PROJECT REPORT

Water Quality Monitoring Report
Little Chute Hydroelectric Project
FERC Project No. 2588

Prepared for:

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Date: November 16, 2006

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1. Project Information

Article 403 of the City of Kaukauna's current license for the Little Chute Project (FERC No. 2588) requires the City to file a water quality plan. The City filed the plan on August 14, 2000, and FERC issued an Order Approving Water Quality Plan on August 24, 2000. The order calls for the licensee to monitor dissolved oxygen (DO) and temperature upstream and downstream of the project for the period from June 15 through September 30 for the first year (2001) and then once every five years for the duration of the license.

In 2006, the City of Kaukauna contracted White Water Associates, Inc., of Amasa, Michigan to carry out the required study for the current period. This report is a presentation of monitoring data, statistics, water quality compliance information, quality assurance data, and a description of problems or malfunctions as required by the Order Approving Water Quality Plan (Appendix A, Documents).

2. Data

Graphs comparing the hourly upstream and downstream dissolved oxygen (Figure 1) and temperature readings (Figure 2) are provided in Appendix A and the corresponding raw data is provided on disk in Excel format in Appendix B as an attached CD-ROM. A copy of this report is also provided as PDF file on the same CD-ROM.

For both upstream and downstream temperature and dissolved oxygen data, the daily means were calculated and graphed (Figure 3, Appendix A). The mean and standard deviation of the difference between the daily means for the upstream and downstream readings were calculated. For the temperature comparison, the mean of the difference in the daily averages was 0.81°C (upstream minus downstream –the positive sign denotes the upstream temperature was higher than the downstream temperature) with a standard deviation of ± 0.17°C. The mean of the difference in the average daily dissolved oxygen concentration was -0.67 mg/L (upstream minus downstream–the negative sign denotes the upstream dissolved oxygen concentration was lower than the downstream dissolved oxygen concentration) with a standard deviation of ± 0.63 mg/L. A comparison of the daily means for dissolved oxygen concentration and temperature are provided in Appendix C (Tables 1 and 2, respectively).

The dissolved oxygen daily averages of the upstream and downstream data were compared, when both data sets were available, and at no time did they vary by greater than 2 mg/L for five or more consecutive days, a condition indicated as a cause for special discussion with the WDNR according to the FERC order. The difference between daily means for dissolved oxygen only exceeded 2 mg/L on four days: August 20-22, and September 1 (-2.44, -2.2, -2.60, and -2.02, respectively). The daily averages for DO of the upstream unit was lower than those of the downstream unit in all four cases, resulting in negative values. The first three instances occurred near the end of a deployment and maintenance cycle. It is unclear why the difference was this large in any of the cases, but there was often a lot of biological activity and fouling, and even the occasional crawfish found around the probes. The daily means for both dissolved oxygen and temperature are shown in Appendix C.

3. Quality Assurance

The upstream and downstream monitoring equipment were calibrated every two weeks at which time the data was also checked. The pre-calibration and post-calibration dissolved oxygen values were compared and never differed by greater than 0.54 mg/L (on October 2 at the downstream location, reading higher before calibration). Calibration summaries for the upstream and downstream monitoring units are provided in Appendix D.

4. Complications in Monitoring During Study Period

A. Upstream Data

Data were never lost during deployment at the upstream location.

B. Downstream Data

Data were lost on two occasions, first from September 10 (3:00) to 20 (11:00) then again from September 26 (8:00) through the duration of the deployment, effectively September 30 (23:00). In both cases, the same unit failed to acquire readings sometime between maintenance visits. Fortunately, these failures occurred at a time when dissolved oxygen and water temperatures, as indicated by readings immediately preceding and following the failures, were moderate. What follows is a description of steps taken and conclusions drawn after each failure.

During the first failure event, the unit failed to acquire readings for the 10 days immediately preceding the maintenance visit on September 20. The unit was totally unresponsive until batteries were changed. After data were downloaded, the data loss was discovered, having been last serviced on September 6. The last reading showed the battery voltage was good. Indeed, batteries had been changed on the previous visit and should have lasted for perhaps a month more. (Batteries were routinely changed every other visit; i.e. monthly.) Nonetheless, the batteries that came out of the unresponsive unit were reading a bit low, as if there was some dissipation of power. Nothing obvious indicated the reason why readings had failed to be acquired: the battery storage area was dry and after a change of batteries the unit was fine and recording on the hour. Perhaps the cleaning motor which rotates once an hour stayed on for some reason drawing down the unit's power, but the loss of readings occurred suddenly.

I consulted with the manufacturer (Hach-Hydrolab) several times from the field without determining a clear reason why this first failure occurred. Both units used after June 27 were new as of June 2006. Hydrolab's technician suggested that the unit should be checked at the end of the season by them. With two weeks to go, the unit was redeployed after a thorough check and recalibration; it was reading properly before I left it.

On the occasion of the second failure on September 26, 5 days of data were lost until the study period concluded September 30. The unit had been thoroughly checked last visit and redeployed with new batteries, but the unit was found totally unresponsive until batteries were once again changed. The last readings showed the unit had plenty of power until the failure, after which no readings were acquired. A check of batteries shows they were further depleted from the last recorded voltage. There were no signs of leakage from the batteries or infiltration of water. The unit was returned to the manufacturer for service at the end of the season.

APPENDIX A

Graphs of Upstream and Downstream Temperature and Dissolved Oxygen Readings

Figure 1. Hourly Dissolved Oxygen Readings, Upstream and Downstream of Little Chute Project FERC No. 2588 on the Fox River in Combined Locks, Wisconsin

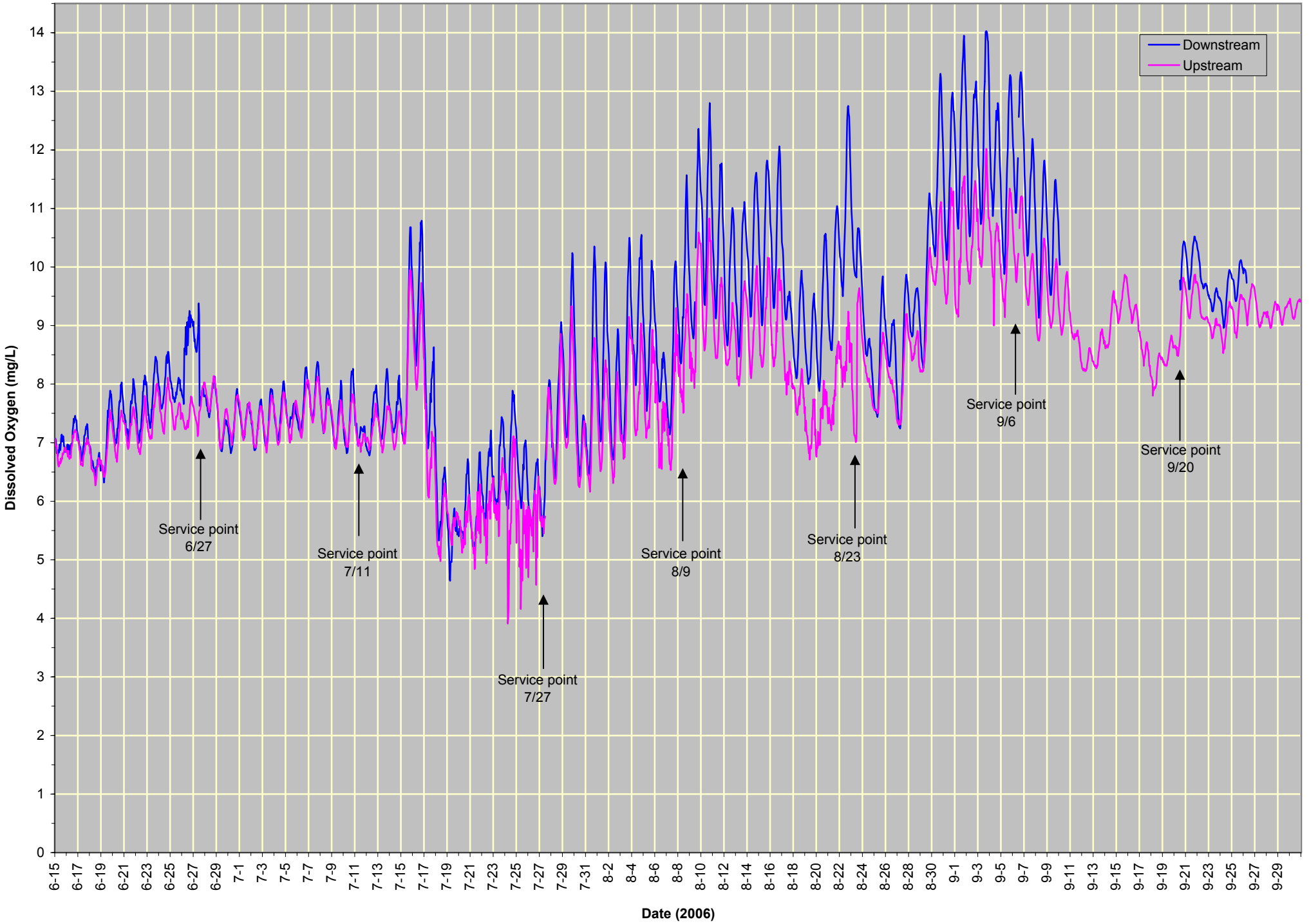


Figure 2. Hourly Temperature Readings, Upstream and Downstream of Little Chute Project FERC No. 2588 on the Fox River in Combined Locks, Wisconsin

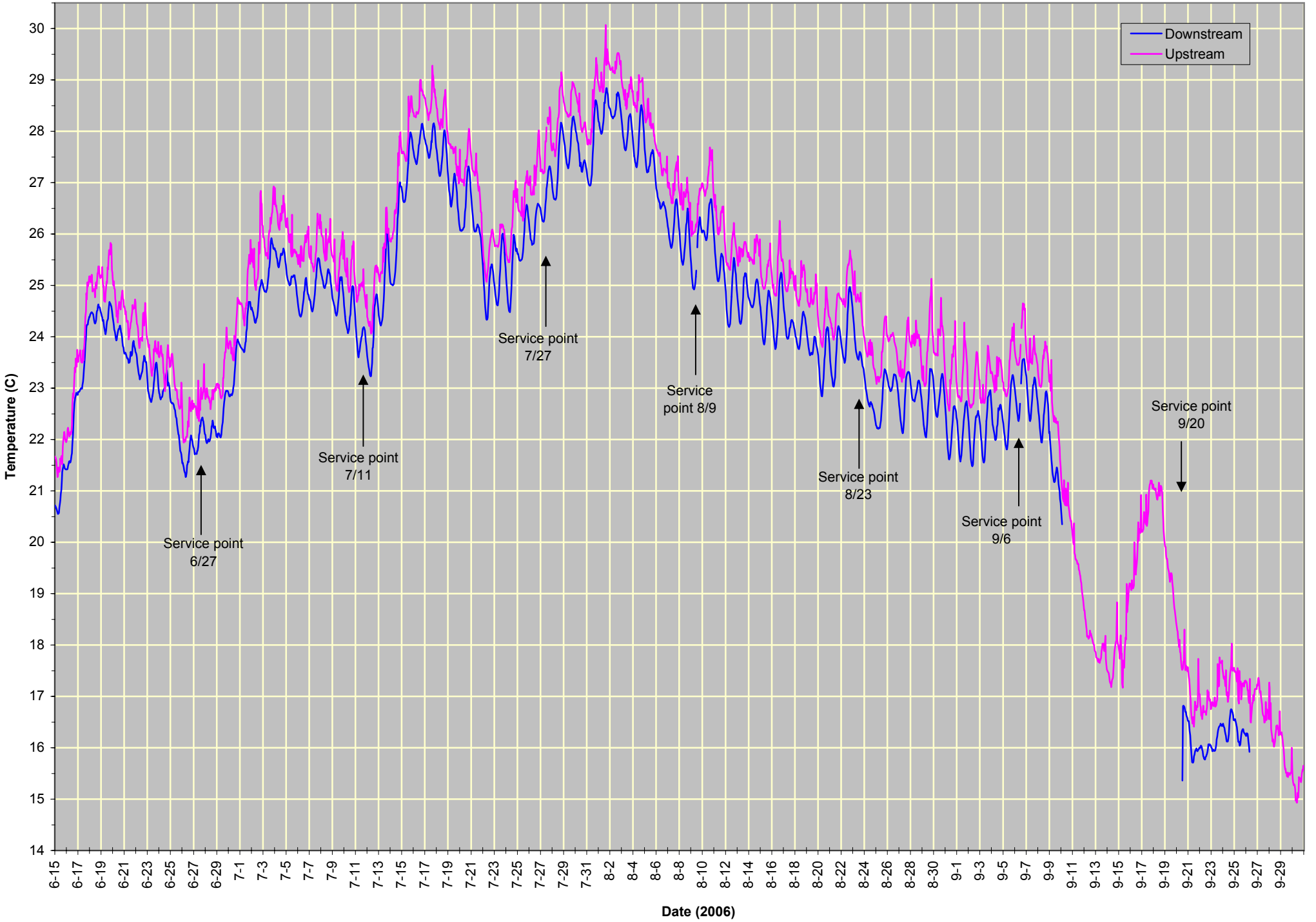
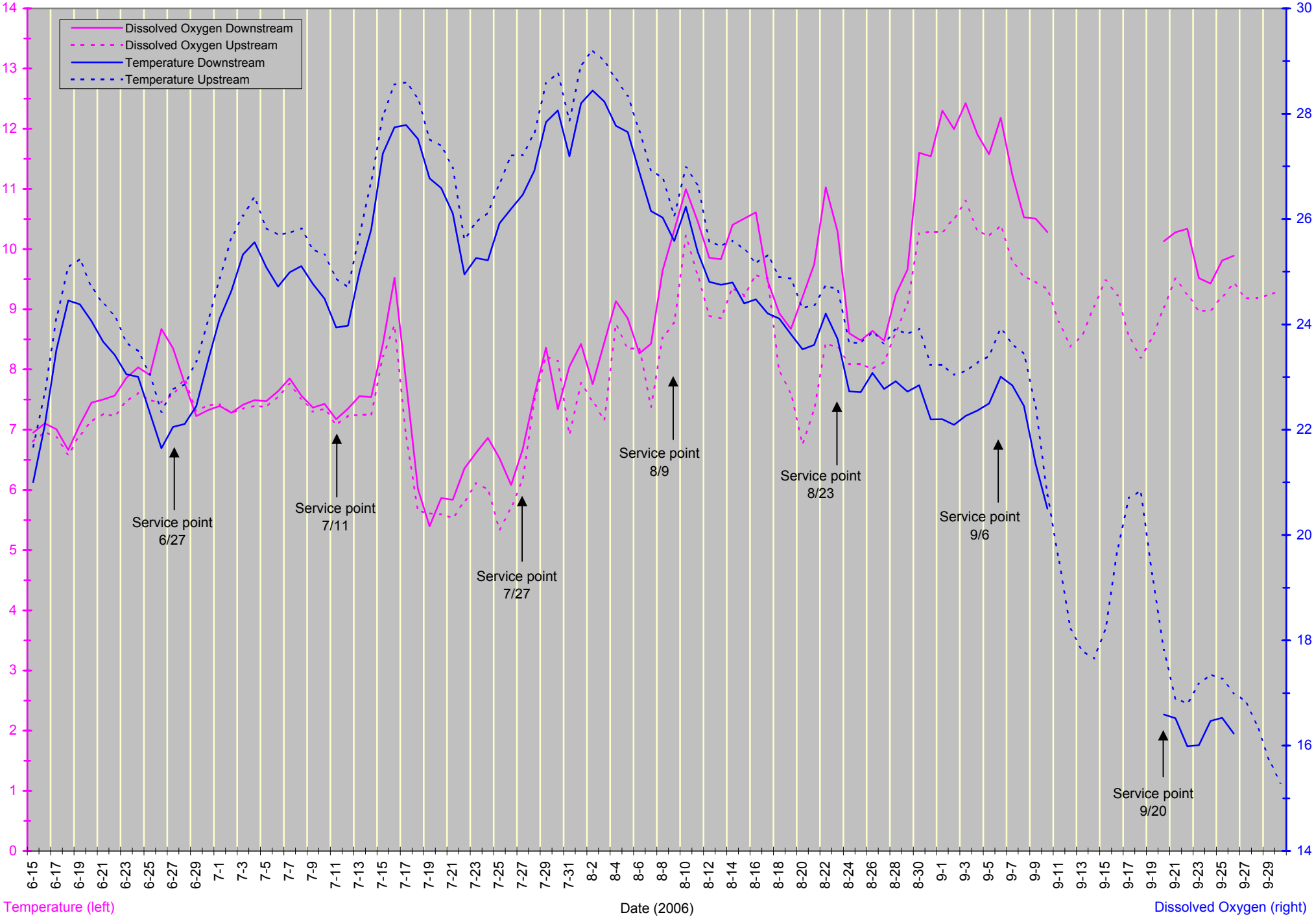


Figure 3. Daily Averages for Dissolved Oxygen and Temperature, Upstream and Downstream of Little Chute Project FERC No. 2588 on the Fox River in Combined Locks, Wisconsin



APPENDIX B
Raw Data

APPENDIX C
Daily Means for Dissolved Oxygen and Temperature

Little Chute Project, FERC No. 2588 on the Fox River in Combined Locks, Wisconsin
Daily Means of the Upstream and Downstream Temperature and Dissolved Oxygen Data

Difference= Upstream - Downstream

Date (shading = service date)	Dissolved Oxygen (mg/L)			Temperature (°C)		
	Upstream	Downstream	Difference	Upstream	Downstream	Difference
6-15-2006	6.80	6.95	-0.15	21.68	21.00	0.68
6-16-2006	6.97	7.11	-0.14	22.69	22.09	0.61
6-17-2006	6.87	7.01	-0.14	24.11	23.51	0.60
6-18-2006	6.58	6.66	-0.08	25.08	24.45	0.63
6-19-2006	6.91	7.08	-0.17	25.24	24.38	0.86
6-20-2006	7.14	7.45	-0.31	24.70	24.06	0.64
6-21-2006	7.26	7.50	-0.24	24.39	23.67	0.72
6-22-2006	7.23	7.57	-0.34	24.17	23.42	0.75
6-23-2006	7.47	7.86	-0.39	23.66	23.05	0.61
6-24-2006	7.61	8.03	-0.42	23.49	23.00	0.49
6-25-2006	7.49	7.91	-0.42	23.06	22.32	0.73
6-26-2006	7.45	8.67	-1.22	22.34	21.65	0.69
6-27-2006	7.59	8.35	-0.77	22.77	22.05	0.72
6-28-2006	7.84	7.77	0.07	22.86	22.11	0.75
6-29-2006	7.32	7.23	0.09	23.29	22.45	0.84
6-30-2006	7.41	7.32	0.08	24.07	23.31	0.75
7-1-2006	7.43	7.39	0.03	24.88	24.11	0.76
7-2-2006	7.27	7.28	-0.01	25.64	24.64	1.00
7-3-2006	7.35	7.41	-0.06	26.06	25.33	0.74
7-4-2006	7.39	7.49	-0.10	26.42	25.56	0.86
7-5-2006	7.38	7.47	-0.09	25.83	25.09	0.74
7-6-2006	7.56	7.64	-0.08	25.70	24.72	0.98
7-7-2006	7.75	7.85	-0.10	25.74	24.99	0.75
7-8-2006	7.52	7.57	-0.05	25.82	25.11	0.71
7-9-2006	7.30	7.37	-0.06	25.43	24.77	0.66
7-10-2006	7.35	7.43	-0.08	25.32	24.49	0.83
7-11-2006	7.08	7.17	-0.09	24.88	23.94	0.94
7-12-2006	7.23	7.35	-0.12	24.70	23.98	0.72
7-13-2006	7.25	7.56	-0.31	25.70	25.01	0.69
7-14-2006	7.25	7.54	-0.29	26.71	25.80	0.91
7-15-2006	8.22	8.42	-0.21	27.96	27.25	0.71
7-16-2006	8.73	9.53	-0.80	28.55	27.74	0.81
7-17-2006	6.89	7.79	-0.90	28.60	27.78	0.81
7-18-2006	5.66	6.02	-0.36	28.30	27.52	0.77
7-19-2006	5.61	5.40	0.21	27.52	26.77	0.75
7-20-2006	5.59	5.86	-0.27	27.39	26.59	0.80
7-21-2006	5.53	5.84	-0.30	26.97	26.11	0.87
7-22-2006	5.81	6.36	-0.55	25.61	24.95	0.67
7-23-2006	6.10	6.62	-0.51	25.94	25.26	0.68
7-24-2006	6.01	6.87	-0.86	26.12	25.22	0.90
7-25-2006	5.34	6.53	-1.18	26.67	25.92	0.75
7-26-2006	5.70	6.08	-0.38	27.21	26.19	1.01
7-27-2006	6.17	6.68	-0.51	27.22	26.46	0.76
7-28-2006	7.49	7.57	-0.08	27.63	26.92	0.71
7-29-2006	8.22	8.36	-0.14	28.57	27.84	0.73
7-30-2006	8.14	7.34	0.80	28.78	28.06	0.72
7-31-2006	6.92	8.05	-1.13	27.87	27.19	0.68
8-1-2006	7.77	8.43	-0.66	28.93	28.2	0.73
8-2-2006	7.47	7.76	-0.29	29.21	28.44	0.77
8-3-2006	7.16	8.45	-1.29	29	28.23	0.77
8-4-2006	8.75	9.13	-0.38	28.65	27.77	0.88
8-5-2006	8.35	8.85	-0.50	28.34	27.65	0.69
8-6-2006	8.35	8.27	0.08	27.67	26.89	0.78
8-7-2006	7.38	8.43	-1.05	26.93	26.15	0.78

Little Chute Project, FERC No. 2588 on the Fox River in Combined Locks, Wisconsin
Daily Means of the Upstream and Downstream Temperature and Dissolved Oxygen Data

Difference= Upstream - Downstream

Date (shading = service date)	Dissolved Oxygen (mg/L)			Temperature (°C)		
	Upstream	Downstream	Difference	Upstream	Downstream	Difference
8-8-2006	8.53	9.65	-1.12	26.78	26.03	0.75
8-9-2006	8.77	10.31	-1.54	26.06	25.58	0.48
8-10-2006	10.22	11.00	-0.78	26.98	26.24	0.75
8-11-2006	9.57	10.46	-0.89	26.66	25.38	1.28
8-12-2006	8.89	9.86	-0.97	25.57	24.81	0.76
8-13-2006	8.85	9.83	-0.98	25.49	24.75	0.74
8-14-2006	9.36	10.41	-1.05	25.59	24.79	0.80
8-15-2006	9.23	10.51	-1.28	25.43	24.40	1.03
8-16-2006	9.57	10.61	-1.04	25.16	24.48	0.68
8-17-2006	9.51	9.47	0.04	25.32	24.21	1.11
8-18-2006	7.97	8.93	-0.96	24.9	24.11	0.79
8-19-2006	7.61	8.67	-1.06	24.87	23.81	1.06
8-20-2006	6.76	9.20	-2.44	24.31	23.53	0.78
8-21-2006	7.33	9.75	-2.42	24.37	23.61	0.76
8-22-2006	8.43	11.03	-2.60	24.73	24.21	0.53
8-23-2006	8.37	10.29	-1.92	24.67	23.72	0.95
8-24-2006	8.09	8.60	-0.51	23.66	22.73	0.93
8-25-2006	8.09	8.49	-0.39	23.64	22.71	0.93
8-26-2006	8.01	8.64	-0.63	23.86	23.08	0.78
8-27-2006	8.13	8.48	-0.35	23.63	22.78	0.86
8-28-2006	8.61	9.24	-0.64	23.91	22.92	0.98
8-29-2006	9.10	9.66	-0.57	23.82	22.72	1.10
8-30-2006	10.26	11.60	-1.34	23.91	22.84	1.07
8-31-2006	10.29	11.54	-1.25	23.24	22.19	1.04
9-1-2006	10.29	12.30	-2.02	23.23	22.20	1.03
9-2-2006	10.51	11.99	-1.48	23.04	22.09	0.95
9-3-2006	10.80	12.42	-1.63	23.12	22.26	0.85
9-4-2006	10.30	11.90	-1.60	23.27	22.36	0.91
9-5-2006	10.22	11.58	-1.35	23.40	22.50	0.90
9-6-2006	10.39	12.18	-1.79	23.92	23.01	0.91
9-7-2006	9.80	11.23	-1.43	23.63	22.84	0.79
9-8-2006	9.54	10.53	-0.99	23.44	22.45	0.99
9-9-2006	9.46	10.51	-1.05	22.45	21.36	1.10
9-10-2006	9.33	10.28	-0.95	20.76	20.50	0.26
9-11-2006	8.79			19.51		
9-12-2006	8.38			18.21		
9-13-2006	8.57			17.81		
9-14-2006	9.04			17.66		
9-15-2006	9.48			18.20		
9-16-2006	9.24			19.71		
9-17-2006	8.55			20.70		
9-18-2006	8.20			20.84		
9-19-2006	8.52			19.25		
9-20-2006	9.03	10.13	-1.10	17.82	16.59	1.22
9-21-2006	9.51	10.28	-0.77	16.89	16.52	0.37
9-22-2006	9.25	10.34	-1.09	16.81	15.99	0.82
9-23-2006	8.97	9.52	-0.55	17.17	16.01	1.16
9-24-2006	8.99	9.43	-0.44	17.35	16.47	0.88
9-25-2006	9.21	9.81	-0.60	17.27	16.53	0.74
9-26-2006	9.43	9.89	-0.46	17.01	16.23	0.78
9-27-2006	9.19			16.85		
9-28-2006	9.19			16.39		
9-29-2006	9.24			15.74		
9-30-2006	9.31			15.29		

APPENDIX D
Calibration Summaries

Little Chute Project, FERC No. 2588 on the Fox River in Combined Locks, Wisconsin
Calibration check data

Must be within 1 mg/L 70 % of time
Percent within limits: 100%

Date	Site	Unit (S/N)	Before	After	Diff.
27-Jun	Down	41968	7.64	7.96	-0.32
	Up	42015	8.74	8.3	0.44
11-Jul	Down	44139	8.6	8.4	0.2
	Up	44140	8.62	8.42	0.2
27-Jul	Down	44139	7.79	7.87	-0.08
	Up	44140	7.64	7.67	-0.03
9-Aug	Down	44139	8.09	8.23	-0.14
	Up	44140	7.95	7.91	0.04
23-Aug	Down	44139	8.37	8.52	-0.15
	Up	44140	8.47	8.63	-0.16
6-Sep	Down	44139	8.43	8.46	-0.03
	Up	44140	8.28	8.23	0.05
20-Sep	Down	44139	9.46	9.74	-0.28
	Up	44140	9.52	9.74	-0.22
2-Oct	Down	44139	9.51	8.97	0.54
	Up	44140	9.01	8.83	0.18

APPENDIX E
FERC Order Approving Water Quality Monitoring Plan
(Issued August 24, 2000)

92 FERC ¶ 62,170

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

City of Kaukauna — Project No. 2588-007

ORDER APPROVING WATER QUALITY MONITORING PLAN

(Issued August 24, 2000)

The City of Kaukauna (licensee) filed, on August 14, 2000, its water quality monitoring plan under article 403 of the license for the Little Chute Project (FERC No. 2588). The project is located on the Fox River, in the Village of Combined Locks, in Outagamie County, Wisconsin.

BACKGROUND

Article 403 requires the licensee to file, for Commission approval, a plan to monitor water quality in the project area. The plan is required to include a description of the methods which will be used to collect dissolved oxygen (DO) and water temperature data from the project area every five years for the term of the license. In addition, the licensee is required to cooperate with any future plans developed by state or federal agencies to remove contaminated sediments from the lower Fox River. Such cooperation by the licensee may include, for example, providing reasonable access to project facilities and may also include brief and temporary modification of project operations to allow safe working conditions for agency personnel. The licensee is also required to prepare the plan after consultation with the Wisconsin Department of Natural Resources (WDNR).

LICENSEE'S PLAN

The licensee proposes that Hydrolab DataSonde probes, or their equivalent, be deployed at locations upstream and downstream of the project. The probes would be deployed from June 15 through September 30, unless flows in the river are above 4,000 cubic feet per second, which would inhibit safe deployment of the probes. The probes would continuously monitor and record DO and water temperature at 1-hour intervals during this period. The upstream probe would be located at the upstream end of the project's reservoir to provide information on the DO and water temperature as it enters the project. The downstream probe would be located approximately 100 yards below the powerhouse and in the discharge flow. Routine profile monitoring of the reservoir will not be included since results of previous monitoring provided evidence that the reservoir does not stratify significantly.

The data generated from the proposed monitoring will be surveyed biweekly. Should a comparison of the DO data from the upstream and downstream monitoring show a daily average difference between locations of greater than 2 milligrams per liter (mg/L) for a period of five consecutive days or more, discussions will be initiated with the WDNR to determine the cause of the difference. It may be determined during those discussions that profile monitoring should be implemented to help explain the differences.

The probes at each location will be calibrated every 10 to 14 days. Calibration will be performed by using the air calibration method recommended by the manufacturer. Prior to calibration, the oxygen concentration of air readings will be recorded. These data will be compared to post-calibration air oxygen concentrations to derive data on meter error or drift. At the end of the monitoring period, the DO data will be considered acceptable if the meters at each location provide readings during the pre- and post-calibration comparison that is within 1 mg/L at least 70 percent of the time. Should a problem with meeting this calibration standard become apparent during the sampling period, the WDNR will be advised and a plan devised to ensure that the calibration standard is met for the remainder of the sampling period.

A report of the findings during the sampling period will contain: raw data; graphs comparing hourly DO readings from upstream and downstream locations; graphs comparing hourly temperature readings from upstream and downstream locations; basis statistics; quality assurance data and comparison percentage; and a description of all mechanical or other complications in monitoring experienced during the sampling period. The report will be submitted to the WDNR and the Commission by December 31, 2001, and every 5 years thereafter, for the term of the license, unless the WDNR and the licensee agree that future water quality monitoring is no longer necessary.

AGENCY COMMENTS

The WDNR, by letter dated August 2, 2000, concurred with the licensee's proposed plan.

DISCUSSION AND CONCLUSIONS

The licensee's plan to monitor water quality at the project satisfies the requirements of article 403. The licensee will monitor DO and water temperature upstream and downstream of the project for the period from June 15 through September 30 for the first year (2001) and then once every five years for the duration of the license.

The licensee will provide a report following the monitoring season to the WDNR and the Commission by December 31 of the monitoring year.

The licensee states that the monitoring will continue through the term of the license unless the licensee and the WDNR agree that monitoring is no longer needed. In the event that it is determined that monitoring is no longer need at the project, the licensee would need to file with the Commission, for approval, a request to discontinue monitoring and include concurrence from the WDNR.

The licensee's plan to monitor water quality fulfills the requirements of article 403 and should, therefore, be approved.

The Director orders:

(A) The licensee's water quality monitoring plan for the Little Chute Project (FERC No. 2588), filed on August 14, 2000, is approved.

(B) This order constitutes final agency action. Requests for rehearing by the Commission may be filed within 30 days of the date of issuance of this order, pursuant to 18 CFR § 385.713.

Rebecca Martin

Rebecca Martin
Team Leader
Division of Hydropower Administration
and Compliance

APPENDIX F
Correspondence

APPENDIX G
Map of Monitoring Locations

Locations of upstream and downstream sites for water quality monitoring, Little Chute Hydroelectric Project, June 15 through September 30, 2006.