



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

January 23, 2017

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

**Subject: 2016 Water Quality Monitoring Report – Articles 404 & 406
Big Falls Hydro (P-2390-01) and Thornapple Hydro (P-2475)**

Dear Secretary:

Enclosed is the 2016 Water Quality Monitoring Report for the Big Falls and Thornapple hydro projects. The report is filed pursuant to license articles 404 (Big Falls) and 406 (Thornapple). The results are summarized for the past five years and while there appears to be some variability in the parameters analyzed, for the most part, the results have been relatively consistent. Xcel Energy (licensee) has also confirmed that the water quality monitoring results for Turtle Flambeau Reservoir (P-2390-02) have been posted on the WDNR's website.

Licensee provided a copy of the report to the WDNR and USFWS for comment via e-mail on December 22, 2016. The USFWS did not have any comments. The WDNR requested licensee's spreadsheets summarizing the water quality data for entry into their database. Licensee provided the information as requested.

Should you have any questions regarding this report, feel free to contact Matthew Miller of this office at (715) 737-1353 or by e-mail at matthew.j.miller@xcelenergy.com.

Sincerely,

A handwritten signature in cursive script that reads 'William Zawacki'.

William Zawacki
Director, Hydro Plants

Enclosure: Water Quality Monitoring Report

c: Jeff Scheirer – WDNR (cover letter only – via e-mail)
Cheryl Laatsch – WDNR (cover letter only – via email)
Nick Utrup – USFWS (cover letter only – via e-mail)
Project Files

2016 Water Quality Monitoring Report for Big Falls Flowage (P-2390-01) and Thornapple Flowage (P-2475)

Northern States Power Company – WI
An Xcel Energy Company

December 2016

APPENDIX A

2016 Water Quality Lab Analysis For Big Falls and Thornapple Flowages



Minneapolis Testing Laboratory
 1518 Chestnut Ave N
 Minneapolis, MN 55043
 Certification # MN-027-053-197
 WI-999071150

Christine Keefe, Supervisor (612) 630-4506

Big Falls Hydro	Project Name/Location: Phosphorus	
1400 Western Ave		Reported:
Eau Claire WI, 54701	Project Manager: Matt J Miller	05/19/2016 08:31

Big Falls Flowage Surface
MBE0042-01 (Water) - Chain of Custody Number: 238393

Analyte	Result	LOD	RL	Units	Analyte		Batch	Prepared	Analyzed	Method	Analyst
					Qualifier	Dilution					

Wet Chemistry

Phosphate, Total as P	0.0177	0.00900	0.0100	mg/L		1	BBE0326	5/16/16 9:02	5/18/16 12:09	EPA 365.1	HRD
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Big Falls Hydro	Project Name/Location: Phosphorus	
1400 Western Ave		Reported:
Eau Claire WI, 54701	Project Manager: Matt J Miller	05/19/2016 08:31

Big Falls Flowage Bottom
MBE0042-02 (Water) - Chain of Custody Number: 238393

Analyte	Result	LOD	RL	Units	Analyte		Batch	Prepared	Analyzed	Method	Analyst
					Qualifier	Dilution					
Wet Chemistry											
Phosphate, Total as P	0.0208	0.00900	0.0100	mg/L		1	BBE0326	5/16/16 9:02	5/18/16 12:10	EPA 365.1	HRD



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Big Falls Hydro	Project Name/Location: Phosphorus	
1400 Western Ave		Reported:
Eau Claire WI, 54701	Project Manager: Matt J Miller	05/19/2016 08:31

Wet Chemistry - Quality Control

Analyte	Result	LOD	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch BBE0326 - Wet Prep

Blank (BBE0326-BLK1)					Prepared: 05/16/2016 Analyzed: 05/18/2016						
Phosphate, Total as P	<0.0100		0.0100	mg/L							
LCS (BBE0326-BS1)					Prepared: 05/16/2016 Analyzed: 05/18/2016						
Phosphate, Total as P	0.525		0.0100	mg/L	0.50000		105	90-110			
Duplicate (BBE0326-DUP1)					Source: MBE0014-03 Prepared: 05/16/2016 Analyzed: 05/18/2016						
Phosphate, Total as P	0.0333		0.0100	mg/L		0.0291			13.5	20	
Duplicate (BBE0326-DUP2)					Source: MBE0014-04 Prepared: 05/16/2016 Analyzed: 05/18/2016						
Phosphate, Total as P	0.0391		0.0100	mg/L		0.0339			14.2	20	
Matrix Spike (BBE0326-MS1)					Source: MBE0014-03 Prepared: 05/16/2016 Analyzed: 05/18/2016						
Phosphate, Total as P	0.550		0.0100	mg/L	0.50000	0.0291	104	90-110			
Matrix Spike (BBE0326-MS2)					Source: MBE0014-04 Prepared: 05/16/2016 Analyzed: 05/18/2016						
Phosphate, Total as P	0.554		0.0100	mg/L	0.50000	0.0339	104	90-110			
Matrix Spike Dup (BBE0326-MSD1)					Source: MBE0014-03 Prepared: 05/16/2016 Analyzed: 05/18/2016						
Phosphate, Total as P	0.542		0.0100	mg/L	0.50000	0.0291	103	90-110	1.47	20	
Matrix Spike Dup (BBE0326-MSD2)					Source: MBE0014-04 Prepared: 05/16/2016 Analyzed: 05/18/2016						
Phosphate, Total as P	0.541		0.0100	mg/L	0.50000	0.0339	102	90-110	2.21	20	



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Thornapple Hydro	Project Name/Location: Phosphorus	
W 5506 Dam Road		Reported:
Glen Flora WI, 54563	Project Manager: Matt J Miller	05/19/2016 08:33

Thornapple Flowage Surface
MBE0043-01 (Water) - Chain of Custody Number: 238393

Analyte	Result	LOD	RL	Units	Analyte Qualifier	Dilution	Batch	Prepared	Analyzed	Method	Analyst
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Wet Chemistry

Phosphate, Total as P	0.0216	0.00900	0.0100	mg/L		1	BBE0326	5/16/16 9:02	5/18/16 12:11	EPA 365.1	HRD
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Thornapple Hydro	Project Name/Location: Phosphorus	
W 5506 Dam Road		Reported:
Glen Flora WI, 54563	Project Manager: Matt J Miller	05/19/2016 08:33

Thornapple Flowage Bottom
MBE0043-02 (Water) - Chain of Custody Number: 238393

Analyte	Result	LOD	RL	Units	Analyte		Batch	Prepared	Analyzed	Method	Analyst
					Qualifier	Dilution					
Wet Chemistry											
Phosphate, Total as P	0.0222	0.00900	0.0100	mg/L		1	BBE0326	5/16/16 9:02	5/18/16 12:12	EPA 365.1	HRD



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Thornapple Hydro	Project Name/Location: Phosphorus	
W 5506 Dam Road		Reported:
Glen Flora WI, 54563	Project Manager: Matt J Miller	05/19/2016 08:33

Wet Chemistry - Quality Control

Analyte	Result	LOD	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch BBE0326 - Wet Prep

Blank (BBE0326-BLK1)					Prepared: 05/16/2016 Analyzed: 05/18/2016						
Phosphate, Total as P	<0.0100		0.0100	mg/L							
LCS (BBE0326-BS1)					Prepared: 05/16/2016 Analyzed: 05/18/2016						
Phosphate, Total as P	0.525		0.0100	mg/L	0.50000		105	90-110			
Duplicate (BBE0326-DUP1)					Source: MBE0014-03 Prepared: 05/16/2016 Analyzed: 05/18/2016						
Phosphate, Total as P	0.0333		0.0100	mg/L		0.0291			13.5	20	
Duplicate (BBE0326-DUP2)					Source: MBE0014-04 Prepared: 05/16/2016 Analyzed: 05/18/2016						
Phosphate, Total as P	0.0391		0.0100	mg/L		0.0339			14.2	20	
Matrix Spike (BBE0326-MS1)					Source: MBE0014-03 Prepared: 05/16/2016 Analyzed: 05/18/2016						
Phosphate, Total as P	0.550		0.0100	mg/L	0.50000	0.0291	104	90-110			
Matrix Spike (BBE0326-MS2)					Source: MBE0014-04 Prepared: 05/16/2016 Analyzed: 05/18/2016						
Phosphate, Total as P	0.554		0.0100	mg/L	0.50000	0.0339	104	90-110			
Matrix Spike Dup (BBE0326-MSD1)					Source: MBE0014-03 Prepared: 05/16/2016 Analyzed: 05/18/2016						
Phosphate, Total as P	0.542		0.0100	mg/L	0.50000	0.0291	103	90-110	1.47	20	
Matrix Spike Dup (BBE0326-MSD2)					Source: MBE0014-04 Prepared: 05/16/2016 Analyzed: 05/18/2016						
Phosphate, Total as P	0.541		0.0100	mg/L	0.50000	0.0339	102	90-110	2.21	20	



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Big Falls Hydro	Project Name/Location: Phosphorus	
1400 Western Ave		Reported:
Eau Claire WI, 54701	Project Manager: Matt J Miller	07/26/2016 07:43

Big Falls Flowage Surface
MBG0212-01 (Water) - Chain of Custody Number: 238394

Analyte	Result	LOD	RL	Units	Analyte		Batch	Prepared	Analyzed	Method	Analyst
					Qualifier	Dilution					

Wet Chemistry

Phosphate, Total as P	0.0309	0.00900	0.0100	mg/L		1	BBG0529	7/25/16 7:49	7/25/16 13:48	EPA 365.1	seal
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Big Falls Hydro	Project Name/Location: Phosphorus	
1400 Western Ave		Reported:
Eau Claire WI, 54701	Project Manager: Matt J Miller	07/26/2016 07:43

Big Falls Flowage Bottom
MBG0212-02 (Water) - Chain of Custody Number: 238394

Analyte	Result	LOD	RL	Units	Analyte		Batch	Prepared	Analyzed	Method	Analyst
					Qualifier	Dilution					
Wet Chemistry											
Phosphate, Total as P	0.0572	0.00900	0.0100	mg/L		1	BBG0529	7/25/16 7:49	7/25/16 13:51	EPA 365.1	seal



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Big Falls Hydro	Project Name/Location: Phosphorus	
1400 Western Ave		Reported:
Eau Claire WI, 54701	Project Manager: Matt J Miller	07/26/2016 07:43

Wet Chemistry - Quality Control

Analyte	Result	LOD	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch BBG0529 - Wet Prep

Blank (BBG0529-BLK1)					Prepared & Analyzed: 07/25/2016						
Phosphate, Total as P	<0.0100		0.0100	mg/L							
LCS (BBG0529-BS1)					Prepared & Analyzed: 07/25/2016						
Phosphate, Total as P	0.505		0.0100	mg/L	0.50000		101	90-110			
Duplicate (BBG0529-DUP1)					Source: MBG0212-01 Prepared & Analyzed: 07/25/2016						
Phosphate, Total as P	0.0369		0.0100	mg/L		0.0309			17.7	20	
Duplicate (BBG0529-DUP2)					Source: MBG0212-02 Prepared & Analyzed: 07/25/2016						
Phosphate, Total as P	0.0548		0.0100	mg/L		0.0572			4.29	20	
Matrix Spike (BBG0529-MS1)					Source: MBG0212-01 Prepared & Analyzed: 07/25/2016						
Phosphate, Total as P	0.542		0.0100	mg/L	0.50000	0.0309	102	90-110			
Matrix Spike (BBG0529-MS2)					Source: MBG0212-02 Prepared & Analyzed: 07/25/2016						
Phosphate, Total as P	0.562		0.0100	mg/L	0.50000	0.0572	101	90-110			
Matrix Spike Dup (BBG0529-MSD1)					Source: MBG0212-01 Prepared & Analyzed: 07/25/2016						
Phosphate, Total as P	0.526		0.0100	mg/L	0.50000	0.0309	99.0	90-110	3.09	20	
Matrix Spike Dup (BBG0529-MSD2)					Source: MBG0212-02 Prepared & Analyzed: 07/25/2016						
Phosphate, Total as P	0.566		0.0100	mg/L	0.50000	0.0572	102	90-110	0.816	20	



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Thornapple Hydro	Project Name/Location: Phosphorus	
W 5506 Dam Road		Reported:
Glen Flora WI, 54563	Project Manager: Matt J Miller	07/26/2016 07:44

Thornapple Flowage Surface
MBG0213-01 (Water) - Chain of Custody Number: 238394

Analyte	Result	LOD	RL	Units	Analyte Qualifier	Dilution	Batch	Prepared	Analyzed	Method	Analyst
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Wet Chemistry

Phosphate, Total as P	0.0299	0.00900	0.0100	mg/L		1	BBG0529	7/25/16 7:49	7/25/16 13:52	EPA 365.1	seal
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Thornapple Hydro	Project Name/Location: Phosphorus	
W 5506 Dam Road		Reported:
Glen Flora WI, 54563	Project Manager: Matt J Miller	07/26/2016 07:44

Thornapple Flowage Bottom
MBG0213-02 (Water) - Chain of Custody Number: 238394

Analyte	Result	LOD	RL	Units	Analyte		Batch	Prepared	Analyzed	Method	Analyst
					Qualifier	Dilution					
Wet Chemistry											
Phosphate, Total as P	0.0343	0.00900	0.0100	mg/L		1	BBG0529	7/25/16 7:49	7/25/16 13:53	EPA 365.1	seal



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Thornapple Hydro	Project Name/Location: Phosphorus	
W 5506 Dam Road		Reported:
Glen Flora WI, 54563	Project Manager: Matt J Miller	07/26/2016 07:44

Wet Chemistry - Quality Control

Analyte	Result	LOD	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch BBG0529 - Wet Prep

Blank (BBG0529-BLK1)					Prepared & Analyzed: 07/25/2016						
Phosphate, Total as P	<0.0100		0.0100	mg/L							
LCS (BBG0529-BS1)					Prepared & Analyzed: 07/25/2016						
Phosphate, Total as P	0.505		0.0100	mg/L	0.50000		101	90-110			
Duplicate (BBG0529-DUP1)					Source: MBG0212-01 Prepared & Analyzed: 07/25/2016						
Phosphate, Total as P	0.0369		0.0100	mg/L		0.0309			17.7	20	
Duplicate (BBG0529-DUP2)					Source: MBG0212-02 Prepared & Analyzed: 07/25/2016						
Phosphate, Total as P	0.0548		0.0100	mg/L		0.0572			4.29	20	
Matrix Spike (BBG0529-MS1)					Source: MBG0212-01 Prepared & Analyzed: 07/25/2016						
Phosphate, Total as P	0.542		0.0100	mg/L	0.50000	0.0309	102	90-110			
Matrix Spike (BBG0529-MS2)					Source: MBG0212-02 Prepared & Analyzed: 07/25/2016						
Phosphate, Total as P	0.562		0.0100	mg/L	0.50000	0.0572	101	90-110			
Matrix Spike Dup (BBG0529-MSD1)					Source: MBG0212-01 Prepared & Analyzed: 07/25/2016						
Phosphate, Total as P	0.526		0.0100	mg/L	0.50000	0.0309	99.0	90-110	3.09	20	
Matrix Spike Dup (BBG0529-MSD2)					Source: MBG0212-02 Prepared & Analyzed: 07/25/2016						
Phosphate, Total as P	0.566		0.0100	mg/L	0.50000	0.0572	102	90-110	0.816	20	



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Big Falls Hydro	Project Name/Location: Phosphorus	
1400 Western Ave		Reported:
Eau Claire WI, 54701	Project Manager: Matt J Miller	09/08/2016 07:50

Big Falls Flowage Surface
MBI0018-01 (Water) - Chain of Custody Number: 238395

Analyte	Result	LOD	LOQ	Units	Analyte Qualifier	Dilution	Batch	Prepared	Analyzed	Method	Analyst
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Wet Chemistry

Phosphate, Total as P	0.0195	0.00900	0.0100	mg/L		1	BBI0081	9/7/16 6:26	9/7/16 13:07	EPA 365.1	seal
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Big Falls Hydro	Project Name/Location: Phosphorus	
1400 Western Ave		Reported:
Eau Claire WI, 54701	Project Manager: Matt J Miller	09/08/2016 07:50

Big Falls Flowage Bottom
MBI0018-02 (Water) - Chain of Custody Number: 238395

Analyte	Result	LOD	LOQ	Units	Analyte		Batch	Prepared	Analyzed	Method	Analyst
					Qualifier	Dilution					
Wet Chemistry											
Phosphate, Total as P	0.0346	0.00900	0.0100	mg/L		1	BB10081	9/7/16 6:26	9/7/16 13:08	EPA 365.1	seal



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Big Falls Hydro	Project Name/Location: Phosphorus	
1400 Western Ave		Reported:
Eau Claire WI, 54701	Project Manager: Matt J Miller	09/08/2016 07:50

Wet Chemistry - Quality Control

Analyte	Result	LOD	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch BBI0081 - Wet Prep

Blank (BBI0081-BLK1)					Prepared & Analyzed: 09/07/2016						
Phosphate, Total as P	<0.0100		0.0100	mg/L							
LCS (BBI0081-BS1)					Prepared & Analyzed: 09/07/2016						
Phosphate, Total as P	0.517		0.0100	mg/L	0.50000		103	90-110			
Duplicate (BBI0081-DUP1)					Source: MBH0413-07 Prepared & Analyzed: 09/07/2016						
Phosphate, Total as P	0.0368		0.0100	mg/L		0.0384			4.26	20	
Duplicate (BBI0081-DUP2)					Source: MBI0021-05 Prepared & Analyzed: 09/07/2016						
Phosphate, Total as P	0.212		0.0100	mg/L		0.220			3.56	20	
Matrix Spike (BBI0081-MS1)					Source: MBH0413-07 Prepared & Analyzed: 09/07/2016						
Phosphate, Total as P	0.562		0.0100	mg/L	0.50000	0.0384	105	90-110			
Matrix Spike (BBI0081-MS2)					Source: MBI0021-05 Prepared & Analyzed: 09/07/2016						
Phosphate, Total as P	0.732		0.0100	mg/L	0.50000	0.220	102	90-110			
Matrix Spike Dup (BBI0081-MSD1)					Source: MBH0413-07 Prepared & Analyzed: 09/07/2016						
Phosphate, Total as P	0.575		0.0100	mg/L	0.50000	0.0384	107	90-110	2.45	20	
Matrix Spike Dup (BBI0081-MSD2)					Source: MBI0021-05 Prepared & Analyzed: 09/07/2016						
Phosphate, Total as P	0.765		0.0100	mg/L	0.50000	0.220	109	90-110	4.36	20	



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Thornapple Hydro	Project Name/Location: Phosphorus	
W 5506 Dam Road		Reported:
Glen Flora WI, 54563	Project Manager: Matt J Miller	09/08/2016 07:51

Thornapple Flowage Surface
MBI0019-01 (Water) - Chain of Custody Number: 238395

Analyte	Result	LOD	LOQ	Units	Analyte Qualifier	Dilution	Batch	Prepared	Analyzed	Method	Analyst
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Wet Chemistry

Phosphate, Total as P	0.0258	0.00900	0.0100	mg/L		1	BBI0081	9/7/16 6:26	9/7/16 13:10	EPA 365.1	seal
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Thornapple Hydro	Project Name/Location: Phosphorus	
W 5506 Dam Road		Reported:
Glen Flora WI, 54563	Project Manager: Matt J Miller	09/08/2016 07:51

Thornapple Flowage Bottom
MBI0019-02 (Water) - Chain of Custody Number: 238395

Analyte	Result	LOD	LOQ	Units	Analyte		Batch	Prepared	Analyzed	Method	Analyst
					Qualifier	Dilution					
Wet Chemistry											
Phosphate, Total as P	0.0299	0.00900	0.0100	mg/L		1	BBI0081	9/7/16 6:26	9/7/16 13:11	EPA 365.1	seal



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Thornapple Hydro	Project Name/Location: Phosphorus	
W 5506 Dam Road		Reported:
Glen Flora WI, 54563	Project Manager: Matt J Miller	09/08/2016 07:51

Wet Chemistry - Quality Control

Analyte	Result	LOD	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch BBI0081 - Wet Prep

Blank (BBI0081-BLK1)					Prepared & Analyzed: 09/07/2016						
Phosphate, Total as P	<0.0100		0.0100	mg/L							
LCS (BBI0081-BS1)					Prepared & Analyzed: 09/07/2016						
Phosphate, Total as P	0.517		0.0100	mg/L	0.50000		103	90-110			
Duplicate (BBI0081-DUP1)					Source: MBH0413-07 Prepared & Analyzed: 09/07/2016						
Phosphate, Total as P	0.0368		0.0100	mg/L		0.0384			4.26	20	
Duplicate (BBI0081-DUP2)					Source: MBI0021-05 Prepared & Analyzed: 09/07/2016						
Phosphate, Total as P	0.212		0.0100	mg/L		0.220			3.56	20	
Matrix Spike (BBI0081-MS1)					Source: MBH0413-07 Prepared & Analyzed: 09/07/2016						
Phosphate, Total as P	0.562		0.0100	mg/L	0.50000	0.0384	105	90-110			
Matrix Spike (BBI0081-MS2)					Source: MBI0021-05 Prepared & Analyzed: 09/07/2016						
Phosphate, Total as P	0.732		0.0100	mg/L	0.50000	0.220	102	90-110			
Matrix Spike Dup (BBI0081-MSD1)					Source: MBH0413-07 Prepared & Analyzed: 09/07/2016						
Phosphate, Total as P	0.575		0.0100	mg/L	0.50000	0.0384	107	90-110	2.45	20	
Matrix Spike Dup (BBI0081-MSD2)					Source: MBI0021-05 Prepared & Analyzed: 09/07/2016						
Phosphate, Total as P	0.765		0.0100	mg/L	0.50000	0.220	109	90-110	4.36	20	

APPENDIX B

**Summary Of Total Phosphorous And Chlorophyll A
Data For Big Falls And Thornapple Flowages
2012 - 2016**

Summary of Water Quality Data for Big Falls and Thornapple Flowages (2012-2016)

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)
4/24/2012	0.03	6.9	0.04	0.03	2.30	0.03
7/23/2012	0.07	6.1	0.10	0.04	11.00	0.05
8/28/2012	0.02	3.3	0.04	0.03	8.60	0.03
5/29/2013	<0.05	2.6	0.06	0.07	1.3	0.07
7/30/2013	<0.05	3.1	<0.05	<0.05	1.3	0.05
8/27/2013	<0.05	5.0	0.06	<0.05	18.0	0.05
7/22/12014**	0.04	5.0	0.05	0.04	1.9	0.05
8/27/2014	0.03	3.6	0.10	0.04	14.0	<0.01
4/28/2015	0.02	1.3	0.03	0.03	1.7	0.02
7/21/2015	0.04	6.8	0.05	0.03	0.6	0.03
8/26/2015	0.03	4.1	0.03	0.03	2.4	0.03
5/3/2016	0.02	1.9	0.02	0.02	2.1	0.02
7/19/2016	0.03	2.0	0.06	0.03	0.6	0.03
8/30/2016	0.02	4.7	0.03	0.03	1.3	0.03
<hr/>						
<i>Average (Ice-out sample)</i>	0.02	4.23	0.05	0.05	2.47	0.05
<i>Average (July sample)</i>	0.03	4.60	0.05	0.03	3.08	0.04
<i>Average (August sample)</i>	0.02	4.14	0.05	0.03	8.86	0.03

APPENDIX C

**Summary Of Dissolved Oxygen and Temperature
Data for Big Falls Flowage and Thornapple Flowage
2012-2016**

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2012.

Date: 4/24/2012
 Secchi Disk (ft.): 4.0
 Depth of Bottom Sample (ft): 32
 Weather Conditions: mostly sunny, light winds
 Temperature (F): 58

Date: 7/23/2012
 Secchi Disk (ft.): 4.0
 Depth of Bottom Sample (ft): 34
 Weather Conditions: mostly sunny, NW wind @ 10
 Temperature (F): 82

Date: 8/28/2012
 Secchi Disk (ft.): 5.5
 Depth of Bottom Sample: 34
 Weather Conditions: sunny, light winds
 Temperature (F): 65

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	11.9	10.90
2.0	11.7	10.94
4.0	11.2	10.91
6.0	11.2	10.91
8.0	11.1	10.88
10.0	11.1	10.87
12.0	11.1	10.85
14.0	11.0	10.83
16.0	11.0	10.81
18.0	11.0	10.81
20.0	11.0	10.77
22.0	11.0	10.73
24.0	11.0	10.72
26.0	11.0	10.72
28.0	11.0	10.72
30.0	11.0	10.72
32.0	11.0	10.71
34.0	Low battery	Low battery
36.0	Low battery	Low battery

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	27.2	7.68
2.0	27.1	7.68
4.0	27.1	7.70
6.0	26.9	7.73
8.0	26.6	7.50
10.0	26.3	7.32
12.0	26.2	7.33
14.0	26.0	6.95
16.0	25.8	6.89
18.0	25.5	6.55
20.0	25.2	6.28
22.0	25.1	6.02
24.0	25.0	5.98
26.0	24.9	5.77
28.0	24.7	5.51
30.0	24.6	5.26
32.0	24.4	4.91
34.0	24.3	4.28
36.0	Bottom	Bottom

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	24.4	8.15
2.0	24.3	8.14
4.0	24.3	8.10
6.0	24.3	8.04
8.0	24.3	8.16
10.0	24.2	7.82
12.0	23.7	7.38
14.0	23.5	7.15
16.0	23.4	6.85
18.0	23.4	6.75
20.0	23.4	6.64
22.0	23.3	6.44
24.0	23.2	6.23
26.0	23.0	5.84
28.0	22.7	5.38
30.0	22.6	5.25
32.0	22.2	4.62
34.0	20.8	3.82
36.0	Bottom	Bottom

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2013.

Date: 5/29/2013
 Secchi Disk (ft.): 4.5
 Depth of Bottom Sample (ft): 38
 Weather Conditions: mostly cloudy, light winds
 Temperature (F): 59

Date: 7/30/2013
 Secchi Disk (ft.): 4.0
 Depth of Bottom Sample (ft): 36
 Weather Conditions: overcast, light winds
 Temperature (F): 64

Date: 8/27/2013
 Secchi Disk (ft.): 5.0
 Depth of Bottom Sample: 38
 Weather Conditions: mostly cloudy, calm winds
 Temperature (F): 65

5/29/2013			7/30/2013			8/27/2013		
Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	15.3	9.22	Surface	20.8	7.89	Surface	26.0	7.35
2.0	15.3	9.17	2.0	20.7	7.83	2.0	26.0	7.31
4.0	15.2	9.13	4.0	20.6	7.75	4.0	25.9	7.27
6.0	15.2	9.13	6.0	20.5	7.62	6.0	25.9	7.23
8.0	15.2	9.10	8.0	19.8	7.81	8.0	25.9	7.22
10.0	15.2	9.10	10.0	19.4	7.56	10.0	25.8	7.25
12.0	15.2	9.07	12.0	19.0	7.60	12.0	25.7	7.22
14.0	15.2	9.07	14.0	18.9	7.39	14.0	25.7	7.26
16.0	15.2	9.07	16.0	18.5	7.63	16.0	25.7	7.30
18.0	15.2	9.07	18.0	18.4	7.66	18.0	25.4	7.10
20.0	15.2	9.06	20.0	18.3	7.86	20.0	25.2	7.00
22.0	15.2	9.06	22.0	18.1	7.98	22.0	24.8	6.94
24.0	15.2	9.05	24.0	18.0	7.99	24.0	24.7	6.77
26.0	15.2	9.05	26.0	18.0	8.01	26.0	24.6	6.68
28.0	15.2	9.04	28.0	18.0	7.85	28.0	24.5	6.54
30.0	15.2	9.04	30.0	18.0	7.88	30.0	24.4	6.29
32.0	15.2	9.04	32.0	17.9	8.02	32.0	23.9	5.69
34.0	15.2	9.03	34.0	17.9	7.81	34.0	23.8	5.40
36.0	15.2	9.01	36.0	17.9	7.7	36.0	23.3	4.0
38.0	Bottom	Bottom	38.0	Bottom	Bottom	38.0	Bottom	Bottom

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2014.

Date: April 2014

Secchi Disk (ft.):

Depth of Bottom Sample (ft):

Weather Conditions:

Temperature (F):

Date: 7/22/2014

Secchi Disk (ft.): 3.5

Depth of Bottom Sample (ft): 36

Weather Conditions: mostly cloudy, NW wind 10-15

Temperature (F): 75

Date: 8/27/2014

Secchi Disk (ft.): 5.0

Depth of Bottom Sample: 36

Weather Conditions: mostly sunny, light winds

Temperature (F): 68

**Not Sampled Due To
High River Flows**

	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)		Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
	Surface	24.9	7.75		Surface	24.1	7.43
	2.0	24.8	7.74		2.0	24.1	7.41
	4.0	24.7	7.71		4.0	24.1	7.43
	6.0	24.7	7.69		6.0	24.0	7.36
	8.0	24.7	7.68		8.0	24.0	7.32
	10.0	24.7	7.68		10.0	23.9	7.13
	12.0	24.6	7.65		12.0	23.8	7.15
	14.0	24.6	7.65		14.0	23.8	7.15
	16.0	24.6	7.64		16.0	23.8	7.17
	18.0	24.5	7.60		18.0	23.8	7.16
	20.0	24.4	7.62		20.0	23.8	7.15
	22.0	24.3	7.61		22.0	23.7	6.91
	24.0	24.0	7.31		24.0	23.6	6.80
	26.0	23.7	7.22		26.0	23.5	6.59
	28.0	23.5	7.19		28.0	23.3	6.38
	30.0	23.5	7.17		30.0	23.0	6.13
	32.0	23.4	7.04		32.0	22.9	6.00
	34.0	23.1	6.93		34.0	22.9	5.90
	36.0	22.9	6.73		36.0	21.7	4.97
	38.0	Bottom	Bottom		38.0	Bottom	Bottom

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2015.

Date: 4/28/2015
 Secchi Disk (ft.): 4.0
 Depth of Bottom Sample (ft): 34
 Weather Conditions: sunny, winds calm
 Temperature (F): 57

Date: 7/21/2015
 Secchi Disk (ft.): 4.0
 Depth of Bottom Sample (ft): 34
 Weather Conditions: mostly sunny, NW winds @ 10
 Temperature (F): 68

Date: 8/26/2015
 Secchi Disk (ft.): 5.0
 Depth of Bottom Sample: 36
 Weather Conditions: mostly sunny, NW winds @ 5
 Temperature (F): 60

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	13.4	10.75
2.0	12.0	10.83
4.0	11.9	10.81
6.0	11.7	10.77
8.0	11.6	10.75
10.0	11.6	10.72
12.0	11.6	10.71
14.0	11.5	10.69
16.0	11.5	10.69
18.0	11.4	10.66
20.0	11.3	10.64
22.0	11.2	10.60
24.0	11.1	10.57
26.0	11.1	10.57
28.0	11.0	10.59
30.0	11.0	10.56
32.0	10.8	10.45
34.0	10.7	10.4
36.0	Bottom	Bottom

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	24.3	7.52
2.0	24.3	7.51
4.0	24.1	7.37
6.0	24.0	7.39
8.0	23.9	7.40
10.0	23.9	7.38
12.0	23.9	7.35
14.0	23.9	7.32
16.0	23.8	7.30
18.0	23.8	7.27
20.0	23.8	7.26
22.0	23.8	7.26
24.0	23.8	7.26
26.0	23.8	7.25
28.0	23.8	7.25
30.0	23.8	7.21
32.0	23.8	7.20
34.0	23.8	7.03
36.0	Bottom	Bottom

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	18.1	7.84
2.0	18.0	7.82
4.0	17.7	7.81
6.0	17.6	7.83
8.0	17.0	8.24
10.0	16.6	8.40
12.0	16.6	8.42
14.0	16.4	8.42
16.0	16.3	8.47
18.0	16.3	8.47
20.0	16.3	8.51
22.0	16.3	8.52
24.0	16.3	8.54
26.0	16.2	8.57
28.0	16.1	8.55
30.0	16.1	8.59
32.0	16.0	8.56
34.0	16.0	8.58
36.0	16.0	8.55
38.0	Bottom	Bottom

Dissolved Oxygen and Temperature Profiles for the Big Falls Flowage in 2016.

Date: 5/3/2016
 Secchi Disk (ft.): 4.5
 Depth of Bottom Sample (ft): 35
 Weather Conditions: hazy sun, wind west @ 10
 Temperature (F): 55

Date: 7/19/2016
 Secchi Disk (ft.): 4.0
 Depth of Bottom Sample (ft): NA
 Weather Conditions: Sunny, calm wind
 Temperature (F): 74

Date: 8/30/2016
 Secchi Disk (ft.): 4.0
 Depth of Bottom Sample: 34
 Weather Conditions: cloudy, calm wind
 Temperature (F): 60

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	13.2	10.18
2	13.0	10.21
4	12.9	10.17
6	12.8	10.15
8	12.8	10.13
10	12.8	10.12
12	12.8	10.11
14	12.8	10.11
16	12.8	10.10
18	12.8	10.10
20	12.8	10.10
22	12.8	10.08
24	12.8	10.05
26	12.7	10.03
28	12.8	10.04
30	12.7	10.03
32	12.7	10.04
34	12.7	10.0
36	Bottom	

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface		
No sampling - DO meter malfunctioned		

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	22.9	7.80
2	22.9	7.77
4	22.7	7.74
6	22.7	7.73
8	22.7	7.71
10	22.7	7.71
12	22.7	7.69
14	22.6	7.66
16	22.6	7.66
18	22.6	7.64
20	22.6	7.64
22	22.6	7.60
24	22.6	7.53
26	22.5	7.46
28	22.5	7.31
30	22.5	7.29
32	22.3	7.35
34	22.0	7.35
36	Bottom	

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2012.

Date: 4/24/2012			Date: 7/23/2012			Date: 8/28/2012		
Secchi Disk (ft.):	4.0		Secchi Disk (ft.):	3.5		Secchi Disk (ft.):	5.5	
Depth of Bottom Sample (ft):	20		Depth of Bottom Sample (ft):	18		Depth of Bottom Sample (ft):	18	
Weather Conditions:	sunny, light NW winds		Weather Conditions:	sunny, winds W @ 5-10		Weather Conditions:	overcast, calm	
Temperature (F):	67		Temperature (F):	85		Temperature (F):	78	
Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	15.4	10.99	Surface	30.6	8.45	Surface	23.6	8.37
2.0	13.2	11.22	2.0	28.3	7.66	2.0	23.3	7.98
4.0	12.8	11.25	4.0	27.4	7.03	4.0	23.7	7.83
6.0	12.4	11.27	6.0	26.8	6.30	6.0	23.1	7.72
8.0	12.1	11.24	8.0	26.5	6.04	8.0	23.1	7.84
10.0	11.9	11.10	10.0	26.3	5.70	10.0	23.1	7.68
12.0	11.9	11.06	12.0	25.6	4.99	12.0	23.0	7.16
14.0	11.7	11.04	14.0	25.2	4.88	14.0	22.8	6.57
16.0	11.6	10.97	16.0	24.6	4.08	16.0	22.6	6.22
18.0	11.6	10.95	18.0	24.2	3.08	18.0	22.0	3.31
20.0	11.6	10.92	20.0	Bottom	Bottom	20.0	Bottom	Bottom
22.0	Bottom	Bottom						

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2013.

Date: 5/29/2013			Date: 7/30/2013			Date: 8/27/2013		
Secchi Disk (ft.):	4.0		Secchi Disk (ft.):	5		Secchi Disk (ft.):	4.5	
Depth of Bottom Sample (ft):	20		Depth of Bottom Sample (ft):	19.5		Depth of Bottom Sample (ft):	20	
Weather Conditions:	mostly cloudy, light winds		Weather Conditions:	overcast, light winds		Weather Conditions:	partly sunny, light winds	
Temperature (F):	62		Temperature (F):	65		Temperature (F):	88	
Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	15.7	8.95	Surface	22.7	7.30	Surface	26.2	8.32
2.0	15.2	8.95	2.0	22.5	7.25	2.0	26.0	8.34
4.0	15.2	8.96	4.0	22.5	7.29	4.0	25.1	7.36
6.0	15.2	8.94	6.0	22.5	7.27	6.0	24.8	7.23
8.0	15.2	8.94	8.0	22.3	7.16	8.0	24.7	7.08
10.0	15.2	8.95	10.0	22.2	7.00	10.0	24.7	6.94
12.0	15.2	8.94	12.0	21.9	6.62	12.0	24.5	6.68
14.0	15.2	8.94	14.0	21.1	6.42	14.0	24.3	6.69
16.0	15.2	8.93	16.0	20.6	6.14	16.0	23.9	6.59
18.0	15.2	8.92	18.0	20.3	5.87	18.0	23.7	6.23
20.0	15.2	8.92	20.0	20.1	5.73	20.0	23.7	6.18
22.0	Bottom	Bottom	22.0	Bottom	Bottom	22.0	Bottom	Bottom

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2014.

Date:	April 2014	Date:	7/22/2014	Date:	8/27/2014
Secchi Disk (ft.):	4.0	Secchi Disk (ft.):	3.5	Secchi Disk (ft.):	5
Depth of Bottom Sample (ft):	20	Depth of Bottom Sample (ft):	20	Depth of Bottom Sample (ft):	20
Weather Conditions:	mostly cloudy, light winds	Weather Conditions:	mostly cloudy, sw wind @ 10	Weather Conditions:	mostly sunny
Temperature (F):	62	Temperature (F):	79	Temperature (F):	74

**Not Sampled Due To
High River Flows**

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	25.4	6.90	Surface	23.9	7.81
2.0	25.1	6.86	2.0	23.1	7.83
4.0	24.8	6.84	4.0	22.8	7.41
6.0	24.7	6.80	6.0	22.8	7.42
8.0	24.1	6.72	8.0	22.7	7.41
10.0	24.0	6.69	10.0	22.3	7.07
12.0	24.0	6.67	12.0	22.2	6.90
14.0	24.0	6.65	14.0	22.2	6.77
16.0	23.9	6.63	16.0	22.1	6.67
18.0	23.9	6.60	18.0	21.8	6.58
20.0	23.9	6.59	20.0	21.8	6.59
22.0	Bottom	Bottom	22.0	Bottom	Bottom

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2015.

Date:	4/28/2015	Date:	7/21/2015	Date:	8/26/2015
Secchi Disk (ft.):	4.0	Secchi Disk (ft.):	5.5	Secchi Disk (ft.):	6.0
Depth of Bottom Sample (ft):	18	Depth of Bottom Sample (ft):	20	Depth of Bottom Sample (ft):	18
Weather Conditions:	sunny, calm winds	Weather Conditions:	sunny, NW winds @ 10	Weather Conditions:	mostly sunny, NW winds @ 5
Temperature (F):	63	Temperature (F):	78	Temperature (F):	66

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)	Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	13.8	10.52	Surface	24.3	6.77	Surface	20.4	8.22
2.0	10.9	10.41	2.0	23.8	6.69	2.0	19.4	8.23
4.0	10.6	10.42	4.0	23.8	6.66	4.0	18.8	8.20
6.0	10.3	10.31	6.0	23.4	6.61	6.0	18.5	8.07
8.0	10.3	10.28	8.0	22.9	6.55	8.0	18.4	7.99
10.0	10.0	10.14	10.0	22.8	6.52	10.0	18.3	7.90
12.0	9.9	10.09	12.0	22.8	6.48	12.0	18.3	7.89
14.0	9.9	10.11	14.0	22.8	6.48	14.0	18.3	7.87
16.0	9.9	10.10	16.0	22.7	6.47	16.0	18.3	7.88
18.0	9.9	10.08	18.0	22.7	6.46	18.0	18.2	7.80
20.0	Bottom	Bottom	20.0	22.7	6.44	20.0	Bottom	Bottom
			22.0	Bottom	Bottom			

Dissolved Oxygen and Temperature Profiles for the Thornapple Flowage in 2016.

Date: 5/3/2016
 Secchi Disk (ft.): 4.5
 Depth of Bottom Sample (ft): 20
 Weather Conditions: overcast, wind west @ 15-20
 Temperature (F): 65

Date: 7/19/2016
 Secchi Disk (ft.): 4.5
 Depth of Bottom Sample (ft): NA
 Weather Conditions: mostly sunny, s wind @ 5-10
 Temperature (F): 79

Date: 8/30/2016
 Secchi Disk (ft.): 4.5
 Depth of Bottom Sample (ft): 20
 Weather Conditions: partly sunny, light winds
 Temperature (F): 80

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	11.0	10.65
2.0	10.9	10.58
4.0	10.8	10.59
6.0	10.8	10.59
8.0	10.5	10.60
10.0	10.5	10.63
12.0	10.5	10.61
14.0	10.4	10.59
16.0	10.4	10.58
18.0	10.4	10.59
20.0	10.4	10.57
22.0	Bottom	Bottom

No Sampling - DO meter malfunctioned

Depth (ft.)	Temperature (celsius)	Dissolved Oxygen (mg/l)
Surface	24.3	6.99
2.0	23.9	6.88
4.0	23.6	6.85
6.0	23.4	6.77
8.0	23.4	6.76
10.0	23.3	6.72
12.0	23.2	6.66
14.0	23.2	6.66
16.0	23.2	6.65
18.0	23.2	6.64
20.0	23.2	6.57
22.0	Bottom	Bottom

APPENDIX D

Agency Correspondence

From: [Utrup, Nick](#)
To: [Miller, Matthew J](#)
Cc: [Laatsch, Cheryl - DNR](#)
Subject: Re: 2016 Water Quality Monitoring Report
Date: Monday, January 23, 2017 7:04:06 AM

XCEL ENERGY SECURITY NOTICE: This email originated from an external sender. Exercise caution before clicking on any links or attachments and consider whether you know the sender. For more information please visit the Phishing page on XpressNET.

I have no comments

Nick Utrup
U.S. Fish and Wildlife Service
Twin Cities Field Office
4101 American Boulevard East
Bloomington, MN 55425

*****Note Number Change Below*****

Office: (952) 252-0092 Ext. 204
FAX: (952) 646-2873
Email: Nick_Utrup@fws.gov

On Fri, Jan 20, 2017 at 3:21 PM, Miller, Matthew J
<Matthew.J.Miller@xcelenergy.com> wrote:

Please let me know if you have any comments so I may file my report with FERC.

From: Miller, Matthew J
Sent: Thursday, December 22, 2016 11:21 AM
To: Laatsch, Cheryl - DNR; (Nick_Utrup@fws.gov)
Subject: 2016 Water Quality Monitoring Report

Hello Cheryl and Nick,

Attached is the 2016 annual water quality monitoring report for Big Falls and Thornapple. Please provide any comments you may have by January 25, 2017 so I may file my report with FERC. Let me know if you require a hard copy. Have a Merry Christmas!

Matthew Miller
Xcel Energy | Responsible By Nature

From: [Laatsch, Cheryl - DNR](#)
To: [Miller, Matthew J](#)
Subject: RE: 2016 Water Quality Monitoring Report
Date: Friday, January 06, 2017 3:28:58 PM

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Thanks a lot. This is very helpful

We are committed to service excellence.

Visit our survey at <http://dnr.wi.gov/customersurvey> to evaluate how I did.

Cheryl Laatsch
Statewide FERC Coordinator
Bureau of Environmental Analysis and Sustainability
Wisconsin Dept of Natural Resources
N7725 Hwy 28
Horicon WI 53032
(T) 920-387-7869 (Fax) 920-387-7888
Cheryl.laatsch@wisconsin.gov



dnr.wi.gov



From: Miller, Matthew J [mailto:Matthew.J.Miller@xcelenergy.com]
Sent: Thursday, January 05, 2017 9:17 AM
To: Laatsch, Cheryl - DNR
Cc: May, Pearl A - DNR
Subject: RE: 2016 Water Quality Monitoring Report

Attached is the spreadsheet which covers 2011-2016. Let me know if you need anything else.

From: Laatsch, Cheryl - DNR [mailto:Cheryl.Laatsch@wisconsin.gov]
Sent: Wednesday, January 04, 2017 12:33 PM
To: Miller, Matthew J
Cc: May, Pearl A - DNR
Subject: RE: 2016 Water Quality Monitoring Report

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Can I get the spreadsheets for these reports? We can auto upload spreadsheets right into the database.

We are committed to service excellence.

Visit our survey at <http://dnr.wi.gov/customersurvey> to evaluate how I did.

Cheryl Laatsch
Statewide FERC Coordinator
Bureau of Environmental Analysis and Sustainability
Wisconsin Dept of Natural Resources
N7725 Hwy 28
Horicon WI 53032
(T) 920-387-7869 (Fax) 920-387-7888
Cheryl.laatsch@wisconsin.gov



dnr.wi.gov



From: Miller, Matthew J [<mailto:Matthew.J.Miller@xcelenergy.com>]
Sent: Thursday, December 22, 2016 11:21 AM
To: Laatsch, Cheryl - DNR; (Nick_Utrup@fws.gov)
Subject: 2016 Water Quality Monitoring Report

Hello Cheryl and Nick,

Attached is the 2016 annual water quality monitoring report for Big Falls and Thornapple. Please provide any comments you may have by January 25, 2017 so I may file my report with FERC. Let me know if you require a hard copy. Have a Merry Christmas!

Matthew Miller

Xcel Energy | Responsible By Nature

Hydro License Compliance Consultant

1414 W. Hamilton Ave., P.O. Box 8, Eau Claire, WI 54702

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