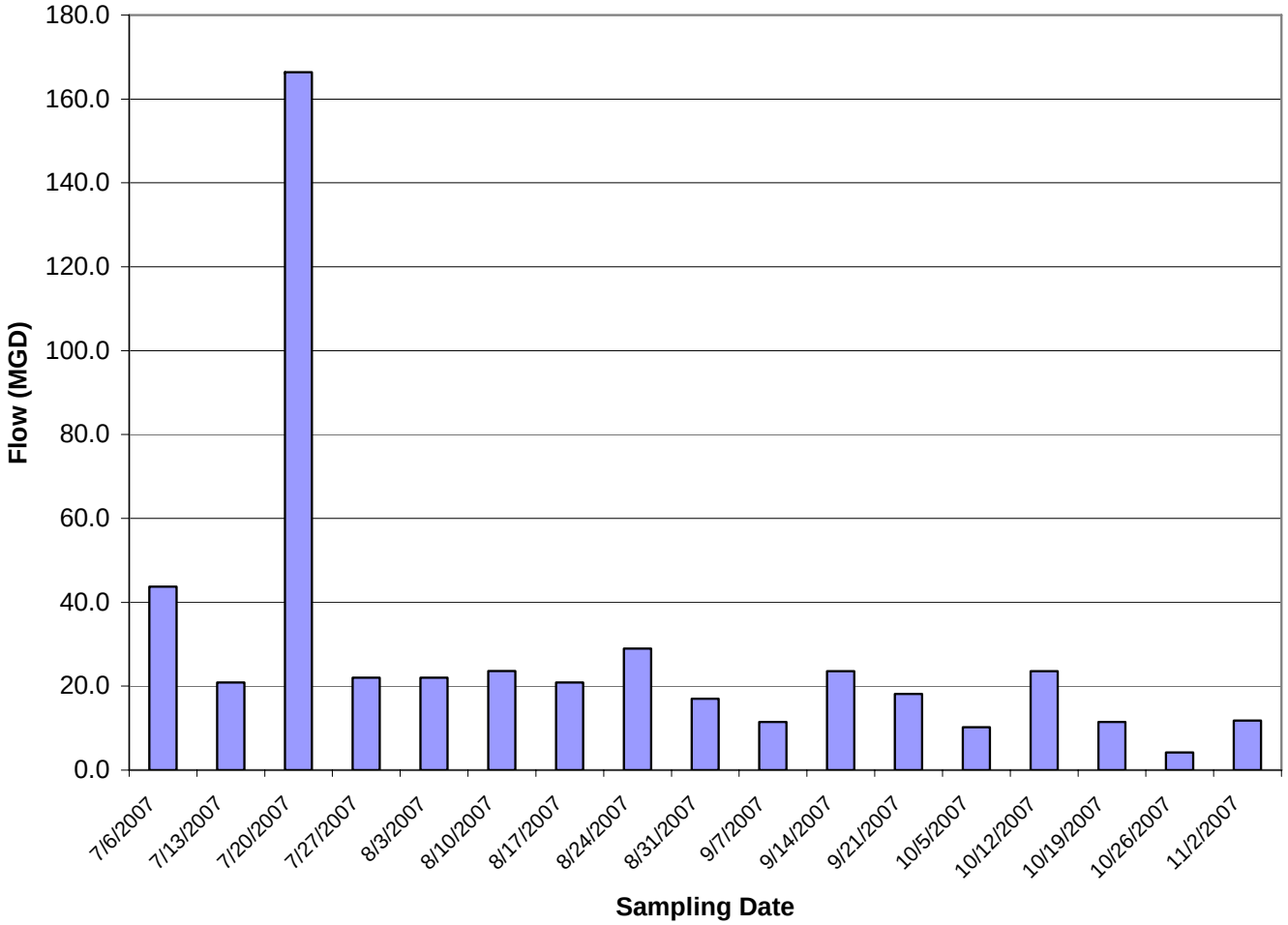


FIGURE 6
Locations Sampled During Mill River Monitoring

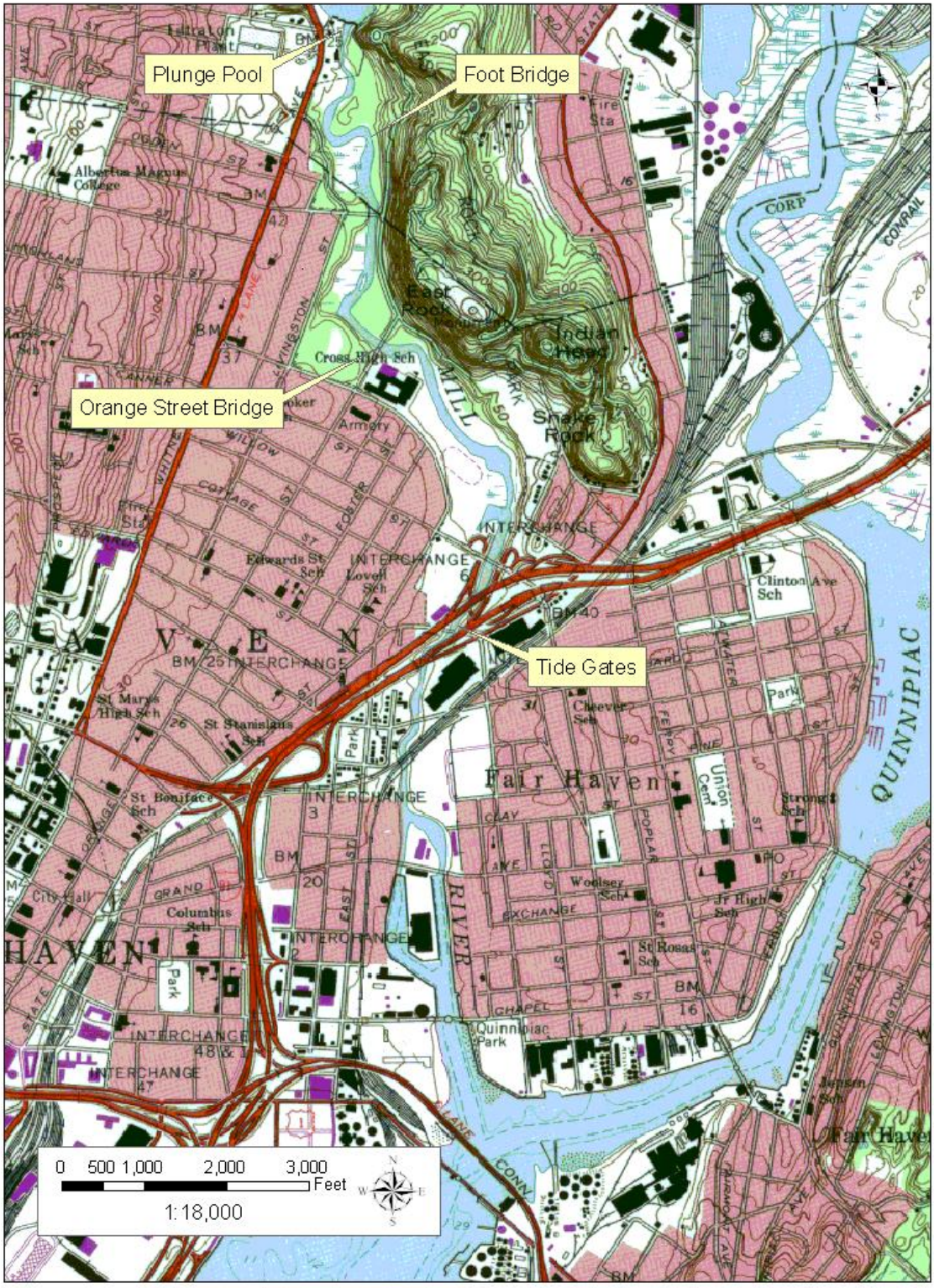


Figure 7: 2007 Mill River Surface Salinity

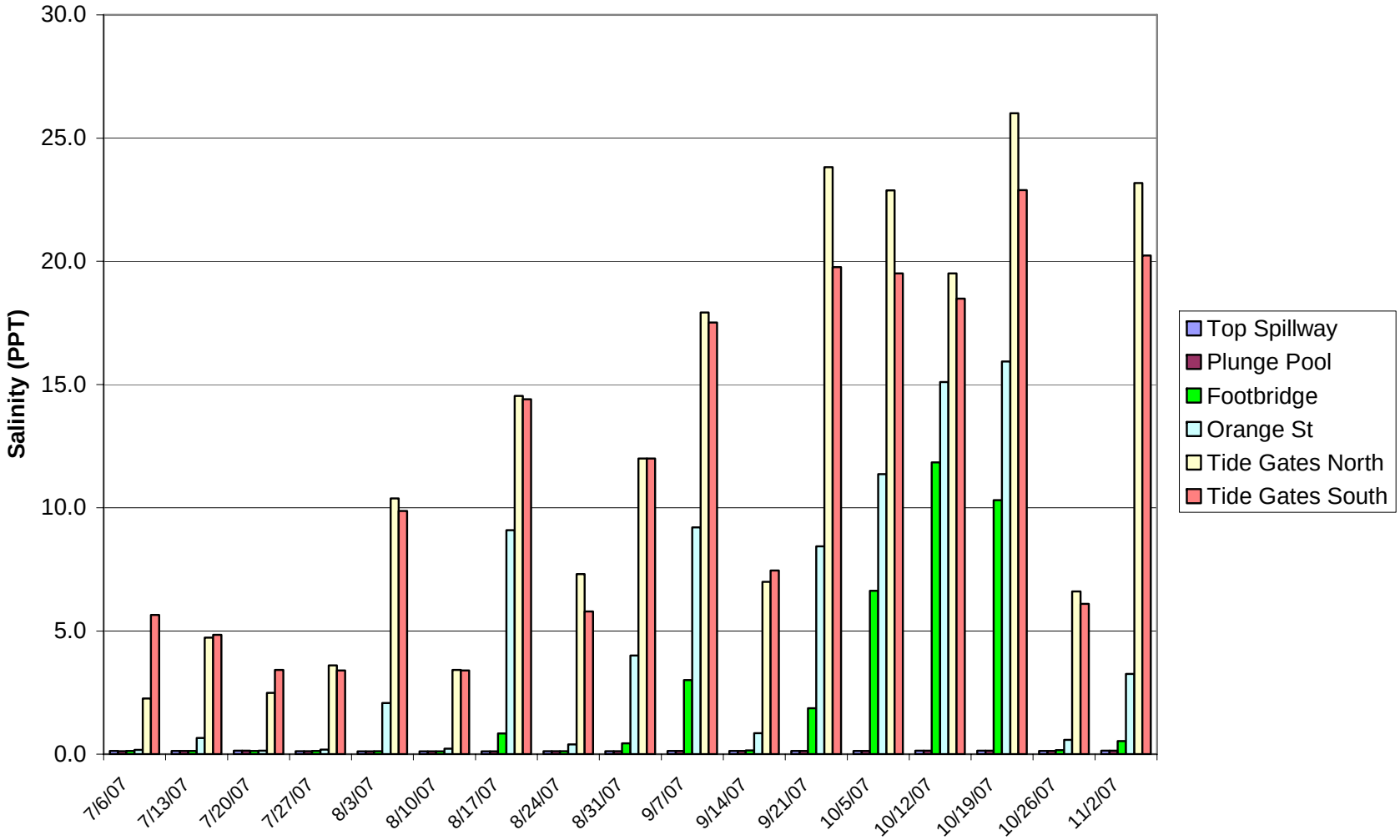


Figure 8: 2007 Mill River Bottom Salinity

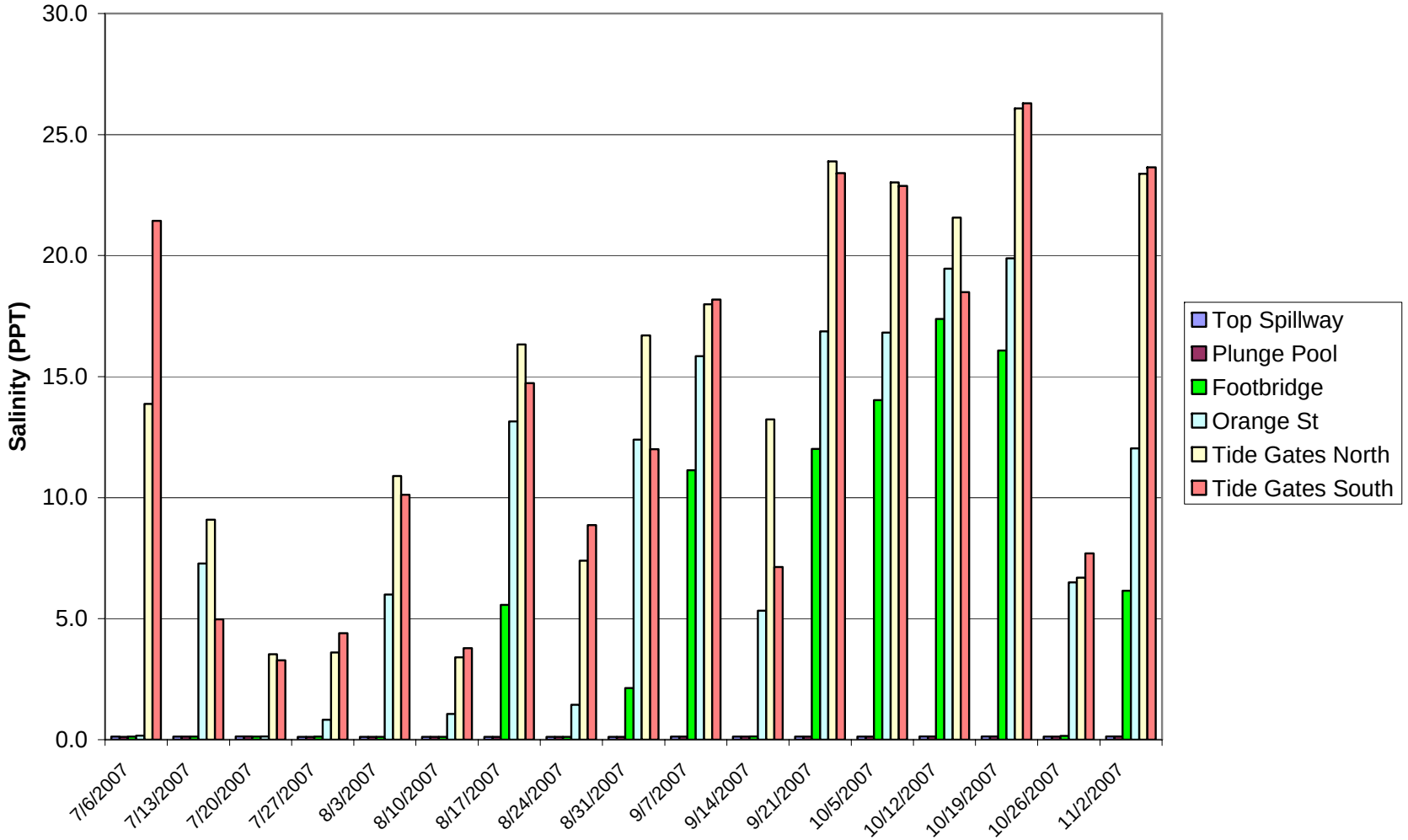


Figure 9: Mill River Downstream Surface Salinity with Flow

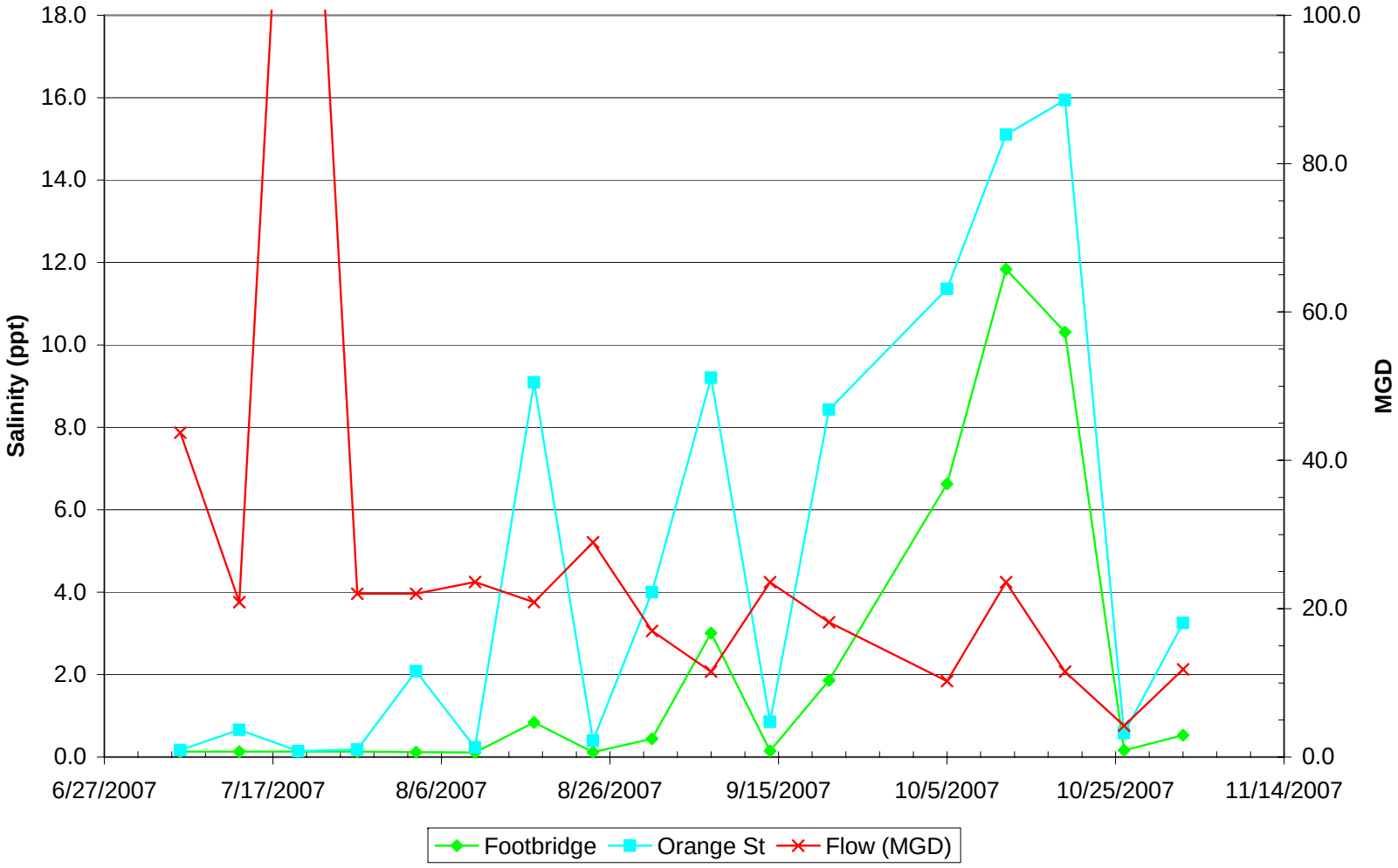


Figure 10: 2007 Mill River Surface Dissolved Oxygen

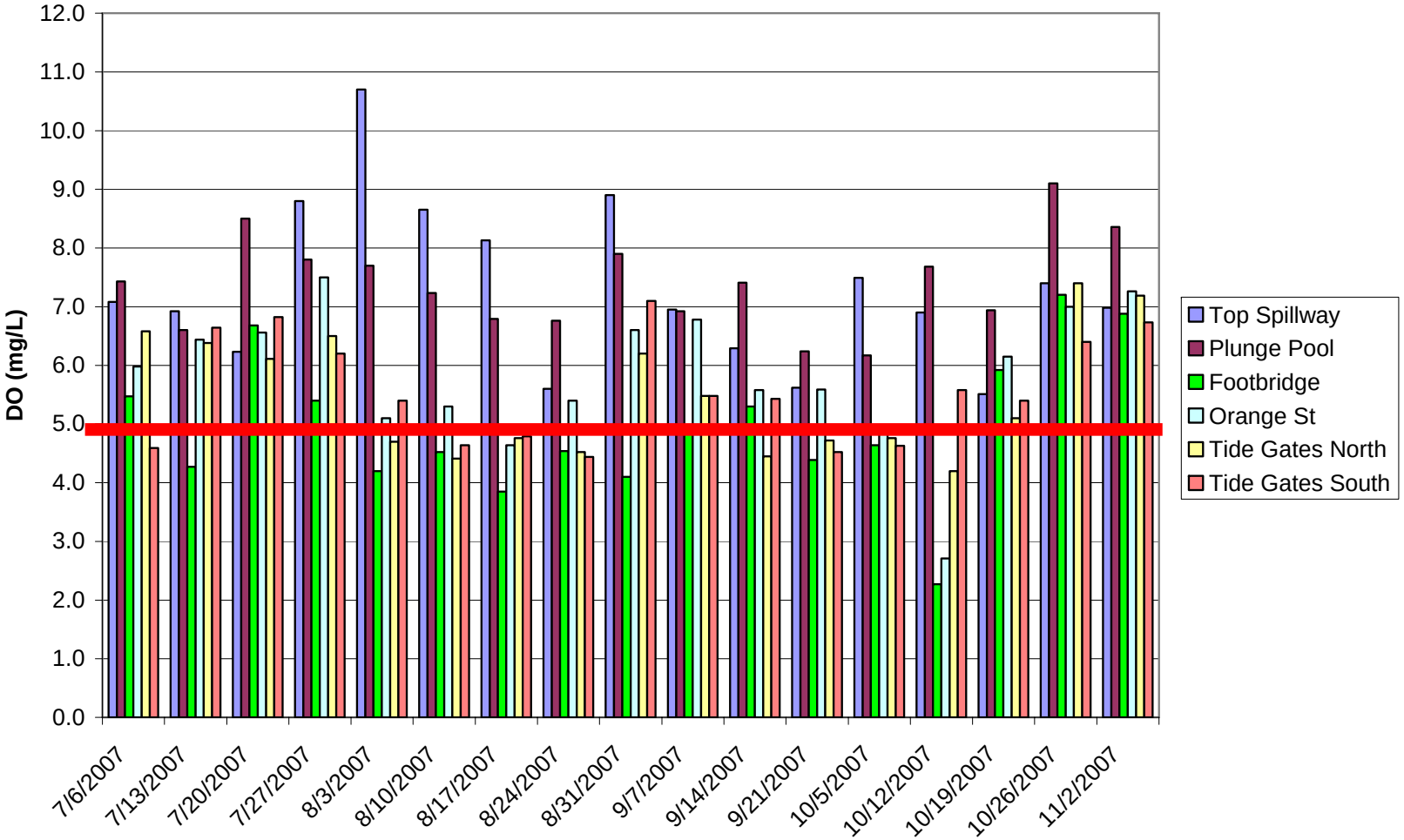


Figure 11: 2007 Mill River Bottom Dissolved Oxygen

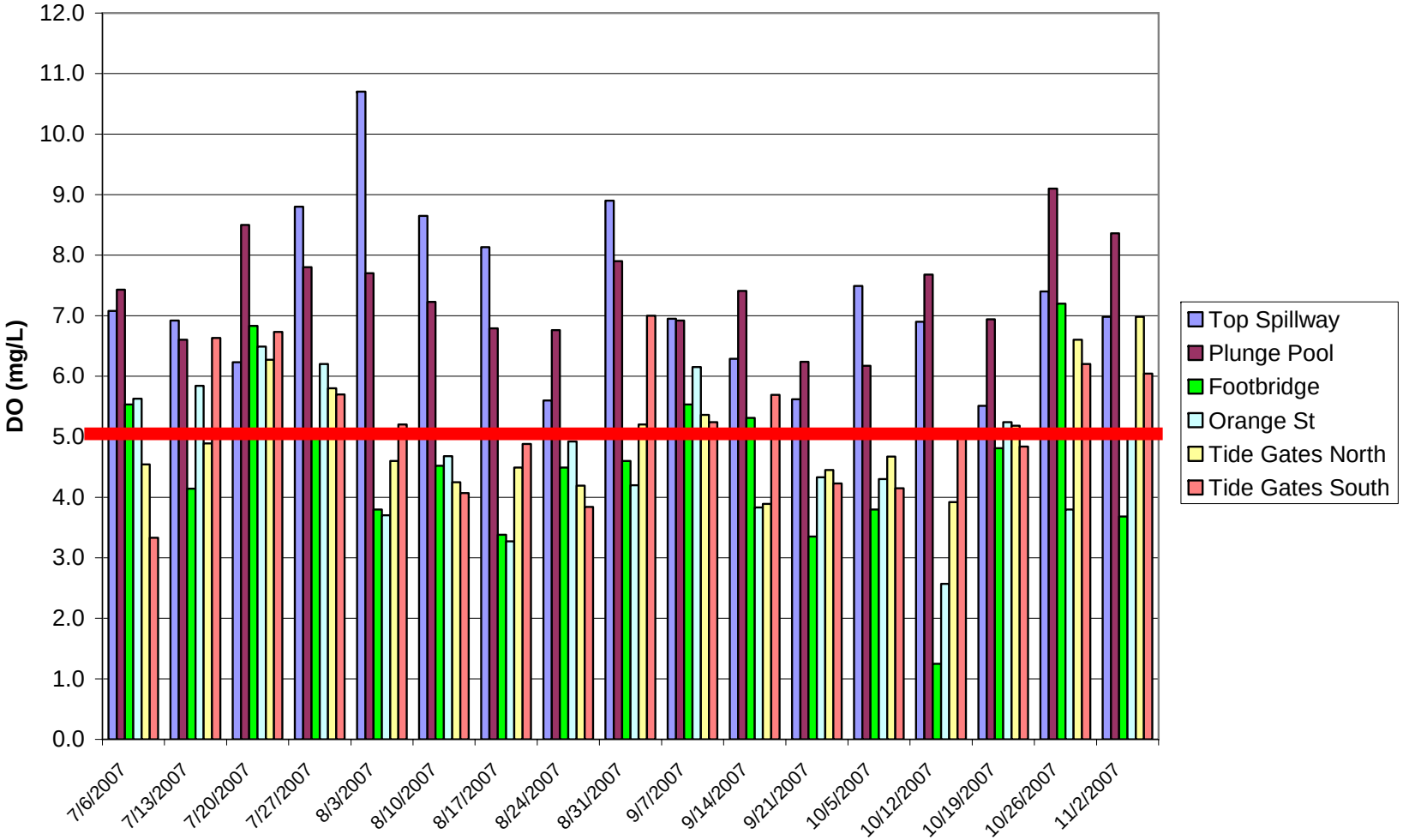
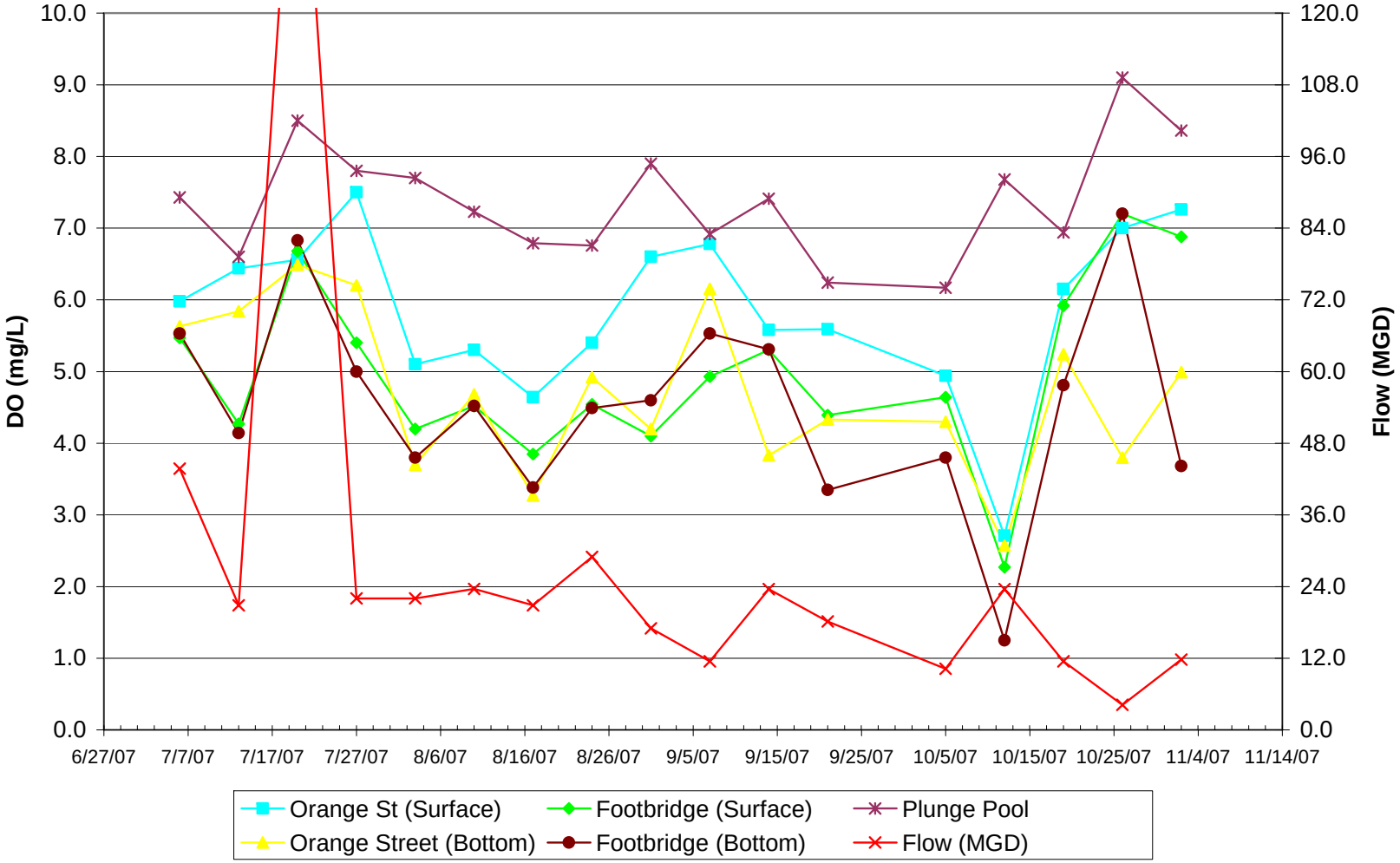


Figure 12: Mill River Downstream DO with Flow



Attachment A
Weekly Monitoring Data

ID	DATE	Station	Time	Depth (m)	Temp (C)	SpC (mS/cm)	Salinity (PSS)	pH	DO (mg/l)	DO%	Tide Stage	Dry or Wet
717	7/6/2007	0	5:40	0.30	23.14	0.26	0.13	7.97	7.08	83.00	High	Wet
718	7/6/2007	1	5:46	0.40	22.95	0.259	0.12	8.03	7.43	86.70	High	Wet
715	7/6/2007	4	5:25	0.20	22.68	0.261	0.13	7.88	5.47	63.50	High	Wet
716	7/6/2007	4	5:30	0.90	22.68	0.261	0.13	7.81	5.53	64.10	High	Wet
713	7/6/2007	6	5:10	0.10	22.07	0.344	0.17	7.74	5.98	69.70	High	Wet
714	7/6/2007	6	5:15	0.90	22.95	0.344	0.17	7.70	5.63	65.70	High	Wet
719	7/6/2007	7	6:05	0.10	23.08	4.26	2.26	7.82	6.58	78.00	High	Wet
720	7/6/2007	7	6:10	0.90	21.00	23.1	13.87	7.44	4.54	55.60	High	Wet
721	7/6/2007	8	6:15	0.10	22.30	10.06	5.65	7.40	4.59	55.20	High	Wet
722	7/6/2007	8	6:20	0.90	19.63	34.4	21.43	7.24	3.33	42.10	High	Wet
727	7/13/2007	0	5:40	0.40	26.03	0.27	0.13	8.04	6.92	85.40	Low	Wet
728	7/13/2007	1	5:45	0.30	24.35	0.271	0.13	7.90	6.60	78.90	Low	Wet
725	7/13/2007	4	5:28	0.20	23.27	0.276	0.13	7.30	4.27	50.10	Low	Wet
726	7/13/2007	4	5:34	0.70	23.20	0.275	0.13	7.21	4.14	49.70	Low	Wet
723	7/13/2007	6	5:10	0.30	24.77	1.328	0.66	7.49	6.44	78.00	Low	Wet
724	7/13/2007	6	5:18	0.80	25.56	12.7	7.28	7.18	5.81	74.60	Low	Wet
729	7/13/2007	7	5:55	0.10	24.01	8.51	4.73	7.52	6.38	78.20	Low	Wet
730	7/13/2007	7	6:05	0.70	24.40	15.6	9.09	7.31	4.89	62.10	Low	Wet
731	7/13/2007	8	6:12	0.20	23.96	8.71	4.84	7.44	6.64	81.40	Low	Wet
732	7/13/2007	8	6:18	0.40	23.97	8.92	4.97	7.42	6.63	81.30	Low	Wet
737	7/20/2007	0	5:50	0.40	25.15	0.28	0.14	7.67	6.23	75.70	High	Wet
738	7/20/2007	1	5:55	0.30	25.11	0.28	0.14	7.84	8.50	103.20	High	Wet
735	7/20/2007	4	5:35	0.20	25.12	0.279	0.13	7.80	6.68	81.10	High	Wet
736	7/20/2007	4	5:40	1.50	25.12	0.279	0.13	7.72	6.83	82.90	High	Wet
733	7/20/2007	6	5:20	0.30	25.12	0.284	0.14	7.75	6.56	79.60	High	Wet
734	7/20/2007	6	5:25	0.90	25.11	0.286	0.14	7.68	6.49	78.80	High	Wet
739	7/20/2007	7	6:10	0.10	24.83	4.67	2.49	7.68	6.11	75.00	High	Wet
740	7/20/2007	7	6:15	0.40	24.76	6.47	3.53	7.58	6.27	77.90	High	Wet
741	7/20/2007	8	6:20	0.10	24.78	6.28	3.42	7.57	6.82	85.10	High	Wet
742	7/20/2007	8	6:25	0.90	24.79	6.04	3.28	7.57	6.73	82.30	High	Wet

ID	DATE	Station	Time	Depth (m)	Temp (C)	SpC (mS/cm)	Salinity (PSS)	pH	DO (mg/l)	DO%	Tide Stage	Dry or Wet
743	7/27/2007	0	6:05	0.20	25.20	0.257	0.12	8.00	8.80	107.10	Low	Dry
744	7/27/2007	1	6:10	0.20	24.60	0.258	0.12	8.00	7.80	93.30	Low	Dry
745	7/27/2007	4	6:30	0.30	23.40	0.265	0.13	7.50	5.40	64.60	Low	Dry
746	7/27/2007	4	6:33	0.90	23.40	0.265	0.13	7.40	5.00	59.40	Low	Dry
747	7/27/2007	6	6:47	0.20	25.50	0.38	0.18	7.60	7.50	91.30	Low	Dry
748	7/27/2007	6	6:50	1.00	25.50	1.64	0.83	7.40	6.20	76.00	Low	Dry
749	7/27/2007	7	7:02	0.40	25.10	6.59	3.60	7.40	6.50	80.20	Low	Dry
750	7/27/2007	7	7:05	1.00	25.10	6.66	3.60	7.40	5.80	72.20	Low	Dry
751	7/27/2007	8	7:08	0.30	25.10	6.16	3.40	7.40	6.20	72.20	Low	Dry
752	7/27/2007	8	7:12	0.70	25.10	8.03	4.40	7.20	5.70	71.20	Low	Dry
753	8/3/2007	0	5:52	0.20	27.50	0.231	0.11	9.00	10.70	136.20	High	Dry
754	8/3/2007	1	6:00	0.40	26.60	0.233	0.11	9.00	7.70	96.40	High	Dry
755	8/3/2007	4	6:15	0.20	25.90	0.243	0.12	8.30	4.20	51.60	High	Dry
756	8/3/2007	4	6:18	1.00	25.90	0.242	0.12	8.30	3.80	46.60	High	Dry
757	8/3/2007	6	6:32	0.10	27.30	2.08	2.08	8.00	5.10	64.40	High	Dry
758	8/3/2007	6	6:34	0.90	27.00	10.6	6.00	7.40	3.70	48.10	High	Dry
759	8/3/2007	7	6:49	0.10	26.30	17.6	10.38	7.40	4.70	62.40	High	Dry
760	8/3/2007	7	6:50	0.70	26.30	18.4	10.89	7.30	4.60	60.50	High	Dry
761	8/3/2007	8	6:51	0.20	26.30	16.8	9.87	7.40	5.40	71.70	High	Dry
762	8/3/2007	8	6:52	0.50	26.40	17.2	10.12	7.40	5.20	68.50	High	Dry
767	8/10/2007	0	6:10	0.30	26.41	0.217	0.11	8.82	8.65	107.50	Low	Wet
768	8/10/2007	1	6:15	0.30	25.45	0.218	0.11	8.82	7.23	88.30	Low	Wet
765	8/10/2007	4	5:50	0.20	24.54	0.225	0.11	8.23	4.52	54.30	Low	Wet
766	8/10/2007	4	5:55	0.70	24.45	0.225	0.11	8.17	4.52	54.10	Low	Wet
763	8/10/2007	6	5:30	0.20	25.82	0.483	0.23	8.27	5.30	65.30	Low	Wet
764	8/10/2007	6	5:35	0.80	26.21	2.1	1.07	8.02	4.68	58.40	Low	Wet
769	8/10/2007	7	6:25	0.20	25.73	6.28	3.42	7.69	4.41	55.40	Low	Wet
770	8/10/2007	7	6:30	0.70	25.73	6.27	3.41	7.66	4.25	53.40	Low	Wet
771	8/10/2007	8	6:35	0.20	25.71	6.25	3.40	7.68	4.64	58.20	Low	Wet
772	8/10/2007	8	6:40	0.50	25.79	6.9	3.78	7.59	4.07	51.30	Low	Wet

ID	DATE	Station	Time	Depth (m)	Temp (C)	SpC (mS/cm)	Salinity (PSS)	pH	DO (mg/l)	DO%	Tide Stage	Dry or Wet
777	8/17/2007	0	6:05	0.30	25.32	0.224	0.11	8.63	8.13	99.10	High	Dry
778	8/17/2007	1	6:10	0.30	24.38	0.226	0.11	8.48	6.79	81.30	High	Dry
775	8/17/2007	4	5:50	0.10	24.71	1.67	0.84	7.59	3.85	46.60	High	Dry
776	8/17/2007	4	5:55	0.90	25.09	9.91	5.57	7.18	3.38	42.50	High	Dry
773	8/17/2007	6	5:30	0.20	25.07	15.6	9.09	7.30	4.64	59.60	High	Dry
774	8/17/2007	6	5:40	0.70	24.89	21.9	13.15	7.10	3.27	42.80	High	Dry
779	8/17/2007	7	6:20	0.20	24.67	24	14.53	7.32	4.76	62.70	High	Dry
780	8/17/2007	7	6:25	0.80	24.65	26.7	16.33	7.27	4.49	59.80	High	Dry
781	8/17/2007	8	6:30	0.20	24.67	23.8	14.40	7.28	4.79	63.00	High	Dry
782	8/17/2007	8	6:35	0.70	24.66	24.3	14.73	7.27	4.88	64.40	High	Dry
787	8/24/2007	0	6:10	0.30	21.71	0.247	0.12	7.43	5.60	63.70	Low	Wet
788	8/24/2007	1	6:18	0.20	21.34	0.247	0.12	7.67	6.76	76.50	Low	Wet
785	8/24/2007	4	5:50	0.20	21.40	0.254	0.12	7.30	4.54	51.30	Low	Wet
786	8/24/2007	4	6:00	0.70	21.38	0.255	0.12	7.23	4.49	50.70	Low	Wet
783	8/24/2007	6	5:35	0.30	22.04	0.818	0.40	7.44	5.40	62.00	Low	Wet
784	8/24/2007	6	5:45	0.90	22.03	2.79	1.44	7.34	4.92	56.80	Low	Wet
789	8/24/2007	7	6:25	0.20	21.77	12.79	7.31	7.18	4.52	54.00	Low	Wet
790	8/24/2007	7	6:30	0.80	21.77	12.93	7.40	7.15	4.19	50.10	Low	Wet
791	8/24/2007	8	6:35	0.30	21.74	10.31	5.79	7.18	4.44	52.40	Low	Wet
792	8/24/2007	8	6:42	0.90	21.77	15.3	8.87	7.08	3.84	46.30	Low	Wet
793	8/31/2007	0	6:39	0.20	24.60	0.249	0.12	8.40	8.90	106.60	Mid	Dry
794	8/31/2007	1	6:44	0.20	23.10	0.251	0.12	8.30	7.90	92.20	Mid	Dry
795	8/31/2007	4	6:56	0.30	22.40	0.889	0.44	7.40	4.10	47.60	Mid	Dry
796	8/31/2007	4	7:00	0.60	23.90	4.03	2.13	7.30	4.60	55.00	Mid	Dry
797	8/31/2007	6	7:13	0.10	23.90	7.28	4.00	7.30	6.60	80.60	Mid	Dry
798	8/31/2007	6	7:15	0.80	24.70	20.8	12.40	6.90	4.20	55.10	Mid	Dry
799	8/31/2007	7	7:28	0.10	23.90	20.1	12.00	7.20	6.20	78.90	Mid	Dry
800	8/31/2007	7	7:30	0.80	24.20	27.3	16.70	7.10	5.20	68.90	Mid	Dry
801	8/31/2007	8	7:32	0.10	24.00	20.2	12.00	7.20	7.10	90.20	Mid	Dry
802	8/31/2007	8	7:34	0.50	24.00	20.2	12.00	7.20	7.00	89.40	Mid	Dry

ID	DATE	Station	Time	Depth (m)	Temp (C)	SpC (mS/cm)	Salinity (PSS)	pH	DO (mg/l)	DO%	Tide Stage	Dry or Wet
807	9/7/2007	0	6:10	0.40	23.10	0.262	0.13	8.13	6.95	81.30	Low	Dry
808	9/7/2007	1	6:15	0.30	21.99	0.264	0.13	7.81	6.92	79.20	Low	Dry
805	9/7/2007	4	5:50	0.30	23.05	5.59	3.01	7.31	4.93	58.70	Low	Dry
806	9/7/2007	4	5:55	0.60	24.81	18.8	11.13	7.11	5.53	71.50	Low	Dry
803	9/7/2007	6	5:35	0.20	23.33	15.8	9.20	7.38	6.78	84.40	Low	Dry
804	9/7/2007	6	5:40	0.80	24.15	26	15.85	7.25	6.15	80.80	Low	Dry
809	9/7/2007	7	6:25	0.20	23.47	29.1	17.92	7.33	5.48	71.90	Low	Dry
810	9/7/2007	7	6:30	0.70	23.48	29.2	17.99	7.30	5.36	70.40	Low	Dry
811	9/7/2007	8	6:40	0.20	23.39	28.5	17.51	7.36	5.48	71.80	Low	Dry
812	9/7/2007	8	6:45	0.70	23.45	29.5	18.19	7.33	5.24	68.90	Low	Dry
817	9/14/2007	0	6:15	0.30	22.36	0.273	0.13	7.60	6.29	72.30	Mid	Wet
818	9/14/2007	1	6:20	0.40	20.75	0.274	0.13	7.69	7.41	82.80	Mid	Wet
815	9/14/2007	4	6:00	0.30	19.78	0.308	0.15	7.34	5.30	58.00	Mid	Wet
816	9/14/2007	4	6:05	0.80	19.70	0.299	0.14	7.29	5.31	58.20	Mid	Wet
813	9/14/2007	6	5:45	0.30	20.52	1.69	0.85	7.36	5.58	62.40	Mid	Wet
814	9/14/2007	6	5:49	0.90	21.85	9.53	5.33	7.09	3.83	45.30	Mid	Wet
819	9/14/2007	7	6:30	0.20	20.93	12.28	6.99	7.20	4.45	52.20	Mid	Wet
820	9/14/2007	7	6:35	0.70	21.94	22.1	13.23	7.04	3.89	48.40	Mid	Wet
821	9/14/2007	8	6:40	0.30	21.05	13.03	7.45	7.17	5.43	64.00	Mid	Wet
822	9/14/2007	8	6:45	0.50	20.98	12.51	7.13	7.17	5.69	66.80	Mid	Wet
827	9/21/2007	0	6:20	0.30	20.31	0.279	0.13	7.60	5.62	62.20	Mid	Dry
828	9/21/2007	1	6:25	0.30	19.12	0.28	0.13	7.56	6.24	67.50	Mid	Dry
825	9/21/2007	4	6:05	0.20	19.55	3.56	1.86	7.25	4.39	48.50	Mid	Dry
826	9/21/2007	4	6:10	0.70	22.45	20.2	12.01	6.88	3.35	41.70	Mid	Dry
823	9/21/2007	6	5:40	0.20	20.94	14.6	8.43	7.17	5.59	66.20	Mid	Dry
824	9/21/2007	6	5:50	0.80	21.83	27.6	16.87	7.00	4.33	54.70	Mid	Dry
829	9/21/2007	7	6:30	0.30	21.01	37.8	23.82	7.19	4.72	61.50	Mid	Dry
830	9/21/2007	7	6:35	0.80	21.01	37.9	23.89	7.14	4.45	57.80	Mid	Dry
831	9/21/2007	8	6:40	0.20	20.98	31.9	19.76	7.15	4.52	57.30	Mid	Dry
832	9/21/2007	8	6:45	0.90	21.00	37.2	23.41	7.14	4.23	54.80	Mid	Dry

ID	DATE	Station	Time	Depth (m)	Temp (C)	SpC (mS/cm)	Salinity (PSS)	pH	DO (mg/l)	DO%	Tide Stage	Dry or Wet
837	10/5/2007	0	6:25	0.30	21.54	0.272	0.13	8.24	7.49	85.00	Mid	Dry
838	10/5/2007	1	6:35	0.40	20.63	0.277	0.13	7.79	6.17	68.70	Mid	Dry
835	10/5/2007	4	6:10	0.20	22.77	11.67	6.63	6.99	4.64	56.20	Mid	Dry
836	10/5/2007	4	6:15	0.60	22.77	23.3	14.03	6.81	3.80	48.10	Mid	Dry
833	10/5/2007	6	5:50	0.30	22.49	19.2	11.36	6.98	4.94	61.20	Mid	Dry
834	10/5/2007	6	5:55	0.70	22.41	27.5	16.82	6.87	4.30	55.00	Mid	Dry
839	10/5/2007	7	6:40	0.20	21.84	36.4	22.88	7.06	4.76	62.50	Mid	Dry
840	10/5/2007	7	6:45	0.70	21.83	36.6	23.02	7.04	4.67	61.40	Mid	Dry
841	10/5/2007	8	6:50	0.20	22.01	31.5	19.51	7.04	4.63	59.80	Mid	Dry
842	10/5/2007	8	6:55	1.00	21.83	36.4	22.88	6.98	4.15	54.40	Mid	Dry
847	10/12/2007	0	6:20	0.30	19.82	0.285	0.14	7.81	6.90	75.70	Mid	Wet
848	10/12/2007	1	6:25	0.30	18.97	0.285	0.14	7.71	7.68	82.80	Mid	Wet
845	10/12/2007	4	6:00	0.20	19.68	20	11.84	6.69	2.27	26.70	Mid	Wet
846	10/12/2007	4	6:10	0.70	20.55	28.4	17.38	6.61	1.25	15.50	Mid	Wet
843	10/12/2007	6	5:40	0.20	19.54	25	15.10	6.71	2.71	32.50	Mid	Wet
844	10/12/2007	6	5:50	0.60	20.05	31.5	19.46	6.68	2.57	32.00	Mid	Wet
849	10/12/2007	7	6:35	0.10	19.36	31.6	19.51	6.87	4.20	51.50	Mid	Wet
850	10/12/2007	7	6:40	0.60	19.74	34.6	21.57	6.83	3.92	49.00	Mid	Wet
851	10/12/2007	8	6:50	0.10	19.17	30.1	18.49	6.80	5.58	67.70	Mid	Wet
852	10/12/2007	8	6:55	0.50	19.18	30.1	18.49	6.79	5.03	61.20	Mid	Wet
857	10/19/2007	0	6:15	0.20	17.76	0.295	0.14	7.22	5.51	58.00	High	Dry
858	10/19/2007	1	6:25	0.40	18.05	0.296	0.14	7.30	6.94	73.50	High	Dry
855	10/19/2007	4	6:00	0.30	19.81	17.6	10.31	6.95	5.92	69.30	High	Dry
856	10/19/2007	4	6:05	0.80	19.18	26.5	16.08	6.79	4.81	57.60	High	Dry
853	10/19/2007	6	5:40	0.30	18.98	26.3	15.94	6.95	6.15	73.30	High	Dry
854	10/19/2007	6	5:50	0.80	18.52	32.2	19.89	6.87	5.24	63.40	High	Dry
859	10/19/2007	7	6:35	0.20	17.88	41.1	26.01	7.03	5.10	63.20	High	Dry
860	10/19/2007	7	6:40	0.80	17.89	41.2	26.08	7.02	5.18	64.30	High	Dry
861	10/19/2007	8	6:45	0.20	18.00	36.6	22.89	7.04	5.40	65.90	High	Dry
862	10/19/2007	8	6:55	1.20	17.87	41.5	26.29	7.00	4.84	60.10	High	Dry

ID	DATE	Station	Time	Depth (m)	Temp (C)	SpC (mS/cm)	Salinity (PSS)	pH	DO (mg/l)	DO%	Tide Stage	Dry or Wet
863	10/26/2007	0	6:54	0.20	16.70	0.276	0.13	7.40	7.40	76.20	Low	Wet
864	10/26/2007	1	7:00	0.20	16.40	0.282	0.13	7.60	9.10	93.60	Low	Wet
865	10/26/2007	4	7:16	0.20	14.30	0.339	0.16	7.40	7.20	70.70	Low	Wet
866	10/26/2007	4	7:17	0.70	14.30	0.339	0.16	7.40	7.20	70.00	Low	Wet
867	10/26/2007	6	7:32	0.20	14.20	1.18	0.58	7.50	7.00	68.60	Low	Wet
868	10/26/2007	6	7:35	0.90	16.60	11.6	6.50	7.00	3.80	40.40	Low	Wet
869	10/26/2007	7	7:53	0.40	15.00	11.8	6.60	7.20	7.40	76.50	Low	Dry
870	10/26/2007	7	7:54	1.00	15.10	11.9	6.70	7.20	6.60	69.00	Low	Dry
871	10/26/2007	8	7:56	0.20	14.90	10.9	6.10	7.20	6.40	65.90	Low	Wet
872	10/26/2007	8	7:57	0.70	15.40	13.5	7.70	7.10	6.20	65.50	Low	Wet
877	11/2/2007	0	6:30	0.20	14.24	0.296	0.14	7.05	6.98	68.10	High	Dry
878	11/2/2007	1	6:35	0.20	13.77	0.296	0.14	7.33	8.36	80.80	High	Dry
875	11/2/2007	4	6:15	0.20	12.04	1.091	0.53	7.09	6.88	64.20	High	Dry
876	11/2/2007	4	6:20	0.70	15.60	10.96	6.15	6.87	3.68	38.20	High	Dry
873	11/2/2007	6	5:55	0.20	13.04	6.05	3.25	7.13	7.26	70.50	High	Dry
874	11/2/2007	6	6:05	0.70	15.35	20.4	12.03	6.83	4.99	53.90	High	Dry
879	11/2/2007	7	6:45	0.20	14.46	37.2	23.17	7.29	7.19	81.70	High	Dry
880	11/2/2007	7	6:50	0.80	14.48	37.5	23.38	7.16	6.98	79.20	High	Dry
881	11/2/2007	8	6:55	0.20	14.48	32.9	20.24	7.11	6.73	75.20	High	Dry
882	11/2/2007	8	7:05	1.00	14.52	37.9	23.65	7.09	6.04	69.00	High	Dry