



414 Nicollet Mall
Minneapolis, Minnesota 55401-1993

December 28, 2006

ORIGINAL

Office of the Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, D.C. 20426

FILED
OFFICE OF THE
SECRETARY
2007 JAN -3 P 4: 15
FEDERAL ENERGY
REGULATORY COMMISSION

Subject: Water Quality Monitoring Results For The Big Falls and Thornapple Flowages – Articles 404 (Water Quality Monitoring Plan). 059
Big Falls Hydroelectric Project (FERC Project No. 2390) and Thornapple Hydroelectric Project (FERC Project No. 2475) – 061

Dear Secretary:

Enclosed is an original and eight copies of the water quality monitoring results obtained from the above-mentioned projects in 2006 as directed by the Federal Energy Regulatory Commission's (Commission) license orders. The license orders require Northern States Power Company – Wisconsin (d.b.a. Xcel Energy) to perform water quality sampling on the two flowages after ice-out, in mid-July, and mid-August to monitor long-term changes in water quality.

Also included is a summary of the data that has been collected since 1998, the first year of the required water quality sampling. The data collected in 2006 is consistent to the sampling performed in earlier years and all parameters are well within the normal ranges expected for natural environments.

The sampling results were filed with the Wisconsin Department of Natural Resources (WDNR) on October 23, 2006 and they were allowed 30 days to provide comments (*see attached letter*). The WDNR did not provide any comments by letter or electronic mail.

If you have any questions in regards to the monitoring results or to this filing, please feel free to contact me by telephone at (715) 839-1353 or by electronic mail at robert.w.olson@xcelenergy.com.

Very truly yours,

Robert W. Olson
Hydro Licensing Specialist

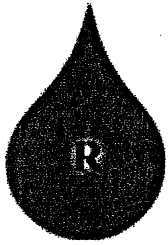
Attachment: Water quality monitoring results

c: Mr. Jeff Scheirer (Wisconsin DNR)

**Summary Of Water Quality Data Collected In 2006
For The Big Falls And Thornapple Flowages**

Analysis of Big Falls and Thornapple Flowages

Lab No	Sample Description	Date Sampled	Total Phosphorus
Method			EPA 365.3
Units			mg/L P
EF52556	Big Falls Surface	4/26/2006	0.023
EF52557	Big Falls Bottom	4/26/2006	0.035
EF52558	Thornapple Surface	4/26/2006	0.026
EF52559	Thornapple Bottom	4/26/2006	0.024



Instrumental Research, Inc.
 7800 Main Street NE
 Fridley, MN 55432.
Ph. 763-571-3698 Fax. 763-571-3372

LABORATORY ANALYSIS REPORT 185-06 Wednesday, May 10, 2006
MDH CERTIFIED LABORATORY 027-003-130 EPA LAB CODE MN 00076

Attn: Rob Olson
 Xcel Energy
 1414 West Hamilton Ave. P.O. Box 8
 Eau Claire, WI 54702

Date Collected: 4/26/2006
 Date Received: 4/28/2006
 Collected By: Client

Parameter/Method	Sample ID	Results	Units	MDL	IRI Reporting Limit	Analysis Date
Chlorophyll-a SM 19th 10200 H.	BF - 1	0.94	ug/L	0.041	0.500	5/3/2006
	TA - 1	2.35	ug/L	0.041	0.500	5/3/2006

MDL = Method detection level

All analyses were performed using Standard Methods for the Examination of Water and Wastewater, 18th and 19th edition EPA approved methodologies.

Report submitted by,

SUZANNE MELCHIOR, LABORATORY SUPERVISOR
 SM/kg



Minneapolis Testing Laboratory Report

1518 Chestnut Avenue N
 Minneapolis, MN 55403
 Phone: (612)630-4439
 Fax: (612) 630-4367
 Contact: Tom Leverentz

Lab Certification MN ID: 027-053-197
 Lab Certification WI ID:999071150

Report To: ERAD-WI
 Hydro Regulatory-WI

Attention: Leroy Wilder
 Rob Olson

Work Request # WIRV0706
 Date of Report 8/23/2006

Sample Description: BOTTOM
 Location: BIG FALLS FLOWAGE
 Customer Sample I.D.:

LabWorks I.D. EF61488
 Laboratory I.D.: 081.26
 Collection Date: 7/24/2006
 Date Submitted: 7/26/2006

Constituent	Result	Units	Detection Limit	Analytical Method	Analysis Start Date
Total Phosphorus	0.099	mg/L P	0.001	EPA 365.3	8/16/2006

Comments related to sample number EF61488:



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 Fax: (612) 630-4367
 Contact: Tom Leverentz

Lab Certification MN ID: 027-053-197
 Lab Certification WI ID:999071150

Report To: ERAD-WI
 Hydro Regulatory-WI

Attention: Leroy Wilder
 Rob Olson

Work Request # WIRV0706
 Date of Report 8/23/2006

Sample Description: SURFACE
 Location: BIG FALLS FLOWAGE
 Customer Sample I.D.:

LabWorks I.D. EF61487
 Laboratory I.D.: 081.25
 Collection Date: 7/24/2006
 Date Submitted: 7/26/2006

Constituent	Result	Units	Detection Limit	Analytical Method	Analysis Start Date
Chlorophyll-a	<0.5	ug/L	0.041	SM 19th 10200	8/10/2006
Total Phosphorus	0.029	mg/L P	0.001	EPA 365.3	8/16/2006

Comments related to sample number EF61487:



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Phone: (612)630-4439

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Contact: Tom Leverentz

Lab Certification MN ID: 027-053-197

Lab Certification WI ID:999071150

Report To: ERAD- WI
 Hydro Regulatory-WI

Attention: Leroy Wilder
 Rob Olson

Work Request # WIRV0706
 Date of Report 8/23/2006

Sample Description: BOTTOM
 Location: THORNAPPLE FLOWAGE
 Customer Sample I.D.:

LabWorks I.D. EF61486
 Laboratory I.D.: 081.24
 Collection Date: 7/24/2006
 Date Submitted: 7/26/2006

Constituent	Result	Units	Detection Limit	Analytical Method	Analysis Start Date
Total Phosphorus	0.041	mg/L P	0.001	EPA 365.3	8/16/2006

Comments related to sample number EF61486:



Minneapolis Testing Laboratory Report

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Phone: (612)630-4439
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Contact: Tom Leverentz

Lab Certification MN ID: 027-053-197
 Lab Certification WI ID:999071150

Report To: ERAD-WI
 Hydro Regulatory-WI

Attention: Leroy Wilder
 Rob Olson

Work Request # WIRV0706
 Date of Report 8/23/2006

Sample Description: SURFACE
 Location: THORNAPPLE FLOWAGE
 Customer Sample I.D.:

LabWorks I.D. EF61485
 Laboratory I.D.: 081.23
 Collection Date: 7/24/2006
 Date Submitted: 7/26/2006

Constituent	Result	Units	Detection Limit	Analytical Method	Analysis Start Date
Chlorophyll-a	4.03	ug/L	0.041	SM 19th 10200	8/10/2006
Total Phosphorus	0.035	mg/L P	0.001	EPA 365.3	8/16/2006

Comments related to sample number EF61485:



Minneapolis Testing Laboratory Report

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Phone: (612)630-4439
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Contact: Tom Leverentz

Lab Certification MN ID: 027-053-197
Lab Certification WI ID:999071150

I certify that this analysis report was prepared under my direction or supervision under a system designed to assure that qualified personnel analyzed the submitted samples. All protocols for analysis were followed as required by Minnesota Rules and the Applicable Management Plan.

Christine M. Keefe

Christine M. Keefe
System Chemist
612-630-4506



Minneapolis Testing Laboratory Report

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 Minneapolis, MN 55403

Phone: (612)630-4439
 Fax: (612) 630-4367

Contact: Tom Leverentz
 Lab Certification MN ID: 027-053-197
 Lab Certification WI ID:999071150

Report To: Hydro Regulatory-WI

Attention: Rob Olson

Work Request # WIRV0806
 Date of Report 9/22/2006

Sample Description: BOTTOM
 Location: BIG FALLS FLOWAGE
 Customer Sample I.D.:

LabWorks I.D. EF64745
 Laboratory I.D.: 084.25
 Collection Date: 8/23/2006
 Date Submitted: 8/25/2006

Constituent	Result	Units	Detection Limit	Analytical Method	Analysis Start Date
Total Phosphorus	0.035	mg/L P	0.001	EPA 365.3	9/15/2006

Comments related to sample number EF64745:



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Phone: (612)630-4439
 Fax: (612) 630-4367

Contact: Tom Leverentz

Lab Certification MN ID: 027-053-197

Lab Certification WI ID:999071150

Report To: Hydro Regulatory-WI

Attention: Rob Olson

Work Request # WIRV0806
 Date of Report 9/22/2006

Sample Description: SURFACE
 Location: BIG FALLS FLOWAGE
 Customer Sample I.D.:

LabWorks I.D. EF64744
 Laboratory I.D.: 084.24
 Collection Date: 8/23/2006
 Date Submitted: 8/25/2006

Constituent	Result	Units	Detection Limit	Analytical Method	Analysis Start Date
Chlorophyll-a	1.5	ug/L	0.041	SM 19th 10200	9/22/2006
Send Chlorophyll A	Completed				8/23/2006
Total Phosphorus	0.048	mg/L P	0.001	EPA 365.3	9/15/2006

Comments related to sample number EF64744:



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Phone: (612)630-4439

Fax: (612) 630-4367

Contact: Tom Leverentz

Lab Certification MN ID: 027-053-197

Lab Certification WI ID:999071150

Report To: Hydro Regulatory-WI

Attention: Rob Olson

Work Request # WIRV0806
 Date of Report 9/22/2006

Sample Description: BOTTOM

Location: THORNAPPLE FLOWAGE

Customer Sample I.D.:

LabWorks I.D. EF64743
 Laboratory I.D.: 084.23
 Collection Date: 8/23/2006
 Date Submitted: 8/25/2006

Constituent	Result	Units	Detection Limit	Analytical Method	Analysis Start Date
Total Phosphorus	0.040	mg/L P	0.001	EPA 365.3	9/15/2006

Comments related to sample number EF64743:



Minneapolis Testing Laboratory Report

1518 Chestnut Avenue N
 Minneapolis, MN 55403

Phone: (612)630-4439

Fax: (612) 630-4367

Contact: Tom Leverentz

Lab Certification MN ID: 027-053-197

Lab Certification WI ID:999071150

Report To: Hydro Regulatory-WI

Attention: Rob Olson

Work Request # WIRV0806
 Date of Report 9/22/2006

Sample Description: SURFACE
 Location: THORNAPPLE FLOWAGE
 Customer Sample I.D.:

LabWorks I.D. EF64742
 Laboratory I.D.: 084.22
 Collection Date: 8/23/2006
 Date Submitted: 8/25/2006

Constituent	Result	Units	Detection Limit	Analytical Method	Analysis Start Date
Chlorophyll-a	2.11	ug/L	0.041	SM 19th 10200	9/22/2006
Send Chlorophyll A	Completed				8/23/2006
Total Phosphorus	0.050	mg/L P	0.001	EPA 365.3	9/15/2006

Comments related to sample number EF64742:



Minneapolis Testing Laboratory Report

1518 Chestnut Avenue N
Minneapolis, MN 55403

Phone: (612)630-4439

Fax: (612) 630-4367

Contact: Tom Leverentz

Lab Certification MN ID: 027-053-197

Lab Certification WI ID:999071150

I certify that this analysis report was prepared under my direction or supervision under a system designed to assure that qualified personnel analyzed the submitted samples. All protocols for analysis were followed as required by Minnesota Rules and the Applicable Management Plan.

Christine M. Keefe

Christine M. Keefe
System Chemist
612-630-4506

Water Quality Sampling - Big Falls Flowage

Date: 4/26/06 11:15 A.M.

Temperature: 60°F

Weather Conditions: Sunny, 60°F, West wind @ ~10mph

Depth of Bottom Sample: 13 M

Secchi Disk Reading: 4 ft

Dissolved Oxygen and Temperature Profile

Depth	Temperature (C)	Dissolved Oxygen (mg/l)
Surface	12.4	9.9
2	12.1	10.0
4	12.0	10.0
6	12.0	10.0
8	11.9	10.0
10	11.3	10.0
12	11.2	10.2
14	11.2	10.2
16	11.2	10.2
18	11.1	10.1
20	11.1	10.0
22	11.1	9.8
24	11.1	9.8
26	11.0	9.9
28	11.0	9.9
30	11.0	9.9
32	11.0	9.9
34	11.0	9.9
36	11.0	9.9
38	11.0	9.9
40	Bottom	Bottom
42		
44		
46		

Remarks: * Sample was taken at third buoy on boat restraining barrier from the west side of the dam.

* No navigational hazards were noted in lower portion of reservoir.

H:\excel5\bigfalls\wqsheets * Searched eagle nest for nesting activity. Two adult eagles were found at the nest site.

Water Quality Sampling - Thornapple Flowage

Date: 4/26/06 1330
 Temperature: 64°F
 Weather Conditions: Sunny, West wind @ ~15mph
 Depth of Bottom Sample: 6M
 Secchi Disk Reading: 4 ft.

Dissolved Oxygen and Temperature Profile

Depth	Temperature (C)	Dissolved Oxygen (mg/L)
Surface	13.9	10.1
2	13.9	10.2
4	13.7	10.2
6	13.3	10.1
8	13.0	10.0
10	12.4	9.9
12	12.3	9.8
14	12.3	9.7
16	12.3	9.7
18	12.3	9.7
20	12.3	9.5
22	Bottom	Bottom
24		
26		
28		
30		
32		
34		
36		
38		
40		
42		
44		
46		

Remarks: * Sample was taken at the third buoy on the boat retaining barrier from the west side of the dam.
 * No navigational hazards were noted in lower portion of reservoir

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* Check eagle nest for nesting eagles and two adult eagles were at the nest site. An immature eagle was also seen flying over the reservoir.

Water Quality Sampling - Big Falls Flowage

Date: 7/24/06
 Temperature: 85°F
 Weather Conditions: Partly Cloudy, SW wind @ 10mph
 Depth of Bottom Sample: 15 m
 Secchi Disk Reading: 6 feet

Dissolved Oxygen and Temperature Profile

Depth	Temperature (C)	Dissolved Oxygen (mg/l)
Surface	25.9	7.55
2	25.4	7.46
4	25.2	7.27
6	25.1	7.18
8	25.0	6.87
10	24.9	6.78
12	24.8	6.42
14	24.7	6.06
16	24.5	5.84
18	24.5	5.64
20	24.2	6.14
22	24.0	6.38
24	24.0	6.38
26	23.9	6.30
28	23.8	6.28
30	23.8	6.20
32	23.8	5.87
34	23.7	5.47
36	21.8	0.59
38	Bottom	Bottom
40		
42		
44		
46		

Remarks: * Sample was taken at the third buoy from the west side of the boat restraining barrier
 * Flambeau River flows are extremely low (~430 cfs)
 * No navigational hazards were noted in lower portion of reservoir
 * No eagles were sighted near eagle nest and the young eagles may have already fledged.

Water Quality Sampling - Thornapple Flowage

Date: 7/24/06
 Temperature: 90°F
 Weather Conditions: Hot, Mostly sunny, South wind @ 10 mph
 Depth of Bottom Sample: 5M
 Secchi Disk Reading: 6 ft.

Dissolved Oxygen and Temperature Profile

Depth	Temperature (C)	Dissolved Oxygen (mg/l)
Surface	25.1	7.55
2	24.6	7.38
4	24.3	7.20
6	24.0	6.84
8	23.8	6.68
10	23.6	6.43
12	23.5	6.15
14	22.8	5.01
16	19.7	0.3
18	Bottom	Bottom
20		
22		
24		
26		
28		
30		
32		
34		
36		
38		
40		
42		
44		
46		

Remarks:

- * Sample was taken at the third buoy from the west side of the boat restraining barrier.
- * Flambeau River is experiencing extremely low river flows (a 430cfs)
- * No navigational hazards were noted in the lower portion of the reservoir
- * No eagles were observed near the eagle nest or on the flowage - young birds have already fledged

Water Quality Sampling - Big Falls Flowage

Date: 8/23/06
 Temperature: 68°F
 Weather Conditions: Cloudy, S wind @ 5 mph
 Depth of Bottom Sample: 38 feet
 Secchi Disk Reading: 5 feet

Dissolved Oxygen and Temperature Profile

Depth	Temperature (C)	Dissolved Oxygen (mg/l)
Surface	23.3	8.3
2	23.3	8.3
4	23.1	8.2
6	23.1	8.1
8	23.1	8.1
10	23.1	8.1
12	23.1	8.0
14	23.0	7.9
16	22.9	7.5
18	22.8	7.1
20	22.7	7.0
22	22.7	7.0
24	22.5	6.8
26	22.3	6.3
28	22.2	6.0
30	22.1	5.8
32	22.1	5.8
34	22.0	5.6
36	22.0	5.3
38	22.0	5.1
40	Bottom	Bottom
42		
44		
46		

Remarks: * Sample was taken out the third buoy from the west side of the boat restraining barrier;
 * There were no navigational buoys located near the dam
 * Eagle nest was surveyed and no eagles were observed

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* The flowage shoreline was surveyed for purple loosestrife and none was found.

Water Quality Sampling - Thornapple Flowage

Date: 8/23/06
 Temperature: 70°F Cloudy
 Weather Conditions: South wind @ 5mph
 Depth of Bottom Sample: 18 feet
 Secchi Disk Reading: 4 feet

Dissolved Oxygen and Temperature Profile

Depth	Temperature (C)	Dissolved Oxygen (mg/l)
Surface	24.3	9.6
2	24.1	9.4
4	23.6	8.6
6	23.3	7.9
8	23.3	7.8
10	23.2	7.6
12	23.2	7.4
14	23.1	7.0
16	23.0	6.7
18	22.9	5.6
20	Bottom	Bottom
22		
24		
26		
28		
30		
32		
34		
36		
38		
40		
42		
44		
46		

Remarks: * Sample was taken at the third buoy from the west side of the boat restraining barrier
 * No navigational hazards were noted near the dam
 * Eagle nest was surveyed and one lone adult eagle was located at the nest site - no young eagles were observed.
 * A survey of purple loosestrife was conducted on the ~~slough~~

**Summary Of Total Phosphorus And Chlorophyll A
Data For The Big Falls And Thornapple Flowages**

1998-2006

Summary of Water Quality Data for the Big Falls and Thornapple Flowages (1998 - 2006).

Date	<u>Big Falls Flowage</u>			<u>Thornapple Flowage</u>		
	Surface Total Phosphorus (mg/L P)	Surface Chlorophyll-A (ug/L)	Bottom Total Phosphorus (mg/L P)	Surface Total Phosphorus (mg/L P)	Surface Chlorophyll-A (ug/L)	Bottom Total Phosphorus (mg/L P)
4/22/1998	0.037	5.9	0.04	0.034	0.8	0.032
7/27/1998	0.04	2.0	0.05	0.03	7.0	0.04
8/25/1998	0.04	24.0	0.07	0.04	8.0	0.05
4/26/1999	0.04	0.5	0.13	0.04	0.5	0.05
7/23/1999	0.05	10.0	0.10	0.04	5.2	0.06
8/20/1999	0.04	7.6	0.06	0.07	0.6	0.10
4/14/2000	0.03	5.0	0.04	0.04	2.0	0.04
7/26/2000	0.05	5.0	0.12	0.05	3.9	0.07
8/25/2000	0.04	4.8	0.06	0.04	0.5	0.05
5/7/2001	0.04	0.6	0.05	0.04	1.3	0.05
7/24/2001	0.04	4.3	0.06	0.04	1.4	0.05
8/22/2001	0.04	2.2	0.06	0.04	4.8	0.04
5/13/2002	0.03	1.6	0.03	0.03	1.6	0.03
7/24/2002	0.04	1.6	0.06	0.05	0.5	0.05
8/28/2002	0.04	1.7	0.04	0.03	1.5	0.04
5/12/2003	0.03	0.7	0.03	0.04	0.5	0.04
7/28/2003	0.06	9.4	0.05	0.06	5.0	0.05
8/13/2003	0.03	5.9	0.06	0.07	10.7	0.06
5/5/2004	0.053	1.55	0.031	0.035	1.80	0.036
7/28/2004	0.037	3.10	0.084	0.050	4.60	0.049
8/25/2004	0.024	3.35	0.042	0.029	4.10	0.027
4/19/2005	0.050	0.50	0.057	0.055	0.70	0.051
7/25/2005	0.031	0.60	0.044	0.031	1.50	0.045
8/31/2005	0.020	1.50	0.092	0.029	2.75	0.030
4/26/2006	0.023	0.94	0.035	0.026	2.35	0.024
7/24/2006	0.029	< 0.50	0.099	0.035	4.03	0.041
8/23/2006	0.048	1.50	0.035	0.050	2.11	0.040
<i>Average (Ice-out sample)</i>	0.04	1.92	0.05	0.04	1.28	0.04
<i>Average (July sample)</i>	0.04	4.06	0.07	0.04	3.68	0.05
<i>Average (August sample)</i>	0.04	5.84	0.06	0.04	3.90	0.05

**Summary Of Dissolved Oxygen And
Temperature Data For The Big Falls Flowage**

1998-2006

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 1998.

Date: 4/22/1998
 Secchi Disk (ft.): 4
 Depth of Bottom Sample: 11 meters
 Weather Conditions: sunny, calm, 50 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	10.5	10.8
1.0	10.5	10.7
2.0	10.0	10.7
3.0	10.0	10.6
4.0	10.0	10.6
5.0	10.0	10.6
6.0	10.0	10.6
7.0	10.0	10.6
8.0	10.0	10.6
9.0	10.0	10.6
10.0	10.0	10.6

Date: 7/27/1998
 Secchi Disk (ft.): 4
 Depth of Bottom Sample: 33 ft.
 Weather Conditions: sunny, calm, 75 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	23.5	8.6
2.0	23.5	8.6
4.0	23.5	8.6
6.0	23.5	8.6
8.0	22.5	7.8
10.0	22.0	7.4
12.0	22.0	7.3
14.0	22.0	7.3
16.0	22.0	7.3
18.0	22.0	7.3
20.0	22.0	7.2
22.0	22.0	7.2
24.0	22.0	7.1
26.0	22.0	7.0
28.0	21.5	6.8
30.0	21.5	6.6
32.0	21.5	6.2

Date: 8/23/1998
 Secchi Disk (ft.): 3
 Depth of Bottom Sample: 35 ft.
 Weather Conditions: sunny, light wind, 85 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	23.0	9.2
2.0	22.0	9.2
4.0	22.0	9.0
6.0	22.0	8.6
8.0	22.0	8.3
10.0	22.0	7.9
12.0	21.5	7.7
14.0	21.5	7.6
16.0	21.5	7.4
18.0	21.5	7.2
20.0	21.5	6.7
22.0	21.0	6.3
24.0	21.0	6.3
26.0	21.0	6.1
28.0	21.0	5.9
30.0	21.0	5.8
32.0	21.0	5.7
34.0	20.5	5.4

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 1999.

Date: 4/26/1999
 Secchi Disk (ft.): 4
 Depth of Bottom Sample: 36 ft.
 Weather Conditions: sunny, N wind, 23 C

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	11.0	11.6
2.0	11.0	11.5
4.0	10.5	11.2
6.0	10.5	11.2
8.0	10.5	11.0
10.0	10.0	11.0
12.0	10.0	11.0
14.0	10.0	11.0
16.0	10.0	11.0
18.0	9.5	11.0
20.0	9.0	11.0
22.0	9.0	11.0
24.0	9.0	11.0
26.0	8.0	10.8
28.0	8.0	10.8
30.0	7.5	9.4
32.0	7.5	1.5
34.0	7.0	1.2

Date: 7/23/1999
 Secchi Disk (ft.): 4.5
 Depth of Bottom Sample: 45 ft.
 Weather Conditions: sunny, SW wind, 80 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	26.8	7.21
2.0	26.4	7.06
4.0	26.2	6.82
6.0	26.0	6.78
8.0	25.8	6.66
10.0	25.8	6.62
12.0	25.8	6.57
14.0	25.8	6.56
16.0	25.7	6.35
18.0	25.6	6.33
20.0	25.2	6.24
22.0	25.1	6.13
24.0	24.8	5.84
26.0	24.7	5.74
28.0	24.7	5.74
30.0	24.5	5.71
32.0	24.5	5.71
34.0	24.5	5.71
36.0	24.4	5.33
38.0	24.3	5.16
40.0	24.3	5.02

Date: 8/19/1999
 Secchi Disk (ft.): 3.5
 Depth of Bottom Sample: 46 ft.
 Weather Conditions: cloudy, light wind, 70 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	20.9	7.2
2.0	20.8	7.2
4.0	20.7	7.1
6.0	20.5	7.0
8.0	20.4	7.0
10.0	20.4	7.0
12.0	20.4	7.0
14.0	20.4	7.1
16.0	20.1	7.1
18.0	20.1	7.1
20.0	20.0	7.1
22.0	20.0	7.1
24.0	20.0	7.1
26.0	20.0	7.1
28.0	19.9	7.2
30.0	19.9	7.2
32.0	19.9	7.2
34.0	19.9	7.2
36.0	19.9	7.1
38.0	19.9	7.1
40.0	19.9	7.1
42.0	19.9	7.1

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2000.

Date: 4/12/2000
 Secchi Disk (ft.): 5.5
 Depth of Bottom Sample: 46 ft.
 Weather Conditions: sunny, E wind, 40 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	7.2	11.3
2.0	7.0	11.4
4.0	6.7	11.5
6.0	6.6	11.7
8.0	6.5	11.6
10.0	6.5	11.6
12.0	6.5	11.6
14.0	6.4	11.7
16.0	6.4	11.2
18.0	6.4	11.3
20.0	6.4	11.2
22.0	6.4	11.1
24.0	6.4	11.2
26.0	6.4	11.2
28.0	6.4	11.2
30.0	6.4	11.1
32.0	6.4	10.9
34.0	6.4	10.9
36.0	6.4	10.9
38.0	6.4	10.8
40.0	6.4	10.8

Date: 7/26/2000
 Secchi Disk (ft.): 4.5
 Depth of Bottom Sample: 37 ft.
 Weather Conditions: cloudy, S wind, 75 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	22.9	7.38
2.0	22.8	7.36
4.0	22.8	7.36
6.0	22.8	7.36
8.0	22.7	7.35
10.0	22.7	7.35
12.0	22.7	7.33
14.0	22.7	7.31
16.0	22.7	7.30
18.0	22.7	7.23
20.0	22.7	7.18
22.0	22.7	7.17
24.0	22.6	7.16
26.0	22.6	7.15
28.0	22.6	7.14
30.0	22.6	7.14
32.0	22.6	7.12
34.0	22.6	7.10
36.0	22.4	6.91
38.0	22.2	1.89

Date: 8/22/2000
 Secchi Disk (ft.): 4
 Depth of Bottom Sample: 33 ft.
 Weather Conditions: sunny, 75 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	21.1	7.84
2.0	20.4	7.82
4.0	20.3	7.96
6.0	20.3	7.97
8.0	20.3	7.98
10.0	20.2	7.95
12.0	20.2	7.95
14.0	20.2	7.91
16.0	20.0	7.99
18.0	19.8	7.92
20.0	19.7	7.91
22.0	19.6	7.91
24.0	19.6	7.91
26.0	19.6	7.94
28.0	19.6	7.94
30.0	19.6	7.94
32.0	19.6	7.94
34.0	19.6	7.92
36.0	19.6	7.92
38.0	19.6	7.89

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2001.

Date: 5/7/2001
 Secchi Disk (ft.): 4
 Depth of Bottom Sample: 12.5 m
 Weather Conditions: prtly cloudy, W wind, 19°C

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	14.6	9.5
2.0	14.5	9.4
4.0	14.2	9.4
6.0	14.1	9.4
8.0	14.0	9.4
10.0	14.0	9.4
12.0	14.0	9.4
14.0	14.0	9.4
16.0	14.0	9.3
18.0	14.0	9.3
20.0	14.0	9.3
22.0	14.0	9.3
24.0	14.0	9.2
26.0	14.0	9.2
28.0	14.0	9.2
30.0	14.0	9.2
32.0	14.0	9.2
34.0	14.0	9.2
36.0	14.0	9.2
38.0	14.0	9.1

Date: 7/24/2001
 Secchi Disk (ft.): 4.5
 Depth of Bottom Sample: 11.5 m
 Weather Conditions: ptly cloudy, 78 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	27.0	7.10
2.0	27.0	7.00
4.0	26.9	6.90
6.0	26.3	6.50
8.0	26.2	7.10
10.0	26.1	6.70
12.0	26.1	6.20
14.0	26.1	5.80
16.0	26.0	5.40
18.0	25.9	5.50
20.0	25.9	5.80
22.0	25.9	5.90
24.0	25.9	6.00
26.0	25.9	6.00
28.0	25.8	6.00
30.0	25.8	5.50
32.0	25.7	5.20
34.0	25.6	5.00
36.0	25.6	3.60
38.0	25.5	3.10

Date: 8/22/2001
 Secchi Disk (ft.): 5.5
 Depth of Bottom Sample: 11.5 m
 Weather Conditions: cloudy, 75 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	22.5	8.0
2.0	22.4	7.8
4.0	22.4	7.8
6.0	22.3	7.7
8.0	22.3	7.7
10.0	22.3	7.7
12.0	22.3	7.7
14.0	22.3	7.6
16.0	22.2	7.6
18.0	22.2	7.5
20.0	22.1	7.3
22.0	22.0	7.2
24.0	21.9	7.2
26.0	21.8	7.1
28.0	21.8	7.0
30.0	21.7	7.0
32.0	21.2	6.7
34.0	21.1	6.6
36.0	21.0	6.6
38.0	20.9	6.4

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2002.

Date: 5/13/2002
 Secchi Disk (ft.): 4
 Depth of Bottom Sample: 6.5 m
 Weather Conditions: cloudy, NW wind, 50F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	7.9	11.4
2.0	7.8	11.5
4.0	7.8	11.5
6.0	7.8	11.5
8.0	7.8	11.5
10.0	7.8	11.5
12.0	7.8	11.5
14.0	7.8	11.5
16.0	7.8	11.5
18.0	7.8	11.5
20.0	7.8	11.5
22.0	7.8	11.4
24.0	7.8	11.4

Could not sample earlier due to excessively high river flows

Date: 7/24/2002
 Secchi Disk (ft.): 5
 Depth of Bottom Sample: 11.5 m
 Weather Conditions: ptly cloudy, 70 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	24.8	7.3
2.0	24.8	7.3
4.0	24.7	7.2
6.0	24.6	7.2
8.0	24.5	7.2
10.0	24.4	7.1
12.0	24.4	7.1
14.0	24.4	7.1
16.0	24.4	7.1
18.0	24.4	7.1
20.0	24.4	7.1
22.0	24.3	7.1
24.0	24.3	7.1
26.0	24.3	7.1
28.0	24.3	7.1
30.0	24.3	7.1
32.0	24.3	7.0
34.0	24.3	7.0
36.0	24.3	7.0

Date: 8/28/2002
 Secchi Disk (ft.): 4.75
 Depth of Bottom Sample: 37 ft.
 Weather Conditions: cloudy, 75 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	23.8	7.4
2.0	23.3	7.5
4.0	23.1	7.5
6.0	23.1	7.5
8.0	23.0	7.5
10.0	22.9	7.4
12.0	22.8	7.3
14.0	22.8	7.3
16.0	22.8	7.3
18.0	22.8	7.3
20.0	22.8	7.3
22.0	22.8	7.3
24.0	22.7	7.3
26.0	22.7	7.2
28.0	22.6	7.1
30.0	22.4	6.9
32.0	22.3	6.9
34.0	22.3	6.8
36.0	22.2	6.6
38.0	22.1	6.1

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2003.

Date: 5/19/2003
 Secchi Disk (ft.): 4.5
 Depth of Bottom Sample: 37 ft.
 Weather Conditions: cloudy, S wind, 65 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	16.1	8.50
2.0	16.1	8.61
4.0	16.1	8.73
6.0	16.1	8.68
8.0	16.1	8.68
10.0	16.1	8.68
12.0	16.1	8.66
14.0	16.1	8.65
16.0	16.1	8.65
18.0	16.1	8.68
20.0	16.1	8.63
22.0	16.1	8.65
24.0	16.1	8.65
26.0	16.1	8.66
28.0	16.1	8.66
30.0	16.1	8.65
32.0	16.1	8.67
34.0	16.1	8.67
36.0	16.1	8.67
38.0	16.1	8.63

Date: 7/28/2003
 Secchi Disk (ft.): 6
 Depth of Bottom Sample: 11.5 m
 Weather Conditions: clear, calm, 70 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	26.3	7.83
2.0	25.8	7.82
4.0	25.2	7.58
6.0	25.0	7.42
8.0	25.0	7.35
10.0	24.9	7.28
12.0	24.8	7.06
14.0	24.8	6.91
16.0	24.7	6.91
18.0	24.6	6.88
20.0	24.5	6.78
22.0	24.4	6.70
24.0	24.3	6.62
26.0	24.2	6.44
28.0	23.7	6.12
30.0	23.1	5.67
32.0	22.8	5.44
34.0	22.6	4.95
36.0	21.9	4.45
38.0	21.3	3.95

Date: 8/13/2003
 Secchi Disk (ft.): 6
 Depth of Bottom Sample: 11 m
 Weather Conditions: sunny, calm, 80 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	25.9	8.30
2.0	25.6	8.33
4.0	25.0	8.39
6.0	24.8	7.96
8.0	24.6	7.19
10.0	24.4	6.86
12.0	24.3	6.71
14.0	24.2	6.58
16.0	24.1	6.44
18.0	23.9	6.16
20.0	23.9	6.03
22.0	23.8	6.23
24.0	23.8	6.20
26.0	23.7	5.83
28.0	23.5	5.81
30.0	23.5	5.78
32.0	23.5	5.75
34.0	23.4	5.18
36.0	22.9	3.55

Could not sample earlier due to excessively high river flows

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2004.

Date: 5/5/2004
 Secchi Disk (ft.): 5.5
 Depth of Bottom Sample: 11.5 m
 Weather Conditions: cloudy, S wind, 50 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	12.4	10.1
2.0	12.4	10.4
4.0	12.4	10.4
6.0	12.4	10.2
8.0	12.3	10.3
10.0	12.2	10.4
12.0	12.1	10.4
14.0	12.1	10.6
16.0	12.1	10.6
18.0	12.0	10.6
20.0	11.9	10.5
22.0	11.8	10.3
24.0	11.7	10.3
26.0	11.6	10.3
28.0	11.6	10.3
30.0	11.6	10.2
32.0	11.6	10.2
34.0	11.6	10.2
36.0	11.5	10.2
38.0	11.3	10.1
40.0	11.3	9.7

Date: 7/28/2004
 Secchi Disk (ft.): 6.5
 Depth of Bottom Sample: 12 m
 Weather Conditions: clear, S wind, 75 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	24.2	7.4
2.0	24.2	8.0
4.0	24.1	8.1
6.0	24.0	8.1
8.0	24.0	7.6
10.0	23.9	7.1
12.0	23.9	6.4
14.0	23.7	6.1
16.0	23.5	6.0
18.0	23.3	5.7
20.0	23.1	5.6
22.0	23.0	5.3
24.0	22.8	5.1
26.0	22.7	4.9
28.0	22.5	4.1
30.0	22.4	4.4
32.0	22.2	4.2
34.0	22.0	3.9
36.0	21.7	3.2
38.0	20.4	1.1

Date: 8/25/2004
 Secchi Disk (ft.): 6.5
 Depth of Bottom Sample: 37 ft.
 Weather Conditions: cloudy, 75 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	21.2	8.9
2.0	21.2	8.9
4.0	19.8	8.8
6.0	19.7	8.8
8.0	19.6	8.7
10.0	19.6	8.7
12.0	19.6	8.6
14.0	19.6	8.5
16.0	19.6	8.4
18.0	19.5	8.3
20.0	19.4	8.4
22.0	19.2	8.3
24.0	19.2	8.2
26.0	19.0	8.2
28.0	18.8	7.8
30.0	18.7	7.8
32.0	18.4	7.4
34.0	18.2	7.2
36.0	17.9	5.4
38.0	17.6	4.4

Could not sample earlier due to excessively high river flows

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2005.

Date: 4/19/2005
 Secchi Disk (ft.): 5.5
 Depth of Bottom Sample: 11 m
 Weather Conditions: prtly cldy, S wind, 70 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	15.4	10.1
2.0	15.2	10.2
4.0	14.9	10.2
6.0	14.8	10.2
8.0	14.8	10.2
10.0	14.8	10.2
12.0	14.8	10.2
14.0	14.8	10.2
16.0	14.8	10.2
18.0	14.7	10.1
20.0	14.6	10.1
22.0	14.7	9.8
24.0	14.8	9.9
26.0	14.7	10.0
28.0	14.7	10.0
30.0	14.7	10.0
32.0	14.6	10.0
34.0	14.6	10.0
36.0	14.6	10.0
38.0	14.5	9.9
40.0	14.3	9.6

Date: 7/25/2005
 Secchi Disk (ft.): 4
 Depth of Bottom Sample: 12.5 m
 Weather Conditions: cloudy, S wind, 75 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	26.5	6.3
2.0	26.4	6.2
4.0	26.2	6.0
6.0	26.1	5.9
8.0	26.1	5.9
10.0	26.0	5.7
12.0	25.9	5.9
14.0	25.7	5.6
16.0	25.5	5.3
18.0	25.4	5.0
20.0	25.2	5.2
22.0	25.1	5.0
24.0	25.1	5.0
26.0	25.1	5.1
28.0	25.1	5.2
30.0	25.0	5.5
32.0	24.9	5.3
34.0	24.9	5.1
36.0	24.8	4.2
38.0	22.4	0.2

Date: 8/31/2005
 Secchi Disk (ft.): 7
 Depth of Bottom Sample: 37 ft.
 Weather Conditions: Mstly sny, 65 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	21.6	8.2
2.0	21.5	8.2
4.0	21.3	8.3
6.0	21.2	8.1
8.0	21.1	8.0
10.0	21.1	8.0
12.0	21.0	8.0
14.0	21.0	8.0
16.0	21.0	8.0
18.0	20.9	8.0
20.0	20.9	7.9
22.0	20.9	7.7
24.0	20.8	7.5
26.0	20.8	7.4
28.0	20.6	6.9
30.0	20.5	6.7
32.0	20.5	6.6
34.0	20.5	6.5
36.0	20.5	6.4
38.0	20.5	2.3

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2006.

Date: 4/26/2006
 Secchi Disk (ft.): 4
 Depth of Bottom Sample: 13 m
 Weather Conditions: sunny, west wind @ 10 mph

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	12.4	9.9
2.0	12.1	10.0
4.0	12.0	10.0
6.0	12.0	10.0
8.0	11.9	10.0
10.0	11.3	10.0
12.0	11.2	10.2
14.0	11.2	10.2
16.0	11.2	10.2
18.0	11.1	10.1
20.0	11.1	10.0
22.0	11.1	9.8
24.0	11.1	9.8
26.0	11.0	9.9
28.0	11.0	9.9
30.0	11.0	9.9
32.0	11.0	9.9
34.0	11.0	9.9
36.0	11.0	9.9
38.0	11.0	9.9
40.0	Bottom	Bottom

Date: 7/24/2006
 Secchi Disk (ft.): 6
 Depth of Bottom Sample: 15 m
 Weather Conditions: Prtly cloudy, south wind at 10 mph

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	25.9	7.6
2.0	25.4	7.5
4.0	25.2	7.3
6.0	25.1	7.2
8.0	25.0	6.9
10.0	24.9	6.8
12.0	24.8	6.4
14.0	24.7	6.1
16.0	24.5	5.8
18.0	24.5	5.6
20.0	24.2	6.1
22.0	24.0	6.4
24.0	24.0	6.4
26.0	23.9	6.3
28.0	23.8	6.3
30.0	23.8	6.2
32.0	23.8	5.9
34.0	23.7	5.5
36.0	21.8	0.6
38.0	Bottom	Bottom
40.0		

Date: 8/23/2006
 Secchi Disk (ft.): 5
 Depth of Bottom Sample: 38 ft.
 Weather Conditions: Cloudy, south wind @ 5 mph

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	23.3	8.3
2.0	23.3	8.3
4.0	23.1	8.2
6.0	23.1	8.1
8.0	23.1	8.1
10.0	23.1	8.1
12.0	23.1	8.0
14.0	23.0	7.9
16.0	22.9	7.5
18.0	22.8	7.1
20.0	22.7	7.0
22.0	22.7	7.0
24.0	22.5	6.8
26.0	22.3	6.3
28.0	22.2	6.0
30.0	22.1	5.8
32.0	22.1	5.8
34.0	22.0	5.6
36.0	22.0	5.3
38.0	22.0	5.1
40.0	Bottom	Bottom

**Summary Of Dissolved Oxygen And
Temperature Data For The Thornapple Flowage**

1998-2006

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 1998.

Date: 4/22/1998			Date: 7/27/1998			Date: 8/23/1998		
Secchi Disk (ft.): 6			Secchi Disk (ft.): 5			Secchi Disk (ft.): 3.5		
Depth of Bottom Sample: 8 meters			Depth of Bottom Sample: 19 ft.			Depth of Bottom Sample: 19		
Weather Conditions: sunny, calm, 55 F			Weather Conditions: sunny, calm, 70 F			Weather Conditions: sunny, light wind, 90 F		
Dissolved			Dissolved			Dissolved		
Depth (ft.)	Temperature (celsius)	Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Oxygen (mg/l)
Surface	11.0	10.5	Surface	24.0	8.9	Surface	22.5	9.3
1.0	10.5	10.5	2.0	24.0	8.8	2.0	22.5	9.1
2.0	10.0	10.5	4.0	24.0	8.7	4.0	22.0	8.5
3.0	10.0	10.4	6.0	23.0	8.3	6.0	22.0	8.1
4.0	10.0	10.2	8.0	22.5	7.8	8.0	21.5	7.4
5.0	10.0	10.2	10.0	22.5	7.4	10.0	21.5	7.3
6.0	10.0	10.2	12.0	22.5	6.9	12.0	21.5	7.3
7.0	9.5	10.2	14.0	22.0	6.5	14.0	21.5	7.2
8.0	9.5	10.2	16.0	22.0	6.3	16.0	21.5	7.1
9.0	9.5	10.2	18.0	22.0	5.9	18.0	20.5	5.8
10.0	9.5	10.2						

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 1999.

Date: 4/26/1999			Date: 7/23/1999			Date: 8/19/1999		
Secchi Disk (ft.): 4			Secchi Disk (ft.): 6.5			Secchi Disk (ft.): 4.5		
Depth of Bottom Sample: 22.5 ft.			Depth of Bottom Sample: 23 ft.			Depth of Bottom Sample: 22		
Weather Conditions: sunny, N wind, 23 C			Weather Conditions: sunny, SW wind, 85 F			Weather Conditions: cloudy, calm, 70 F		
Dissolved			Dissolved			Dissolved		
Depth (ft.)	Temperature (celsius)	Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Oxygen (mg/l)
Surface	12.0	11.4	Surface	27.0	6.32	Surface	21.1	6.9
2.0	11.5	11.2	2.0	25.6	6.24	2.0	20.6	6.5
4.0	11.5	11.2	4.0	25.1	5.99	4.0	20.5	6.4
6.0	11.0	11.2	6.0	24.9	5.85	6.0	20.4	6.3
8.0	10.5	11.0	8.0	24.8	5.83	8.0	20.3	6.3
10.0	10.5	10.9	10.0	24.8	5.82	10.0	20.3	6.3
12.0	10.5	10.9	12.0	24.7	5.78	12.0	20.4	6.3
14.0	10.0	10.9	14.0	24.7	5.72	14.0	20.3	6.2
16.0	9.5	10.9	16.0	24.7	5.67	16.0	20.3	6.2
18.0	8.5	9.8	18.0	24.7	5.63	18.0	20.3	6.2
20.0	8.5	8.6	20.0	24.7	5.62	20.0	20.3	6.2
			22.0	24.7	5.58			

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2000.

Date: 4/12/2000
 Secchi Disk (ft.): 5
 Depth of Bottom Sample: 23 ft.
 Weather Conditions: sunny, NE wind, 45F

Date: 7/26/2000
 Secchi Disk (ft.): 4
 Depth of Bottom Sample: 19.5 ft.
 Weather Conditions: cloudy, S wind, 80 F

Date: 8/22/2000
 Secchi Disk (ft.): 5.5
 Depth of Bottom Sample: 17 ft.
 Weather Conditions: cloudy, 78 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	7.8	11.7
2.0	7.3	11.5
4.0	6.5	11.3
6.0	6.2	11.2
8.0	6.1	11.3
10.0	6.1	11.4
12.0	6.1	11.4
14.0	6.1	11.6
16.0	6.1	11.5
18.0	6.1	11.4
20.0	6.1	11.4

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	23.6	6.80
2.0	23.3	6.80
4.0	22.9	6.81
6.0	22.8	6.79
8.0	22.8	6.69
10.0	22.8	6.74
12.0	22.8	6.73
14.0	22.7	6.69
16.0	22.7	6.59
18.0	22.7	6.56
20.0	22.7	6.56
22.0	22.7	6.40
24.0	22.6	1.8
26.0	22.6	<1

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	23.1	6.99
2.0	22.5	7.05
4.0	22.3	7.03
6.0	21.8	7.03
8.0	21.7	6.94
10.0	21.6	6.89
12.0	21.6	6.87
14.0	21.6	6.87
16.0	21.6	6.79
18.0	21.6	6.72
20.0	21.4	6.38

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2001.

Date: 5/7/2001
 Secchi Disk (ft.): 4
 Depth of Bottom Sample: 6 m
 Weather Conditions: cloudy, W wind, 15 C

Date: 7/24/2001
 Secchi Disk (ft.): 4.5
 Depth of Bottom Sample: 5 m
 Weather Conditions: partly cloudy, 75 F

Date: 8/22/2001
 Secchi Disk (ft.): 5.5
 Depth of Bottom Sample: 17 ft.
 Weather Conditions: cloudy, 78 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	14.5	8.9
2.0	14.5	8.9
4.0	14.4	9.0
6.0	14.4	9.0
8.0	14.4	9.0
10.0	14.4	9.0
12.0	14.4	9.0
14.0	14.3	9.0
16.0	14.3	8.9
18.0	14.3	8.9
20.0	14.3	8.1

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	25.7	6.20
2.0	25.5	6.20
4.0	25.2	6.40
6.0	25.1	6.40
8.0	25.0	9.80
10.0	25.0	7.20
12.0	25.0	5.60
14.0	25.0	5.40
16.0	24.9	5.40
18.0	24.4	4.60
20.0	24.0	4.10

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	27.4	8.4
2.0	25.5	8.5
4.0	24.3	8.5
6.0	23.8	8.1
8.0	23.3	7.8
10.0	23.1	7.0
12.0	22.9	6.7
14.0	22.8	7.1
16.0	22.5	6.0
18.0	22.4	5.9
20.0	22.3	5.8
22.0	22.3	5.5

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2002.

Date: 5/13/2002	Date: 7/24/2002	Date: 8/28/2002
Secchi Disk (ft.): 4	Secchi Disk (ft.): 4.5	Secchi Disk (ft.): 5
Depth of Bottom Sample: 5.5 m	Depth of Bottom Sample: 5.5 m	Depth of Bottom Sample: 17 ft.
Weather Conditions: cloudy, W wind, 52 F	Weather Conditions: partly cloudy, 75 F	Weather Conditions: cloudy, 70 F
Dissolved	Dissolved	Dissolved
Depth (ft.)	Depth (ft.)	Depth (ft.)
Temperature (celsius)	Temperature (celsius)	Temperature (celsius)
Oxygen (mg/l)	Oxygen (mg/l)	Oxygen (mg/l)
Surface	Surface	Surface
2.0	2.0	2.0
4.0	4.0	4.0
6.0	6.0	6.0
8.0	8.0	8.0
10.0	10.0	10.0
12.0	12.0	12.0
14.0	14.0	14.0
16.0	16.0	16.0
18.0	18.0	16.0
20.0	18.0	18.0
8.7	25.2	22.5
8.6	25.1	22.5
8.6	24.9	22.5
8.6	24.6	22.5
8.6	24.5	22.4
8.6	24.4	22.4
8.6	24.4	22.4
8.6	24.4	22.4
8.6	24.4	22.4
8.6	24.4	22.4
12.5	5.7	7.4
12.1	5.7	7.4
	5.7	7.3

Could not sample earlier due to high river flows

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2003.

Date: 5/19/2003	Date: 7/28/2003	Date: 8/13/2003
Secchi Disk (ft.): 4.5	Secchi Disk (ft.): 6.5	Secchi Disk (ft.): 5
Depth of Bottom Sample: 19 ft.	Depth of Bottom Sample: 6 m	Depth of Bottom Sample: 6 m
Weather Conditions: cloudy, S wind, 65 F	Weather Conditions: clear, calm, 70 F	Weather Conditions: clear, calm, 75 F
Dissolved	Dissolved	Dissolved
Depth (ft.)	Depth (ft.)	Depth (ft.)
Temperature (celsius)	Temperature (celsius)	Temperature (celsius)
Oxygen (mg/l)	Oxygen (mg/l)	Oxygen (mg/l)
Surface	Surface	Surface
2.0	2.0	2.0
4.0	4.0	4.0
6.0	6.0	6.0
8.0	8.0	8.0
10.0	10.0	10.0
12.0	12.0	12.0
14.0	14.0	14.0
16.0	16.0	16.0
18.0	18.0	18.0
20.0	20.0	20.0
13.8	24.5	24.5
13.7	24.4	24.3
13.7	24.3	24.2
13.7	24.3	24.0
13.7	24.3	23.7
13.7	24.3	23.4
13.7	24.0	23.4
13.7	22.9	23.2
13.7	22.6	23.0
13.7	22.3	22.5
13.7	21.9	22.1
9.72	6.73	8.73
9.75	7.00	8.78
9.77	6.97	8.68
9.77	6.89	8.00
9.71	6.79	7.55
9.71	6.79	5.95
9.72	6.29	5.79
9.69	5.43	6.03
9.69	5.18	4.68
9.67	4.71	2.62
9.67	3.75	1.34

Could not sample earlier due to high river flows

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2004.

Date: 5/5/2004	Date: 7/28/2004	Date: 8/25/2004
Secchi Disk (ft.): 5	Secchi Disk (ft.): 5	Secchi Disk (ft.): 5.5
Depth of Bottom Sample: 6 m	Depth of Bottom Sample: 19.5 ft	Depth of Bottom Sample: 6 m
Weather Conditions: cloudy, S wind, 60 F	Weather Conditions: partly sunny, 75 F	Weather Conditions: overcast, 70 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	10.0	10.1
2.0	10.0	10.3
4.0	10.0	10.4
6.0	10.0	10.6
8.0	10.0	10.6
10.0	9.9	10.6
12.0	9.9	10.6
14.0	9.9	10.6
16.0	9.8	10.6
18.0	9.8	10.6
20.0	9.8	10.3

Could not sample earlier due to high river flows

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	23.2	7.6
2.0	23.2	7.6
4.0	22.6	7.1
6.0	22.1	6.5
8.0	21.9	6.2
10.0	21.9	6.2
12.0	21.8	6.2
14.0	21.3	5.8
16.0	21.1	6.2
18.0	20.4	2.4
20.0	19.2	0.9

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	20.4	9.4
2.0	20.3	9.2
4.0	20.2	9.0
6.0	20.1	8.8
8.0	19.9	8.4
10.0	19.8	8.4
12.0	19.5	8.0
14.0	19.4	7.9
16.0	19.4	7.9
18.0	19.3	7.7
20.0	18.6	5.9

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2005.

Date: 4/19/2005	Date: 7/25/2005	Date: 8/31/2005
Secchi Disk (ft.): 5	Secchi Disk (ft.): 4	Secchi Disk (ft.): 5.5
Depth of Bottom Sample: 6 m	Depth of Bottom Sample: 6 m	Depth of Bottom Sample: 6 m
Weather Conditions: cloudy, S wind, 70 F	Weather Conditions: cldy, S wind, 82 F	Weather Conditions: Sunny, S wind, 70 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	10.2	10.7
2.0	10.2	10.7
4.0	10.1	10.8
6.0	10.1	10.8
8.0	10.1	10.8
10.0	10.0	10.8
12.0	9.9	10.8
14.0	9.8	10.8
16.0	9.8	10.8
18.0	9.8	10.8
20.0	9.8	10.8

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	25.4	7.4
2.0	25.0	7.0
4.0	24.7	6.7
6.0	24.5	6.4
8.0	24.4	6.0
10.0	23.8	5.2
12.0	23.5	5.3
14.0	23.3	4.8
16.0	23.2	4.6
18.0	22.3	0.8
20.0		

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	22.4	8.1
2.0	21.9	7.9
4.0	21.5	7.7
6.0	21.4	7.4
8.0	21.3	7.4
10.0	21.3	7.4
12.0	21.3	7.3
14.0	21.2	7.3
16.0	21.2	7.2
18.0	21.2	7.2
20.0	21.2	7.1

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2006.

Date: 4/26/2006
 Secchi Disk (ft.): 4
 Depth of Bottom Sample: 6 m
 Weather Conditions: sunny, W wind @ 15 mph

Date: 7/24/2006
 Secchi Disk (ft.): 6
 Depth of Bottom Sample: 5 m
 Weather Conditions: Mstly sunny, S wind@10mph

Date: 8/23/2006
 Secchi Disk (ft.): 4
 Depth of Bottom Sample: 6 m
 Weather Conditions: Cloudy, S wind@5 mph

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	13.9	10.1
2.0	13.9	10.2
4.0	13.7	10.2
6.0	13.3	10.1
8.0	13.0	10.0
10.0	12.4	9.9
12.0	12.3	9.8
14.0	12.3	9.7
16.0	12.3	9.7
18.0	12.3	9.7
20.0	12.3	9.5
22.0	Bottom	Bottom

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	25.1	7.6
2.0	24.6	7.4
4.0	24.3	7.2
6.0	24.0	6.8
8.0	23.8	6.7
10.0	23.6	6.4
12.0	23.5	6.2
14.0	22.8	5.0
16.0	19.7	0.3
18.0	Bottom	Bottom

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	24.3	9.6
2.0	24.1	9.4
4.0	23.6	8.6
6.0	23.3	7.9
8.0	23.3	7.8
10.0	23.2	7.6
12.0	23.2	7.4
14.0	23.1	7.0
16.0	23.0	6.7
18.0	22.9	5.6
20.0	Bottom	Bottom

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Agency Correspondence



1414 West Hamilton Avenue
P.O. Box 8
Eau Claire, WI 54702-0008

October 23, 2006

Mr. Jeff Scheirer
Wisconsin DNR
875 South 4th Avenue
Park Falls, WI 54552

Subject: Results of the 2006 Water Quality Monitoring Performed On The Big Falls and Thornapple Flowages Pursuant To Article 404 of the Big Falls License (FERC Project No. 2390) and Article 406 of the Thornapple License (FERC Project No. 2475).

Dear Mr. Scheirer:

Enclosed are the results of the water quality sampling effort that Northern States Power Company – Wisconsin (d.b.a. Xcel Energy) personnel conducted during the 2006 field season on the Big Falls and Thornapple Flowages. The samples were taken after ice-out and during July and August, in the deepest point of the reservoirs, immediately upstream from the boat restraining barriers.

I have summarized all of the water quality data for the two sites that we have collected since sampling began in 1998. While there appears to be some variability in some of the parameters analyzed, for the most part, the results have been relatively consistent. The data collected in 2006 is consistent with data from the previous years' sampling.

Please provide me with any comments that you might have concerning the sampling results by November 30, 2006 so that I can transmit the water quality data and any comments that you might have to the Federal Energy Regulatory Commission by the end of this year. You can provide your response either by telephone call, e-mail, or written letter. If you have any questions concerning the water quality sampling or the results provided to you, please feel free to give me a call at (715) 839-1353.

Sincerely,

Robert W. Olson
Hydro Licensing Specialist

Enclosure: Water quality monitoring results