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Xcel Energy®

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

January 29, 2010

Ms. Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, D.C. 20426

Subject: **2009 Water Quality Monitoring Report For Big Falls Hydro (FERC Project #2390-01) And Thornapple Hydro (FERC Project #2475)**

Dear Secretary:

Enclosed are the results of the water quality monitoring that Northern States Power Company – Wisconsin (NSPW), an Xcel Energy Company, conducted during the 2009 field season on the Big Falls and Thornapple Flowages. The samples were obtained after ice-out, in late July, and late August per the Federal Energy Regulatory Commission's license requirement to monitor long-term changes in water quality.

Included in the report is a summary of water quality data for the two flowages since 2003. While there appears to be variability in some of the parameters analyzed, overall, the results have been relatively consistent. The data collected in 2009 is consistent with data from the previous years' sampling.

This report was filed with the Wisconsin Department of Natural Resources (WDNR) on December 17, 2009. The WDNR was provided 30 days to submit comments and to date no correspondence has been received. Should you have any questions regarding this report, feel free to contact Matthew Miller of this office at (715) 737-1353 or by electronic mail at matthew.j.miller@xcelenergy.com.

Sincerely,

William Zawacki
Director, Hydro Plants

Enclosure: Water Quality Monitoring Report

C: Mr. Jeff Scheirer (WDNR)

H:\References\All Plants\Water Quality Monitoring\Annual Reports\ 2010 Letter to FERC 012910.doc

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Agency Correspondence

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December 17, 2009

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

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

Subject: **2009 Water Quality Monitoring Report For Big Falls Flowage (FERC Project #2390-01), Thornapple Flowage (FERC Project #2475) And Turtle-Flambeau Flowage (FERC Project 2390-02).**

Dear Mr. Scheirer:

Enclosed are the results of the water quality sampling that Northern States Power Company – Wisconsin (NSPW) conducted during the 2009 field season on Big Falls and Thornapple Flowages. The samples were taken after ice-out and in late July and August. The samples were acquired from the deepest point of the reservoirs immediately upstream from the boat restraining barriers. Northern Lake Service, Inc. of Crandon, WI performed the chlorophyll analysis and NSPW's Chestnut Service Center performed the phosphorous analysis.

Also included in this year's report are the water quality sampling results for the Turtle-Flambeau Flowage (TFF) conducted by the citizen's self-help lake monitoring program. The results of the TFF sampling are being provided to you pursuant to Item J of the Water Quality Certificate of the October 14, 2008 Federal Energy Regulatory Commission's order amending the Big Falls Hydro Project to include the Turtle-Flambeau Flowage. The TFF results are also available on the WDNR's website.

The results for Big Falls and Thornapple are summarized for the past six years. 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 2009 is consistent with data from the previous years' sampling.

Please provide me with any comments that you might have concerning the sampling results by January 20, 2010 so that I can file the report and any comments that you might have to the Federal Energy Regulatory Commission by the end of January. You can provide your response either by telephone call, e-mail, or written letter. NSPW will continue to work with the WDNR to begin entering water quality data directly into the state database thus eliminating the need to file a hard copy report. Should you have any questions concerning this report, feel free to give me a call at (715) 737-1353 or email me at matthew.j.miller@xcelenergy.com.

Sincerely,

Matthew J. Miller

Matthew J. Miller
Hydro Licensing Specialist

Enclosure: Water quality monitoring results

H:\MLLM40\References\All Plants\Water Quality Monitoring\Annual Reports\2009\2009 Letter To DNR 121709.doc

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Summary Of Total Phosphorous And Chlorophyll A

Data For The Big Falls And Thornapple Flowages

2003 - 2009

Summary of Water Quality Data for the Big Falls and Thornapple Flowages (2003 - 2009).

	Big Falls Flowage			Thornapple Flowage		
Date	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)
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
4/30/2007	0.028	1.95	0.067	0.039	4.50	0.033
7/31/2007	0.029	4.81	0.043	0.037	3.35	0.032
8/29/2007	0.052	4.45	0.027	0.049	2.93	0.033
4/30/2008	0.024	0.579	0.031	0.030	0.961	0.029
7/23/2008	0.032	2.80	0.043	0.041	11.0	0.051
8/26/2008	0.030	3.70	0.047	0.032	13.0	0.034
4/28/2009	**0.030**	**5.5**	**0.033**	**0.040**	**11.0**	**0.033**
7/28/2009	**0.033**	**6.9**	**0.099**	**0.021**	**4.8**	**0.053**
8/24/2009	**0.021**	**5.0**	**0.032**	**0.023**	**3.6**	**0.075**
Average (Ice-out sample)	**0.03**	**1.67**	**0.04**	**0.04**	**3.12**	**0.04**
Average (July sample)	**0.04**	**4.02**	**0.07**	**0.04**	**4.90**	**0.05**
Average (August sample)	**0.03**	**3.63**	**0.05**	**0.04**	**5.60**	**0.04**

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2009 Water Quality Laboratory Analysis

For The Big Falls And Thornapple Flowages

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Xcel Energy

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Phone: (612)630-4506
Fax: (612) 630-4367
Contact: Christine Keefe
Lab Certification MN ID: 027-053-197
Lab Certification WI ID:999071150

Minneapolis Testing Laboratory Report

Report To: Hydro Regulatory-WI
Enviromental Services-WI

Attention: Matt Miller
Leroy Wilder

Work Request # WIHY0409
Date of Report 6/2/2009

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

LabWorks I.D. EG37474
Laboratory I.D.: 234.40
Collection Date: 4/28/2009
Date Submitted: 4/30/2009

Constituent	Result	Units	Analyst	Detection Limit	Reporting Limit	Analytical Method	Analysis Start Date
Total Phosphorus	0.033	mg/L P	HSD	0.001	0.01	EPA 365.3	5/14/2009

Comments related to sample number EG37474:

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Results are representative of submitted samples and not necessarily the original sample source.

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Lab Certification WI ID:999071150

Minneapolis Testing Laboratory Report

Report To: Hydro Regulatory-WI
Enviromental Services-WI

Attention: Matt Miller
Leroy Wilder

Work Request # WIHY0409
Date of Report 6/2/2009

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

LabWorks I.D. EG37475
Laboratory I.D.: 235.01
Collection Date: 4/28/2009
Date Submitted: 4/30/2009

Constituent	Result	Units	Analyst	Detection Limit	Reporting Limit	Analytical Method	Analysis Start Date
Chlorophyll-a	5.5	ug/L	_SERVICE	0.041	0.5	SM 19th 10200 H	4/30/2009
Send Chlorophyll A	Completed		MJM				4/28/2009
Total Phosphorus	0.030	mg/L P	HSD	0.001	0.01	EPA 365.3	5/14/2009

Comments related to sample number EG37475:

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Results are representative of submitted samples and not necessarily the original sample source.

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Lab Certification WI ID:999071150

Minneapolis Testing Laboratory Report

Report To: Hydro Regulatory-WI
Enviromental Services-WI

Attention: Matt Miller
Leroy Wilder

Work Request # WIHY0409
Date of Report 6/2/2009

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

LabWorks I.D. EG37476
Laboratory I.D.: 235.01
Collection Date: 4/28/2009
Date Submitted: 4/30/2009

Constituent	Result	Units	Analyst	Detection Limit	Reporting Limit	Analytical Method	Analysis Start Date
Total Phosphorus	0.033	mg/L P	HSD	0.001	0.01	EPA 365.3	5/14/2009

Comments related to sample number EG37476:

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Lab Certification WI ID:999071150

Minneapolis Testing Laboratory Report

Report To: Hydro Regulatory-WI
Enviromental Services-WI

Attention: Matt Miller
Leroy Wilder

Work Request # WIHY0409
Date of Report 6/2/2009

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

LabWorks I.D. EG37477
Laboratory I.D.: 235.01
Collection Date: 4/28/2009
Date Submitted: 4/30/2009

Constituent	Result	Units	Analyst	Detection Limit	Reporting Limit	Analytical Method	Analysis Start Date
Chlorophyll-a	11	ug/L	_SERVICE	0.041	0.5	SM 19th 10200 H	4/30/2009
Send Chlorophyll A	Completed		MJM				4/28/2009
Total Phosphorus	0.040	mg/L P	HSD	0.001	0.01	EPA 365.3	5/14/2009

Comments related to sample number EG37477:

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Minneapolis Testing Laboratory Report

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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 Applicible Management Plan.

Christine M. Keefe

Christine M. keefe
System Chemist
612-630-4506

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Minneapolis Testing Laboratory Report

Report To: Hydro Operation
Enviromental Services-WI

Attention: Matt Miller
Leroy Wilder

Work Request # WIHY0709
Date of Report 8/24/2009

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

LabWorks I.D. EG45575
Laboratory I.D.: 1016.27
Collection Date: 7/28/2009
Date Submitted: 7/30/2009

Constituent	Result	Units	Analyst	Detection Limit	Reporting Limit	Analytical Method	Analysis Start Date
Total Phosphorus	0.099	mg/L P	CMK	0.001	0.01	EPA 365.3	8/20/2009

Comments related to sample number EG45575:

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Lab Certification MN ID: 027-053-197
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Minneapolis Testing Laboratory Report

Report To: Hydro Regulatory-WI
Enviromental Services-WI

Attention: Matt Miller
Leroy Wilder

Work Request # WIHY0709
Date of Report 8/24/2009

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

LabWorks I.D. EG45574
Laboratory I.D.: 1016.26
Collection Date: 7/28/2009
Date Submitted: 7/30/2009

Constituent	Result	Units	Analyst	Detection Limit	Reporting Limit	Analytical Method	Analysis Start Date
Chlorophyll-a	6.9	ug/L	NLS INC	0.041	0.5	SM 19th 10200 H	8/13/2009
Send Chlorophyll A	Completed		MJM				7/28/2009
Total Phosphorus	0.033	mg/L P	CMK	0.001	0.01	EPA 365.3	8/20/2009

Comments related to sample number EG45574:

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Contact: Christine Keefe
Lab Certification MN ID: 027-053-197
Lab Certification WI ID:999071150

Minneapolis Testing Laboratory Report

Report To:

Attention: ERAD- WI
Leroy Wilder
Matt Miller

Work Request # WIHY0709
Date of Report 8/24/2009

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

LabWorks I.D. EG45577
Laboratory I.D.: 1016.29
Collection Date: 7/28/2009
Date Submitted: 7/30/2009

Constituent	Result	Units	Analyst	Detection Limit	Reporting Limit	Analytical Method	Analysis Start Date
Total Phosphorus	0.053	mg/L P	CMK	0.001	0.01	EPA 365.3	8/20/2009

Comments related to sample number EG45577:

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Xcel Energy

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

Minneapolis Testing Laboratory Report

Report To:

Attention: ERAD-WI
Leroy Wilder
Matt Miller

Work Request # WIHY0709
Date of Report 8/24/2009

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

LabWorks I.D. EG45576
Laboratory I.D.: 1016.28
Collection Date: 7/28/2009
Date Submitted: 7/30/2009

Constituent	Result	Units	Analyst	Detection Limit	Reporting Limit	Analytical Method	Analysis Start Date
Chlorophyll-a	4.8	ug/L	NLS INC	0.041	0.5	SM 19th 10200 H	8/13/2009
Send Chlorophyll A	Completed		MJM				7/28/2009
Total Phosphorus	0.021	mg/L P	CMK	0.001	0.01	EPA 365.3	8/20/2009

Comments related to sample number EG45576:

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Minneapolis Testing Laboratory Report

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Contact: Christine Keefe
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
Laboratory Supervisor
612-630-4506

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Minneapolis Testing Laboratory Report

Report To: Hydro Operation
Enviromental Services-WI

Attention: Matt Miller
Leroy Wilder

Work Request # WIHY0809
Date of Report 9/17/2009

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

LabWorks I.D. EG47613
Laboratory I.D.: 1020.11
Collection Date: 8/24/2009
Date Submitted: 8/26/2009

Constituent	Result	Units	Analyst	Detection Limit	Reporting Limit	Analytical Method	Analysis Start Date
Total Phosphorus	0.032	mg/L P	CMK	0.001	0.01	EPA 365.3	9/16/2009

Comments related to sample number EG47613:

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Minneapolis Testing Laboratory Report

Report To: Hydro Operation
Enviromental Services-WI

Attention: Matt Miller
Leroy Wilder

Work Request # WIHY0809
Date of Report 9/17/2009

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

LabWorks I.D. EG47614
Laboratory I.D.: 1020.12
Collection Date: 8/24/2009
Date Submitted: 8/26/2009

Constituent	Result	Units	Analyst	Detection Limit	Reporting Limit	Analytical Method	Analysis Start Date
Chlorophyll-a	5	ug/L	NLS	0.041	0.5	SM 19th 10200 H	9/3/2009
Send Chlorophyll A	complete		MJM				8/24/2009
Total Phosphorus	0.021	mg/L P	CMK	0.001	0.01	EPA 365.3	9/16/2009

Comments related to sample number EG47614:

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Minneapolis Testing Laboratory Report

Report To: Hydro Operation
Enviromental Services-WI

Attention: Matt Miller
Leroy Wilder

Work Request # WIHY0809
Date of Report 9/17/2009

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

LabWorks I.D. EG47615
Laboratory I.D.: 1020.13
Collection Date: 8/24/2009
Date Submitted: 8/26/2009

Constituent	Result	Units	Analyst	Detection Limit	Reporting Limit	Analytical Method	Analysis Start Date
Total Phosphorus	0.075	mg/L P	CMK	0.001	0.01	EPA 365.3	9/16/2009

Comments related to sample number EG47615:

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Minneapolis Testing Laboratory Report

Report To: Hydro Operation
Enviromental Services-WI

Attention: Matt Miller
Leroy Wilder

Work Request # WIHY0809
Date of Report 9/17/2009

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

LabWorks I.D. EG47616
Laboratory I.D.: 1020.14
Collection Date: 8/24/2009
Date Submitted: 8/26/2009

Constituent	Result	Units	Analyst	Detection Limit	Reporting Limit	Analytical Method	Analysis Start Date
Chlorophyll-a	3.6	ug/L	NLS	0.041	0.5	SM 19th 10200 H	9/3/2009
Send Chlorophyll A	Completed		MJM				8/24/2009
Total Phosphorus	0.023	mg/L P	CMK	0.001	0.01	EPA 365.3	9/16/2009

Comments related to sample number EG47616:

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Minneapolis Testing Laboratory Report

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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
Laboratory Supervisor
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Summary Of Dissolved Oxygen And Temperature

Data For The Big Falls Flowage

2003 - 2009

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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

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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

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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

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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

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Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2007.

Date: 4/30/2007
Secchi Disk (ft.): 4
Depth of Bottom Sample: 12 m
Weather Conditions: Prtly cloudy, light wind

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	15.8	9.40
2.0	15.8	9.59
4.0	15.7	9.74
6.0	15.5	9.82
8.0	15.4	9.76
10.0	15.4	9.74
12.0	15.4	9.66
14.0	15.3	9.54
16.0	15.2	9.47
18.0	15.2	9.39
20.0	15.2	9.35
22.0	15.2	9.33
24.0	15.2	9.28
26.0	15.2	9.23
28.0	15.2	9.08
30.0	15.2	9.05
32.0	14.8	8.99
34.0	13.9	8.85
36.0	12.9	8.75
38.0	Bottom	Bottom
40.0		

Date: 7/31/2007
Secchi Disk (ft.): 7
Depth of Bottom Sample: 12 m
Weather Conditions: Mostly sunny, south wind at 5 mph

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	28.1	7.43
2.0	27.8	7.46
4.0	27.4	7.41
6.0	27.3	7.30
8.0	27.2	7.28
10.0	27.1	6.82
12.0	27.0	6.68
14.0	26.9	6.47
16.0	26.8	6.26
18.0	26.8	6.08
20.0	26.6	5.45
22.0	26.4	5.18
24.0	26.3	5.15
26.0	26.0	4.85
28.0	25.8	4.78
30.0	25.5	4.27
32.0	25.4	4.00
34.0	24.0	0.43
36.0	Bottom	Bottom
38.0		
40.0		

Date: 8/29/2007
Secchi Disk (ft.): 6
Depth of Bottom Sample: 12 m
Weather Conditions: Mostly sunny N wind @ 10 mph

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface		
2.0		
4.0		
6.0	DO/Temperature profile was not taker due to equipment problems	
8.0		
10.0		
12.0		
14.0		
16.0		
18.0		
20.0		
22.0		
24.0		
26.0		
28.0		
30.0		
32.0		
34.0		
36.0		
38.0		
40.0		

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Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2008.

Date: 4/30/2008
Secchi Disk (ft.): 4.5
Depth of Bottom Sample: 11 m
Weather Conditions: 50 F, sunny, south wind @ 10 mph

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	5.8	11.8
2.0	5.9	11.8
4.0	5.7	11.9
6.0	5.7	11.9
8.0	5.7	11.9
10.0	5.7	11.9
12.0	5.7	11.9
14.0	5.7	11.9
16.0	5.7	11.9
18.0	5.7	11.9
20.0	5.7	11.9
22.0	5.7	11.9
24.0	5.7	11.9
26.0	5.7	11.9
28.0	5.7	11.9
30.0	5.7	11.9
32.0	5.7	11.9
34.0	5.7	11.8
36.0	5.7	11.8
38.0	5.7	6.0
40.0	Bottom	Bottom

Date: 7/23/2008
Secchi Disk (ft.): 5.5
Depth of Bottom Sample: 10 m
Weather Conditions: 73 F, sunny, south wind @ 5 mph

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	24.7	7.60
2.0	24.4	7.58
4.0	24.2	7.58
6.0	24.1	7.50
8.0	24.0	7.36
10.0	23.9	7.31
12.0	23.8	7.27
14.0	23.7	7.27
16.0	23.7	7.19
18.0	23.7	7.09
20.0	23.5	6.95
22.0	23.5	6.84
24.0	23.5	6.75
26.0	23.3	6.06
28.0	23.3	6.05
30.0	23.2	5.61
32.0	23.1	5.34
34.0	23.1	4.82
36.0	Bottom	Bottom

Date: 8/26/2008
Secchi Disk (ft.): 5.5
Depth of Bottom Sample: 11 m
Weather Conditions: 71 F, sunny, southe wind 5-10 mph

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	22.7	7.04
2.0	22.5	6.95
4.0	22.3	6.91
6.0	22.3	6.77
8.0	22.3	6.31
10.0	22.2	6.39
12.0	21.9	6.71
14.0	21.8	6.82
16.0	21.8	6.93
18.0	21.7	6.91
20.0	21.7	6.80
22.0	21.6	6.80
24.0	21.6	6.82
26.0	21.6	6.91
28.0	21.6	6.91
30.0	21.5	6.82
32.0	21.5	6.81
34.0	21.4	6.83
36.0	21.4	6.71
38.0	Bottom	Bottom

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Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2009.

Date: 4/28/2009
Secchi Disk (ft.): 5.0
Depth of Bottom Sample (ft) 38
Weather Conditions: mostly sunny, wind NE @ 10
Temperature (F): 51

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	9.4	10.65
2.0	9.4	10.65
4.0	9.4	10.64
6.0	9.3	10.64
8.0	9.3	10.64
10.0	9.3	10.63
12.0	9.3	10.62
14.0	9.2	10.62
16.0	9.2	10.61
18.0	9.2	10.61
20.0	9.2	10.60
22.0	9.2	10.60
24.0	9.2	10.59
26.0	9.2	10.58
28.0	9.2	10.57
30.0	9.2	10.57
32.0	9.2	10.56
34.0	9.2	10.56
36.0	9.2	10.54
38.0	9.2	10.14
40.0	Bottom	Bottom

Date: 7/28/2009
Secchi Disk (ft.): 6.5
Depth of Bottom Sample (ft) 36
Weather Conditions: partly sunny, wind W @ 15
Temperature (F): 66

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	22.7	7.86
2.0	22.8	7.82
4.0	22.7	7.81
6.0	22.7	7.79
8.0	22.7	7.79
10.0	22.7	7.75
12.0	22.5	7.55
14.0	22.4	7.03
16.0	22.3	6.59
18.0	22.1	6.22
20.0	22.0	6.07
22.0	21.7	5.95
24.0	21.6	5.91
26.0	21.6	5.69
28.0	21.4	5.41
30.0	21.3	5.20
32.0	21.2	4.58
34.0	20.3	2.52
36.0	Bottom	Bottom

Date: 8/24/2009
Secchi Disk (ft.): 6.5
Depth of Bottom Sample: 36
Weather Conditions: sunny, wind S @ 10
Temperature (F): 80

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	21.0	8.61
2.0	20.8	8.70
4.0	20.0	8.55
6.0	19.9	8.38
8.0	19.7	7.69
10.0	19.5	7.26
12.0	19.3	7.29
14.0	19.2	7.51
16.0	19.0	7.71
18.0	18.8	8.33
20.0	18.7	8.19
22.0	18.7	8.22
24.0	18.7	8.19
26.0	18.7	8.17
28.0	18.5	7.95
30.0	18.5	7.93
32.0	18.5	7.92
34.0	18.5	7.84
36.0	18.4	7.48
38.0	Bottom	Bottom

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Summary Of Dissolved Oxygen And Temperature

Data For The Thornapple Flowage

2003 - 2009

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

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

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	13.8	9.72
2.0	13.7	9.75
4.0	13.7	9.77
6.0	13.7	9.77
8.0	13.7	9.71
10.0	13.7	9.71
12.0	13.7	9.72
14.0	13.7	9.69
16.0	13.7	9.69
18.0	13.7	9.67
20.0	13.7	9.67

Could not sample earlier due to high river flows

Date:	7/28/2003
Secchi Disk (ft.):	6.5
Depth of Bottom Sample:	6 m
Weather Conditions:	clear, calm, 70 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	24.5	6.73
2.0	24.4	7.00
4.0	24.3	6.97
6.0	24.3	6.89
8.0	24.3	6.79
10.0	24.3	6.79
12.0	24.0	6.29
14.0	22.9	5.43
16.0	22.6	5.18
18.0	22.3	4.71
20.0	21.9	3.75

Date:	8/13/2003
Secchi Disk (ft.):	5
Depth of Bottom Sample:	6 m
Weather Conditions:	clear, calm, 75 F

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	24.5	8.73
2.0	24.3	8.78
4.0	24.2	8.68
6.0	24.0	8.00
8.0	23.7	7.55
10.0	23.4	5.95
12.0	23.4	5.79
14.0	23.2	6.03
16.0	23.0	4.68
18.0	22.5	2.62
20.0	22.1	1.34

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

Date:	5/5/2004
Secchi Disk (ft.):	5
Depth of Bottom Sample:	6 m
Weather Conditions:	cloudy, S wind, 60 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

Date:	7/28/2004
Secchi Disk (ft.):	5
Depth of Bottom Sample:	19.5 ft
Weather Conditions:	partly sunny, 75 F

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

Date:	8/25/2004
Secchi Disk (ft.):	5.5
Depth of Bottom Sample:	6 m
Weather Conditions:	overcast, 70 F

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

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

Date:	4/19/2005
Secchi Disk (ft.):	5
Depth of Bottom Sample:	6 m
Weather Conditions:	cloudy, 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

Date:	7/25/2005
Secchi Disk (ft.):	4
Depth of Bottom Sample:	6 m
Weather Conditions:	Cldy, S wind, 82 F

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		

Date:	8/31/2005
Secchi Disk (ft.):	5.5
Depth of Bottom Sample:	6 m
Weather Conditions:	Sunny, S wind, 70 F

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

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

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

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

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	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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Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2007.

Date:	4/30/2007
Secchi Disk (ft.):	5
Depth of Bottom Sample:	6 m
Weather Conditions:	cldy, S wind @10 mph

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	15.3	11.26
2.0	14.7	11.27
4.0	14.4	11.33
6.0	14.3	11.32
8.0	14.3	11.28
10.0	14.1	11.28
12.0	14.0	11.20
14.0	13.9	11.13
16.0	13.8	10.90
18.0	13.1	10.43
20.0	Bottom	Bottom
22.0		

Date:	7/31/2007
Secchi Disk (ft.):	5
Depth of Bottom Sample:	6 m
Weather Conditions:	Sunny, S wind@5mph

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	27.1	8.50
2.0	26.7	8.31
4.0	25.9	7.54
6.0	25.8	7.35
8.0	25.8	7.27
10.0	25.7	7.22
12.0	25.7	7.04
14.0	25.5	6.81
16.0	25.5	6.79
18.0	25.1	6.27
20.0	24.7	5.78
22.0	Bottom	Bottom

Date:	8/29/2007
Secchi Disk (ft.):	5
Depth of Bottom Sample:	6 m
Weather Conditions:	Mstly sny, S wind@5 mph

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface		
2.0	DO/Temperatures profiles were not taken	
4.0	due to equipment malfunction	
6.0		
8.0		
10.0		
12.0		
14.0		
16.0		
18.0		
20.0		

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Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2008.

Date:	4/30/2008
Secchi Disk (ft.):	4
Depth of Bottom Sample:	NA
Weather Conditions:	55 F, sunny, south wind @ 10 mph

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface		
2.0		
4.0		
6.0	DO/temperature profile not taken	
8.0	due to problems with DO meter	
10.0		
12.0		
14.0		
16.0		
18.0		
20.0		
22.0		

Date:	7/23/2008
Secchi Disk (ft.):	5
Depth of Bottom Sample:	5.5 m
Weather Conditions:	78 F, partly cloudy, south wind @ 5 mph

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	25.1	7.56
2.0	24.7	7.43
4.0	24.2	7.27
6.0	23.5	6.95
8.0	23.1	6.70
10.0	23.1	6.70
12.0	22.9	6.46
14.0	22.4	5.48
16.0	21.8	4.36
18.0	21.6	4.12
20.0	Bottom	Bottom
22.0		

Date:	8/26/2008
Secchi Disk (ft.):	5
Depth of Bottom Sample:	5 m
Weather Conditions:	76 F, sunny, southeast wind @ 5-10 mph

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	22.3	9.64
2.0	22.0	9.46
4.0	21.8	9.25
6.0	21.6	8.99
8.0	21.5	8.82
10.0	21.4	8.73
12.0	21.4	8.70
14.0	21.3	8.65
16.0	21.3	8.62
18.0	21.3	8.60
20.0	Bottom	Bottom

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Dissolved Oxygen and Temperature Profiles for Thornapple Flowage in 2009.

Date:	4/28/2009
Secchi Disk (ft.):	5.5
Depth of Bottom Sample (ft):	20
Weather Conditions:	mostly sunny, wind NE @ 10
Temperature (F):	57

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	8.3	10.90
2.0	8.3	10.95
4.0	8.2	10.96
6.0	8.2	10.93
8.0	8.2	10.93
10.0	8.2	10.94
12.0	8.2	10.92
14.0	8.2	10.91
16.0	8.2	10.90
18.0	8.1	10.90
20.0	8.1	10.86
22.0	Bottom	Bottom

Date:	7/28/2009
Secchi Disk (ft.):	7
Depth of Bottom Sample (ft)	18
Weather Conditions:	cloudy, wind W @ 5
Temperature (F):	67

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	22.4	8.65
2.0	22.3	8.42
4.0	21.8	7.18
6.0	21.4	6.78
8.0	21.1	6.16
10.0	21.0	5.97
12.0	20.7	6.16
14.0	18.1	3.71
16.0	17.0	1.45
18.0	15.7	0.00
20.0	Bottom	Bottom

Date:	8/24/2009
Secchi Disk (ft.):	6.5
Depth of Bottom Sample (ft	18
Weather Conditions:	sunny, wind S @ 10-15
Temperature (F):	77

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	21.1	9.95
2.0	20.9	9.79
4.0	20.6	9.41
6.0	20.1	8.76
8.0	19.7	8.68
10.0	19.6	8.86
12.0	19.5	8.27
14.0	19.2	6.89
16.0	19.1	6.65
18.0	18.6	5.23
20.0	Bottom	Bottom

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2009 Water Quality Fieldwork Data Sheets For

The Big Falls And Thornapple Flowages

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Water Quality Sampling - Big Falls Flowage

Date: 4-28-09
Temperature: 51°
Weather Conditions: MOSTLY SUNNY, WINDS NE 10
Depth of Bottom Sample: 38 FT
Secchi Disk Reading: 5.0 FT

Dissolved Oxygen and Temperature Profile

Depth	Temperature (C)	Dissolved Oxygen (mg/l)
Surface	9.4	10.65
2	9.4	10.65
4	9.4	10.64
6	9.3	10.64
8	9.3	10.64
10	9.3	10.63
12	9.3	10.62
14	9.2	10.62
16	9.2	10.61
18	9.2	10.61
20	9.2	10.60
22	9.2	10.60
24	9.2	10.59
26	9.2	10.58
28	9.2	10.57
30	9.2	10.57
32	9.2	10.56
34	9.2	10.56
36	9.2	10.54
38	9.2	10.14
40	BOTTOM	BOTTOM
42		
44		
46		

Remarks: - SPOTTED 1 MATURE EAGLE ABOVE SPILLWAY + SAME EAGLE ON NEST
- FLOW ≈ 2800 CFS (INCLUDES ≈ 1 FT GATE)
- BOTTOM SAMPLE @ 11.5 M @ 1050 HRS
- NO NAVIGATIONAL HAZARDS
- SAMPLES TAKEN AT 4TH BUOY FROM WEST

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Water Quality Sampling - Thornapple Flowage

Date: 4-28-09
Temperature: 57°F
Weather Conditions: SUNNY, WIND NE @ 10
Depth of Bottom Sample: 20 FT
Secchi Disk Reading: 5.5

Dissolved Oxygen and Temperature Profile

Depth	Temperature (C)	Dissolved Oxygen (mg/l)
Surface	8.3	10.90
2	8.3	10.95
4	8.2	10.96
6	8.2	10.93
8	8.2	10.93
10	8.2	10.94
12	8.2	10.92
14	8.2	10.91
16	8.2	10.90
18	8.1	10.90
20	8.1	10.86
22	BOTTOM	BOTTOM
24		
26		
28		
30		
32		
34		
36		
38		
40		
42		
44		
46		

Remarks: SAMPLES TAKEN AT 4TH BUOY FROM WEST
- BOTTOM SAMPLE (TOTAL PHOSPHORUS) TAKEN AT 6M (19.5 FT) @ 1330 HRS
- FLOW AT 3000 CFS (FULL GENERATION + 8 FT GATE)
- 1 MATURE EAGLE PERCHED NEXT TO NEST
- NO NAVIGATIONAL HAZARDS

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Water Quality Sampling - Big Falls Flowage

Date: 7-28-09
Temperature: 66° F
Weather Conditions: PARTLY SUNNY - WIND W @ 15
Depth of Bottom Sample: 36 FT
Secchi Disk Reading: 6.5 FT

Dissolved Oxygen and Temperature Profile

Depth	Temperature (C)	Dissolved Oxygen (mg/l)
Surface	22.7	7.86
2	22.8	7.82
4	22.7	7.81
6	22.7	7.79
8	22.7	7.79
10	22.7	7.75
12	22.5	7.55
14	22.4	7.03
16	22.3	6.59
18	22.1	6.22
20	22.0	6.07
22	21.7	5.95
24	21.6	5.91
26	21.6	5.69
28	21.4	5.41
30	21.3	5.20
32	21.2	4.58
34	20.3	2.52
36	BOTTOM	BOTTOM
38		
40		
42		
44		
46		

- LOW RIVER FLOWS, 1 GEN @ 40%

Remarks: BOTTOM P SAMPLE COLLECTED @ 11.5 M
OBSERVED 1 LOON UPSTREAM OF SPILLWAY (WEST SHORE) 200 YARDS
NO NAVIGATIONAL HAZARDS
SAMPLES TAKEN @ 4TH BUOY FROM WEST

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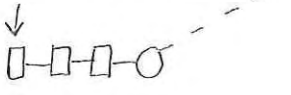

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Water Quality Sampling - Thornapple Flowage

Date: 7-28-09
Temperature: 67°
Weather Conditions: CLOUDY, WIND WEST @ 5
Depth of Bottom Sample: 6M
Secchi Disk Reading: 7FT

Dissolved Oxygen and Temperature Profile

Depth	Temperature (C)	Dissolved Oxygen (mg/l)
Surface	22.4	8.65
2	22.3	8.42
4	21.8	7.18
6	21.4	6.78
8	21.1	6.16
10	21.0	5.97
12	20.7	6.16
14	18.1	3.71
16	17.0	1.45
18	15.7	0.00
20	BOTTOM	
22		
24		
26		
28		
30		
32		
34		
36		
38		
40		
42		
44		
46		

Remarks: BOTTOM SAMPLE COLLECTED @ 6M
NO NAVIGATIONAL HAZARDS
TWO IMMATURE EAGLES PERCHED @ NEST SITE
NEAR RECORD LSW FLOWS ON FLAMBEAU
SAMPLES TAKEN @ 4TH BUOY FROM WEST

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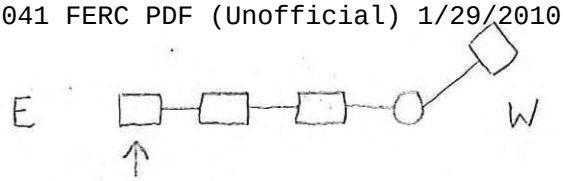

Water Quality Sampling - Big Falls Flowage

Date: 8-24-09
Temperature: 80°
Weather Conditions: SUNNY SOUTH WIND @ 10
Depth of Bottom Sample: 36 FT.
Secchi Disk Reading: 6.5'

Dissolved Oxygen and Temperature Profile

Depth	Temperature (C)	Dissolved Oxygen (mg/l)
Surface	21.0	8.61
2	20.8	8.70
4	20.0	8.55
6	19.9	8.38
8	19.7	7.69
10	19.5	7.26
12	19.3	7.29
14	19.2	7.51
16	19.0	7.71
18	18.8	8.33
20	18.7	8.19
22	18.7	8.22
24	18.7	8.19
26	18.7	8.17
28	18.5	7.95
30	18.5	7.93
32	18.5	7.92
34	18.5	7.84
36	18.4	7.48
38	BOTTOM	BOTTOM
40		
42		
44		
46		

Remarks: 1 MATURE BALD EAGLE SPOTTED SOARING NEAR NEST SITE
- NO NAVIGATIONAL HAZARDS
- LOW RIVER FLOWS - MODERATE TO SEVERE DROUGHT IN THE FLAMBEAU RIVER WATERSHED

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Water Quality Sampling - Thornapple Flowage

Date: 8-24-09
Temperature: 77
Weather Conditions: MOSTLY SUNNY, WIND SOUTH @ 10-15
Depth of Bottom Sample: 19 FT
Secchi Disk Reading: 6.5'

Dissolved Oxygen and Temperature Profile

Depth	Temperature (C)	Dissolved Oxygen (mg/l)
Surface	21.1	9.95
2	20.9	9.79
4	20.6	9.41
6	20.1	8.76
8	19.7	8.68
10	19.6	8.86
12	19.5	8.27
14	19.2	6.89
16	19.1	6.65
18	18.6	5.23
20	BOTTOM	BOTTOM
22		
24		
26		
28		
30		
32		
34		
36		
38		
40		
42		
44		
46		

Remarks: - SAMPLES TAKEN @ 4TH BUOY FROM WEST
- 2 IMMATURE BALD EAGLES NEAR NEST SITE AND ONE MATURE BALD EAGLE AT UPPER END OF FLOWAGE
- LOW RIVER FLOWS
- NO NAVIGATIONAL HAZARDS

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2009 Water Quality Monitoring Report

(Developed by Citizens Self-Help Lake Monitoring Program)

Turtle-Flambeau Flowage (FERC Project No. 2390-02)

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Lake Water Quality 2009 Annual Report

Turtle Flambeau Flowage
Iron County
Waterbody ID Number: 2294900

Lake Type: DRAINAGE
DNR Region: NO
GEO Region: NW

Site Name	Station ID
Turtle Flambeau Flowage - Deep Hole	263059

Date	SD (feet)	SD (meters)	Hit Bottom?	CHL	TP	TSI (SD)	TSI (Chl)	TSI (TP)	Lake Level	Staff Gauge	Clarity	Color	Perception
04/29/2009				3.79	25		45	53					
05/28/2009	8	2.4	NO		18	47		51	HIGH		CLEAR	BROWN	2-Very minor aesthetic problems
06/24/2009	7.5	2.3	NO	2.24	16	48	41	50	NORMAL		MURKY	BROWN	2-Very minor aesthetic problems
06/25/2009				3.05	45		43	58					
07/26/2009	5	1.5	NO	5.39	32	54	48	55	LOW		MURKY	BROWN	2-Very minor aesthetic problems
08/04/2009				3.19	34		44	55					
08/26/2009	6	1.8	NO	6.56	26	51	49	53	LOW		MURKY	BROWN	2-Very minor aesthetic problems
09/03/2009				3.34	17		44	50					

05/28/2009		
Depth	Temp.	D.O.
FEET	DEGREES C	MG/L
0	16.8	7.96
3	16.4	7.93
6	16.1	7.89
9	15.8	7.89
12	15.7	7.88
15	15.4	7.78

06/24/2009		
Depth	Temp.	D.O.
FEET	DEGREES C	MG/L
0	25.6	7.57
3	25.4	7.59
6	24.9	7.62
9	19.8	5.86
12	17.2	4.38
15	15.6	4.89

07/26/2009		
Depth	Temp.	D.O.
FEET	DEGREES C	MG/L
0	20.6	7.41
3	20.5	7.38
6	20.4	7.37
9	20.3	7.25
12	20.1	7.3
15	19.6	6.99

SD = Secchi depth measured in feet converted to meters; Chl = Chlorophyll a in micrograms per liter (ug/l); TP = Total phosphorus in ug/l, surface sample only; TSI(SD),TSI(CHL),TSI(TP) = Trophic state index based on SD, CHL, TP respectively; Depth measured in feet; Temp = Temperature in degrees Fahrenheit; D.O. = Dissolved Oxygen in parts per million.

Wisconsin Department of Natural Resources * Wisconsin Lakes Partnership
Report Generated: 10/22/2009

05/28/2009		
Depth	Temp.	D.O.
FEET	DEGREES C	MG/L
20	14.4	7.41
25	14	7.3
30	13	6.98
35	10.7	4.42
40	9.4	2.77
45	9.6	2.48

06/24/2009		
Depth	Temp.	D.O.
FEET	DEGREES C	MG/L
20	14.9	4.92
25	13.9	4.6
30	12.8	2.84
35	11.1	.06
40	10.3	.09
45	10.1	.14

07/26/2009		
Depth	Temp.	D.O.
FEET	DEGREES C	MG/L
20	17	3.75
25	13.8	.04
30	12	.04
35	11.1	.06
40	10.6	.09
45	10.7	.15

08/26/2009		
Depth	Temp.	D.O.
0	21.9	7.83
3	20.4	7.87
6	19.9	7.68
9	19.8	7.45
12	19.6	6.91
15	19.3	6.54
20	18.2	4.89
25	14.3	.06
30	11.7	.07
35	11.1	.09
40	11	.15

Date	Lab Comment
06/25/2009	MATRIX DUPLICATE Q.C. EXCEEDED
08/04/2009	LOST POWER TO COOLER- STANDARD TEMP NOT MAINTAINED
09/03/2009	SAMPLE RECEIVED WAS NOT ICED OR ICE MELTED

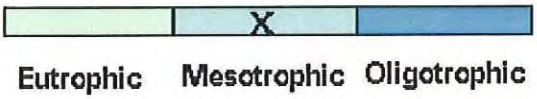
Date	Data Collectors	Project
04/29/2009	USGS	TURTLE FLAMBEAU FLOWAGE TRADE LAKE PROPERTY: Turtle Flambeau Flowage Water Quality Monitoring
05/28/2009	James Leever	Citizen Lake Monitoring - Water Quality - Turtle Flambeau Flowage; Deep Hole
06/24/2009	James Leever	Citizen Lake Monitoring - Water Quality - Turtle Flambeau Flowage; Deep Hole
06/25/2009	USGS	TURTLE FLAMBEAU FLOWAGE TRADE LAKE PROPERTY: Turtle Flambeau Flowage Water Quality Monitoring

SD = Secchi depth measured in feet converted to meters; Chl = Chlorophyll a in micrograms per liter (ug/l); TP = Total phosphorus in ug/l, surface sample only; TSI(SD),TSI(CHL),TSI(TP) = Trophic state index based on SD, CHL, TP respectively; Depth measured in feet; Temp = Temperature in degrees Fahrenheit; D.O. = Dissolved Oxygen in parts per million.

Date	Data Collectors	Project
07/26/2009	James Leever	Citizen Lake Monitoring - Water Quality - Turtle Flambeau Flowage; Deep Hole
08/04/2009	USGS	
08/26/2009	James Leever	Citizen Lake Monitoring - Water Quality - Turtle Flambeau Flowage; Deep Hole
09/03/2009	USGS	

SD = Secchi depth measured in feet converted to meters; Chl = Chlorophyll a in micrograms per liter (ug/l); TP = Total phosphorus in ug/l, surface sample only; TSI(SD),TSI(CHL),TSI(TP) = Trophic state index based on SD, CHL, TP respectively; Depth measured in feet; Temp = Temperature in degrees Fahrenheit; D.O. = Dissolved Oxygen in parts per million.

Turtle Flambeau Flowage - Deep Hole 2009 Results



Turtle Flambeau Flowage - Deep Hole was sampled **8** different days during the 2009 season. Parameters sampled included:

- water clarity
- temperature
- dissolved oxygen
- total phosphorus
- chlorophyll

The average summer (July-Aug) secchi disk reading for Turtle Flambeau Flowage - Deep Hole (Iron County, WBIC: 2294900) was 5.5 feet. The average for the Northwest Georegion was 9.8 feet. Typically the summer (July-Aug) water was reported as **MURKY** and BROWN. This suggests that the secchi depth may have been mostly impacted by suspended sediments, tiny particles of soil or organic matter that are suspended in the water. Shallow lakes are often turbid because wind stirs up sediment from the bottom. High suspended sediments are often found in flowages and impoundments where precipitation runoff from the watershed transports solids via an incoming stream.

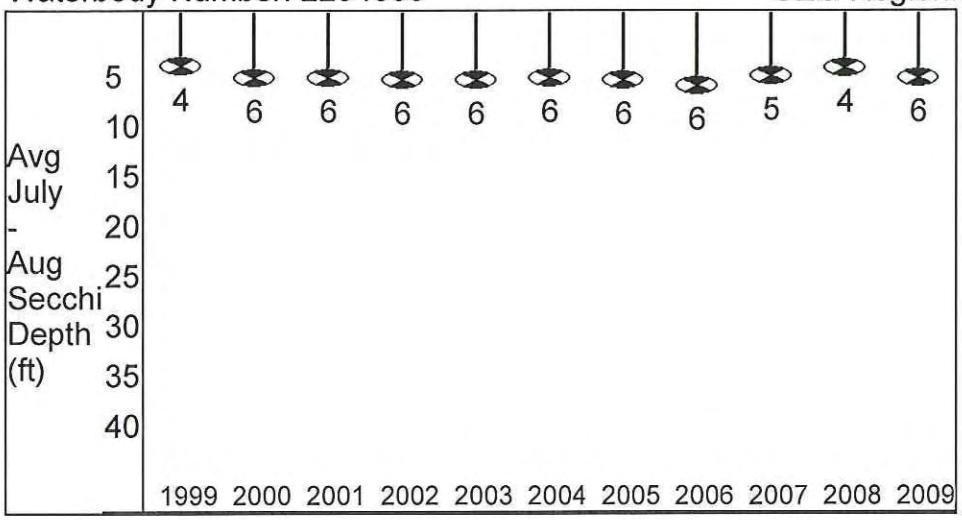
Chemistry data was collected on Turtle Flambeau Flowage - Deep Hole. The average summer Chlorophyll was 5 µg/l (compared to a Northwest Georegion summer average of 14.7 µg/l). The summer Total Phosphorus average was 42.8 µg/l. Lakes that have more than 20 µg/l and impoundments that have more than 30 µg/l of total phosphorus may experience noticable algae blooms.

The overall Trophic State Index (based on chlorophyll) for Turtle Flambeau Flowage - Deep Hole was 47. The TSI suggests that Turtle Flambeau Flowage - Deep Hole was **mesotrophic**. Mesotrophic lakes are characterized by moderately clear water, but have a increasing chance of low dissolved oxygen in deep water during the summer.

Secchi Graph

Turtle Flambeau Flowage
Iron County
Waterbody Number: 2294900

Lake Type: DRAINAGE
DNR Region: NO
GEO Region:NW



Past secchi averages in feet (July and August only).

Year	Secchi Mean	Secchi Min	Secchi Max	Secchi Count
1999	4.3	4.25	4.25	1
2000	5.6	4.7	6.5	2
2001	5.5	5.3	5.6	2
2002	5.8	5.5	6	3
2003	5.8	5.5	6	2
2004	5.5	5	6	2
2005	5.8	5	6.5	2
2006	6.3	6	6.5	2
2007	5.3	5	5.5	2
2008	4.5	4.5	4.5	2
2009	5.5	5	6	2

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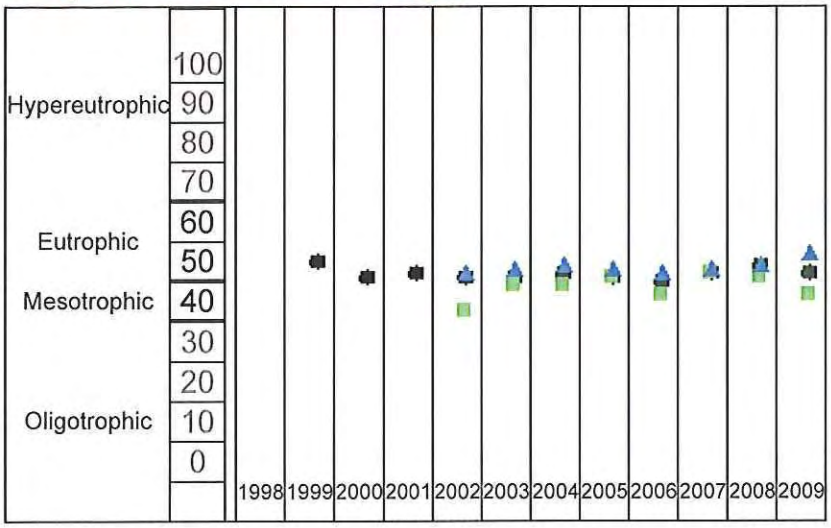
Trophic State Index Graph



Monitoring Station: Turtle Flambeau Flowage - Deep Hole, Iron County
Past Summer (July-August) Trophic State Index (TSI) averages.

● = Secchi ■ = Chlorophyll ▲ = Total Phosphorus

TSI(Chl) = TSI(TP) = TSI (Sec)	It is likely that algae dominate light attenuation.
TSI(Chl) > TSI(Sec)	Large particulates, such as Aphanizomenon flakes dominate
TSI(TP) = TSI(Sec) > TSI (Chl)	Non-algal particulate or color dominate light attenuation
TSI(Sec) = TSI(Chl) >= TSI (TP)	The algae biomass in your lake is limited by phosphorus
TSI(TP) > TSI(Chl) = TSI (Sec)	Zooplankton grazing, nitrogen, or some factor other than phosphorus is limiting algae biomass

TSI	TSI Description
TSI < 30	Classical oligotrophy: clear water, many algal species, oxygen throughout the year in bottom water, cold water, oxygen-sensitive fish species in deep lakes. Excellent water quality.
TSI 30-40	Deeper lakes still oligotrophic, but bottom water of some shallower lakes will become oxygen-depleted during the summer.
TSI 40-50	Water moderately clear, but increasing chance of low dissolved oxygen in deep water during the summer.
TSI 50-60	Lakes becoming eutrophic: decreased clarity, fewer algal species, oxygen-depleted bottom waters during the summer, plant overgrowth evident, warm-water fisheries (pike, perch, bass, etc.) only.
TSI 60-70	Blue-green algae become dominant and algal scums are possible, extensive plant overgrowth problems possible.
TSI 70-80	Becoming very eutrophic. Heavy algal blooms possible throughout summer, dense plant beds, but extent limited by light penetration (blue-green algae block sunlight).
TSI > 80	Algal scums, summer fishkills, few plants, rough fish dominant. Very poor water quality.

Trophic state index (TSI) is determined using a mathematical formula (Wisconsin has its own version). The TSI is a score from 0 to 110, with lakes that are less fertile having a low TSI. We base the overall TSI on the Chlorophyll TSI when we have Chlorophyll data. If we don't have chemistry data, we use TSI Secchi. We do this rather than averaging, because the TSI is used to predict biomass. This makes chlorophyll the best indicator. Visit Bob Carlson's website, dipin.kent.edu/tsi.htm, for more info.

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