Report

2018 Water Quality Monitoring Data

for the

Crowley Hydroelectric Project

FERC Project #2473

Flambeau Hydro, LLC

North Fork of the Flambeau River, Price County, Wisconsin

Respectfully Submitted by:

Angie Stine

WHITE WATER ASSOCIATES, INC.

429 River Lane, P.O. Box 27
Amasa, Michigan 49903

Phone: 906-822-7889

Summary Flambeau (Crowley) Hydroelectric Project – FERC #2473

2018 marked the fourteenth year of water quality sampling under FERC approved "Water Quality Monitoring Plan Per License Article 406 for the Crowley Hydroelectric Project – FERC Project # 2473 – Flambeau Hydro, LLC. Monitoring was conducted on May 9, July 18, and August 21, 2018. This document contains all of the associated records for the 2018 monitoring along with summary figures and tables in four appendices: (1) Appendix A (Figures 1-4), (2) Appendix B (Tables 1-3), (3) Appendix C (sampling logs by date), and (4) Appendix D (laboratory reports and chains of custody).

A map of the Flambeau (Crowley) Hydroelectric Project is shown in Figure 1 indicating the water quality sampling location.

Monitoring results for 2018 are shown in Table 1. No unusual Temperature (Figure 2) or Dissolved Oxygen (Figure 3) readings were observed. The Secchi depths are shown in Figure 4.

In general, the weather (temperature and rainfall) during 2018 monitoring season appeared slightly warmer in May, June, and July, & August, with lower than normal precipitation in November, December, January, February, March, April and June, and normal to high precipitation in the months of October, February, June, July, and August (Table 2).

Ice-Out occurred between Agenda and Nine Mile Landing on the North Fork of the Flambeau River sometime during the week beginning April 30, 2018. The Ice-Out sampling event occurred on May 9, 2018. River flow, based on the Crowley Hydroelectric Project records was approximately 1470 cubic feet per second. Sampling occurred between 13:05 and 13:18. Samples were taken without incident. No unusual D.O. or Temperature readings were observed. Samples for laboratory analysis were delivered to White Water Associates, Inc. laboratory in Amasa, MI on May 9, 2018. White Water Associates, Inc. issued a laboratory report on June 5, 2018. No unusual levels of Chlorophyll *a*, True Color, or Total Phosphorus were noted in the laboratory reports.

River flow, based on Crowley Hydroelectric Project records, was approximately 1177 cubic feet per second during the July 18, 2018 sampling event. Sampling occurred between 1305 and 1316. Samples were taken without incident. No unusual D.O. or Temperature readings were observed. Samples for laboratory analysis were delivered to White Water Associates, Inc. laboratory in Amasa, MI on July 18, 2018. White Water Associates, Inc. issued a laboratory report on August 6, 2018. No unusual levels of Chlorophyll *a*, True Color, or Total Phosphorus were noted in the laboratory reports.

River flow, based on Crowley Hydroelectric Project records, was approximately 733 cubic feet per second during the August 21, 2018 sampling event. Sampling occurred between 1409 and 1420. Samples were taken without incident. No unusual D.O. or Temperature readings were observed. Samples for laboratory analysis were delivered to White Water Associates, Inc. laboratory in Amasa, MI on August 22, 2018. White Water Associates, Inc. issued a laboratory report on September 4, 2018. No unusual levels of Chlorophyll *a*, True Color, or Total Phosphorus were noted in the laboratory reports.

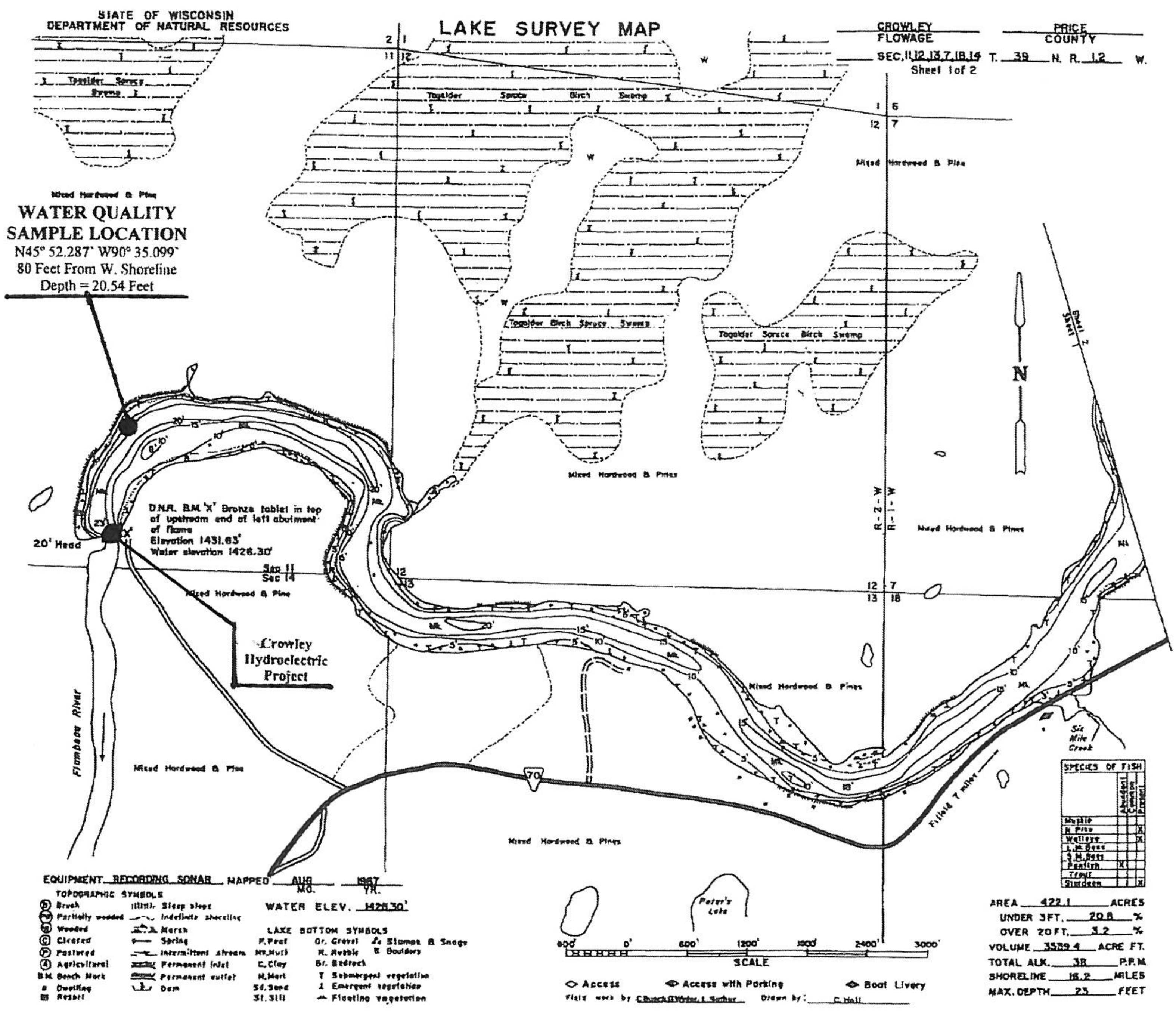
A summary of a comparison between the 2012 thru 2018 (Table 3) sampling results are as follows:

1. Water Clarity – Secchi Increased Ice Out and August
2. Chlorophyll a –Increased Ice Out and July, Decreased August
3. Color – Decreased Ice Out and August
4. Total Phosphorus – Increased Ice Out, July, and August
5. Overall, D.O. –Decreased Ice Out, July & August
6. Water Temperatures – Increased Ice Out, July, and August

The next scheduled Water Quality Monitoring at the Crowley Hydroelectric Project is set to take place in 2019 beginning with the Ice-Out sampling event.

Appendix A – Crowley Hydroelectric Project Figures

Figure 1. Crowley Hydroelectric Project Map


STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES
LAKE SURVEY MAP
CROWLEY FLOWAGE
PRICE COUNTY
SEC. 11,12,13,7,18,14 T. 39 N. R. 1,2 W.
Sheet 1 of 2
WATER QUALITY
SAMPLE LOCATION
N45° 52.287' W90° 35.099'
80 Feet From W. Shoreline
Depth = 20.54 Feet
D.N.R. B.M. 'X' Bronze tablet in top of upstream end of left abutment of flume
Elevation 1431.63'
Water elevation 1426.30'
20' Head
Crowley Hydroelectric Project
Flambeau River
Mixed Hardwood & Pine
Mixed Hardwood & Pines
Tagalder Spruce Birch Swamp
Tagalder Birch Spruce Swamp
Tagalder Spruce Swamp
Peter's Lake
Six Mile Creek
Fifield 7 miles
70
R-2-W
R-1-W
Sec 11
Sec 14
N
Sheet 2
Sheet 1
SPECIES OF FISH
Abundant
Common
Present
Muskie
N. Pike
Walleye
L.M. Bass
S.M. Bass
Panfish
Trout
Sturgeon
AREA 422.1 ACRES
UNDER 3FT. 20.8 %
OVER 20 FT. 3.2 %
VOLUME 3539.4 ACRE FT.
TOTAL ALK. 38 P.P.M.
SHORELINE 16.2 MILES
MAX. DEPTH 23 FEET
EQUIPMENT RECORDING SONAR MAPPED AUG 1967
MO. YR.
WATER ELEV. 1426.30'
TOPOGRAPHIC SYMBOLS
Brush
Partially wooded
Wooded
Cleared
Pastured
Agricultural
B.M. Bench Mark
Dwelling
Resort
Steep slope
Indefinite shoreline
Marsh
Spring
Intermittent stream
Permanent inlet
Permanent outlet
Dam
LAKE BOTTOM SYMBOLS
P. Peat
Mk. Muck
C. Clay
M. Marl
Sd. Sand
St. Silt
Gr. Gravel
R. Rubble
Br. Bedrock
Stumps & Snags
B Boulders
T Submergent vegetation
Emergent vegetation
Floating vegetation
SCALE
600' 0' 600' 1200' 1800' 2400' 3000'
Access
Access with Parking
Boat Livery
Drawn by: C. Hall

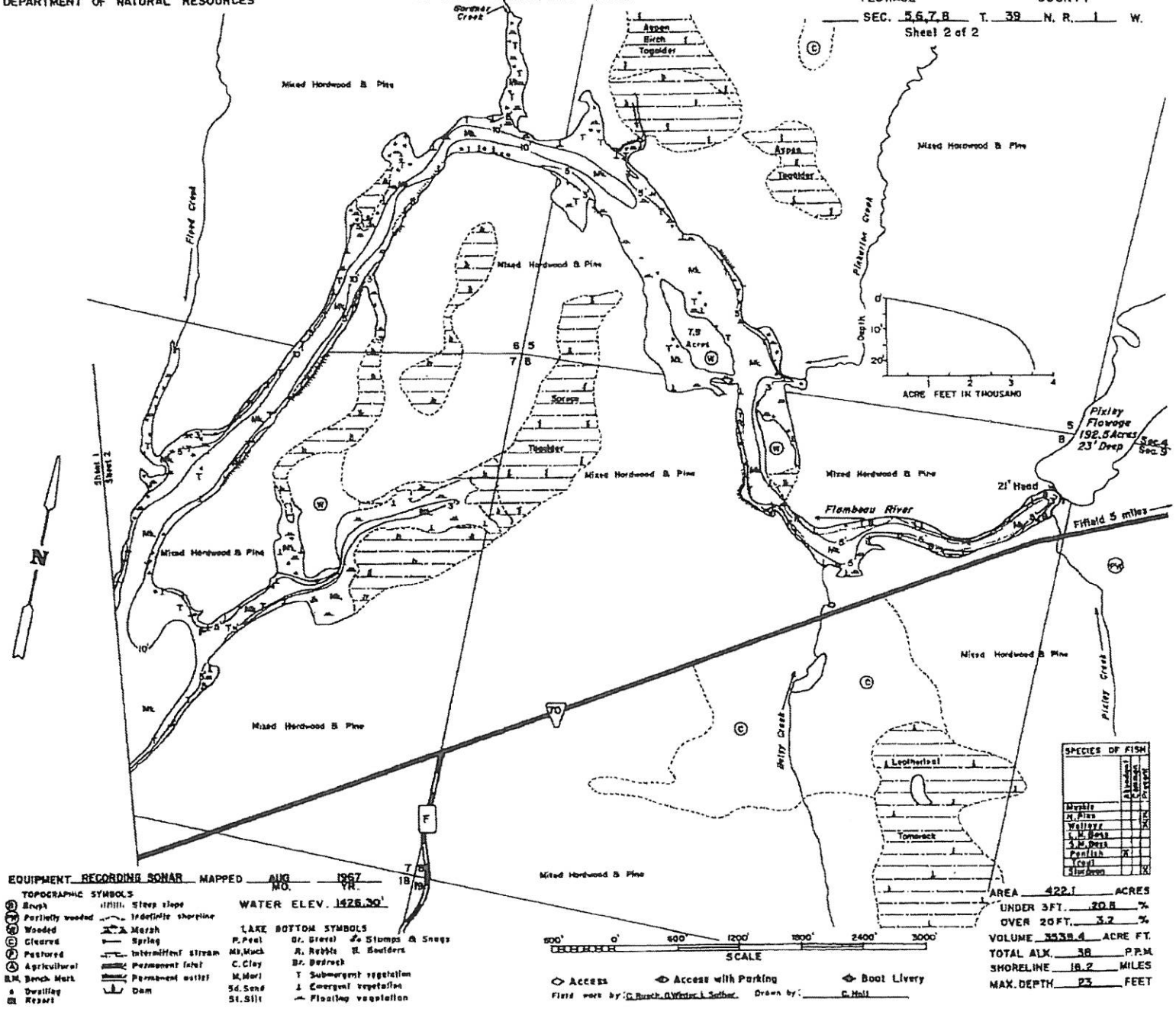
STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

LAKE SURVEY MAP

CROWLEY FLOWAGE — PRICE COUNTY

SEC. 5,6,7,8 T. 39 N. R. 1 W.

Sheet 2 of 2



EQUIPMENT RECORDING SONAR MAPPED AUG 1967
MO. YR.

WATER ELEV. 1426.30'

TOPOGRAPHIC SYMBOLS

- Brush
- Partially wooded
- Wooded
- Cleared
- Pastured
- Agricultural
- B.M. Bench Mark
- Dwelling
- Resort
- Steep slope
- Indefinite shoreline
- Marsh
- Spring
- Intermittent stream
- Permanent inlet
- Permanent outlet
- Dam

LAKE BOTTOM SYMBOLS

- P. Peat
- Mk. Muck
- C. Clay
- M. Marl
- Sd. Sand
- St. Silt
- Gr. Gravel
- Stumps & Snags
- R. Rubble
- B. Boulders
- Br. Bedrock
- Submergent vegetation
- Emergent vegetation
- Floating vegetation

Field work by: C. Roach, O. Winter & Sather. Drawn by: C. Holt

AREA 422.1 ACRES
UNDER 3FT. 20.8 %
OVER 20FT. 3.2 %
VOLUME 3538.4 ACRE FT.
TOTAL ALK. 38 P.P.M.
SHORELINE 18.2 MILES
MAX. DEPTH 23 FEET

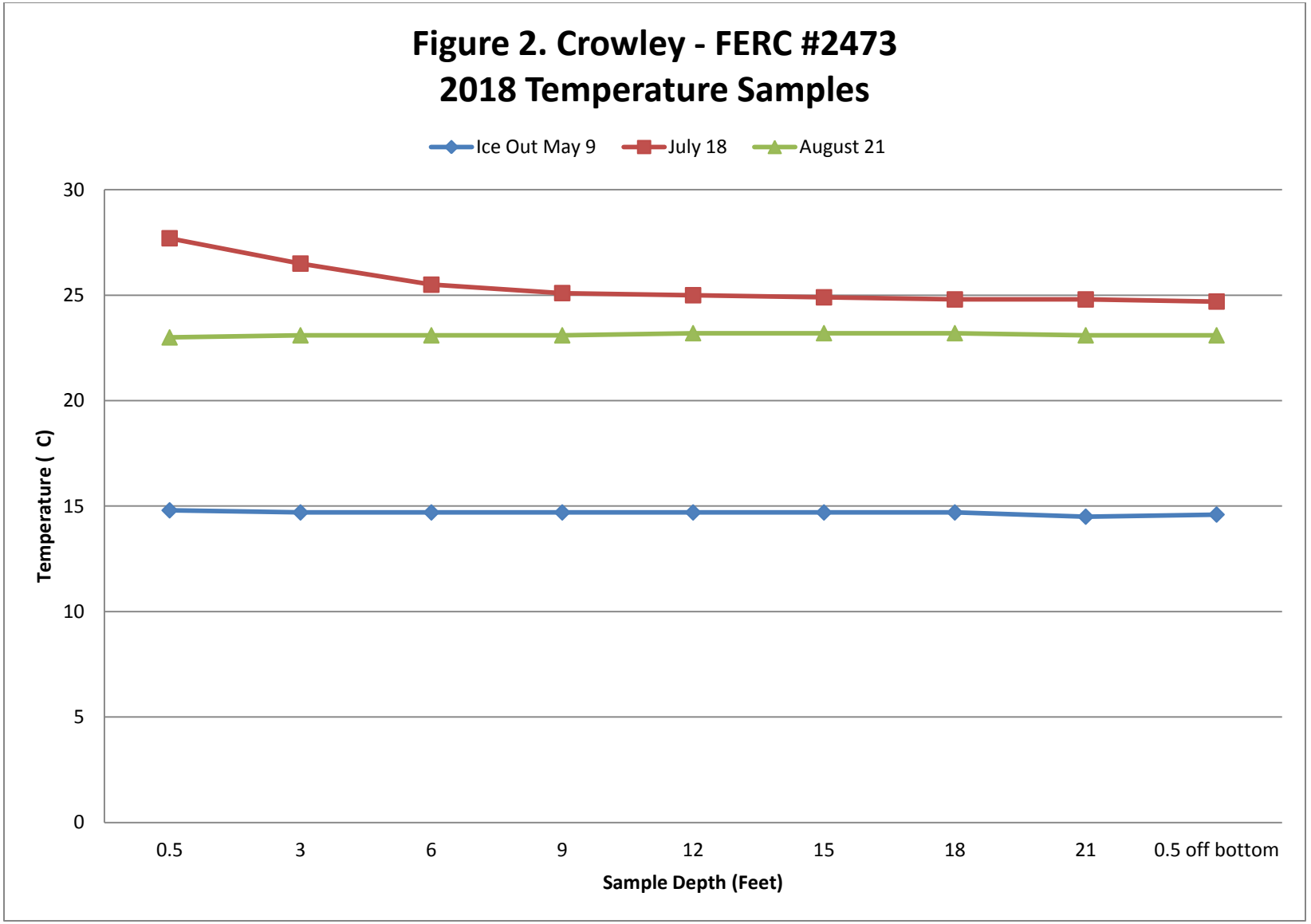


Figure 2. Crowley - FERC #2473
2018 Temperature Samples
Ice Out May 9
July 18
August 21
30
25
20
15
10
5
0
Temperature (C)
0.5
3
6
9
12
15
18
21
0.5 off bottom
Sample Depth (Feet)

Figure 3. Crowley- FERC #2473
2018 Dissolved Oxygen Samples

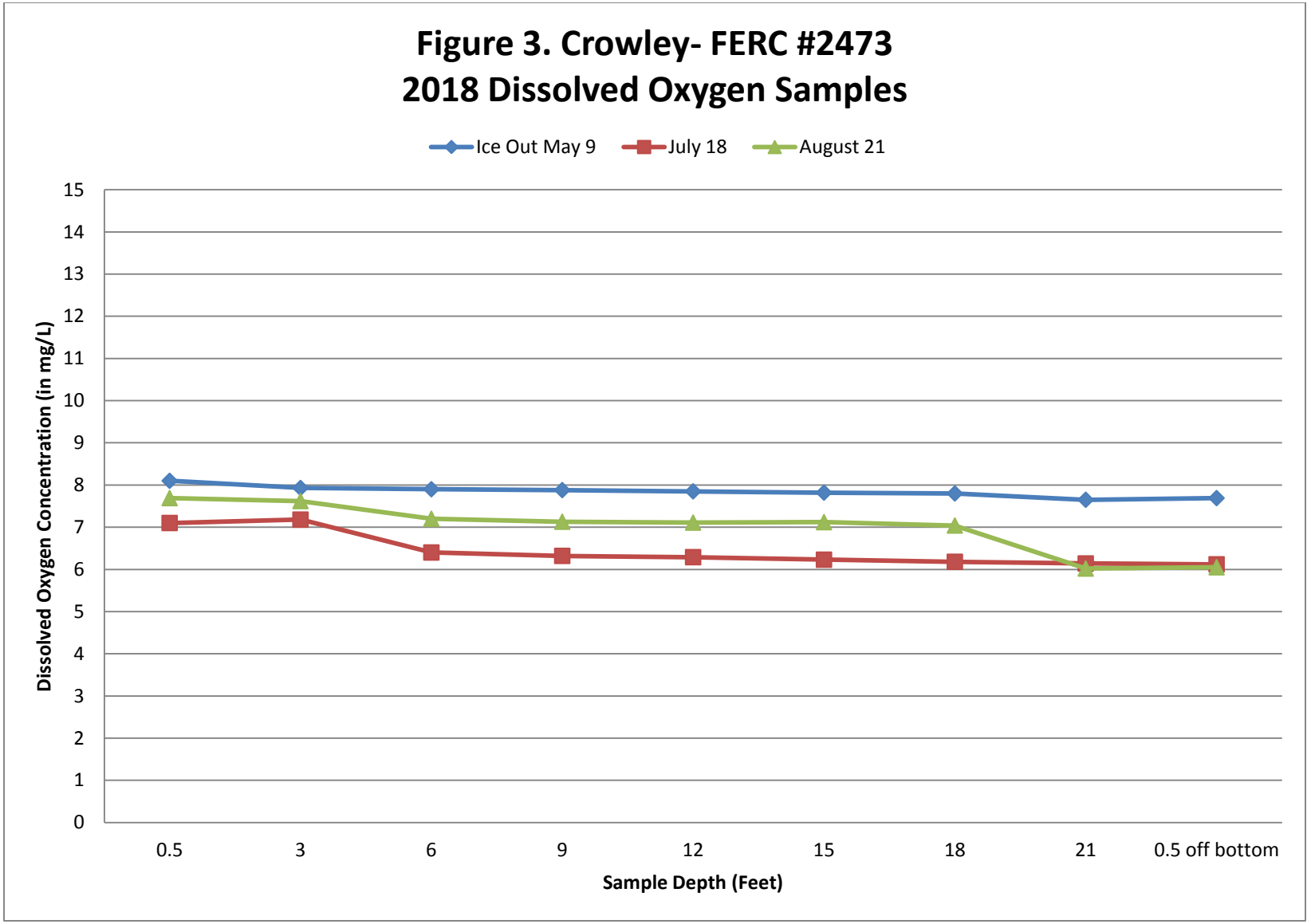
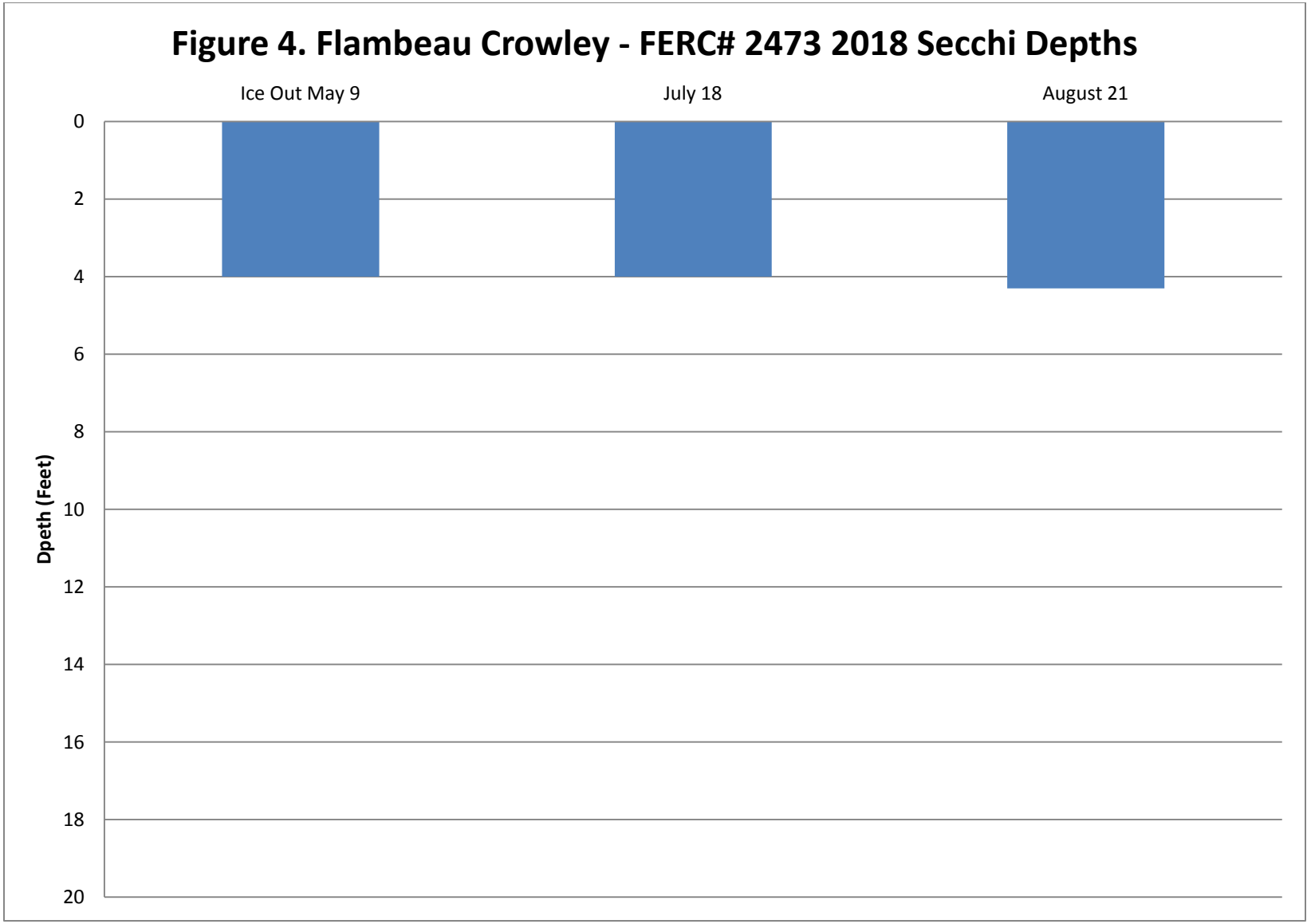


Figure 4. Flambeau Crowley - FERC# 2473 2018 Secchi Depths



Appendix B – Crowley Hydroelectric Project Tables

Table 1. Crowley Hydroelectric Project – FERC Project # 2473: 2018 Water Quality Sampling Data

	Ice Out May 9, 2018			July 18, 2018			August 21, 2018		
Project Flow (c.f.s)	1470			1177			733		
Dissolved Oxygen	**Time**	**D.O. (mg/L)**	**Water Temp. (°C)**	**Time**	**D.O. (mg/L)**	**Water Temp. (°C)**	**Time**	**D.O. (mg/L)**	**Water Temp. (°C)**
0.5 feet below surface	13:07:56	8.10	14.8	13:11:05	7.10	27.7	14:10:15	7.69	23.0
3 feet below surface	13:08:38	7.93	14.7	13:11:56	7.18	26.5	14:10:39	7.62	23.1
6 feet below surface	13:09:05	7.90	14.7	13:12:32	6.40	25.5	14:11:24	7.20	23.1
9 feet below surface	13:09:33	7.88	14.7	13:13:09	6.32	25.1	14:11:56	7.13	23.1
12 feet below surface	13:10:01	7.85	14.7	13:13:46	6.29	25.0	14:12:22	7.11	23.2
15 feet below surface	13:10:39	7.82	14.7	13:14:19	6.23	24.9	14:12:45	7.12	23.2
18 feet below surface	13:11:11	7.80	14.7	13:15:04	6.18	24.8	14:13:11	7.04	23.2
21 feet below surface	13:12:24	7.65	14.5	13:15:39	6.14	24.8	14:13:15	6.02	23.1
0.5 meter above bottom	13:13:16	7.69	14.6	13:16:31	6.12	24.7	14:15:05	6.05	23.1
Secchi Disk	**Time**	**Depth (ft)**		**Time**	**Depth (ft)**		**Time**	**Depth (ft)**	
Feet below surface	13:18	4.0		13:10	4		14:20	4.3	
Chlorophyll a	**Time**	**µg/L**		**Time**	**µg/L**		**Time**	**µg/L**	
3 feet below surface	13:07	5.2		13:11	10		14:11	10	
Color (True)	**Time**	**C.P.U. Units**	**LOD**	**Time**	**C.P.U. Units**	**LOD**	**Time**	**C.P.U. Units**	**LOD**
3 feet below surface	13:07	40	5*	13:11	35	5*	14:11	45	5*
Total Phosphorus	**Time**	**mg/L**	**LOD**	**Time**	**mg/L**	**LOD**	**Time**	**mg/L**	**LOD**
3 feet below surface	13:07	0.036	0.008*	13:11	0.061	0.008*	14:11	0.033	0.008*
3 feet above bottom	13:40	0.032	0.008*	13:16	0.043	0.008*	14:15	0.036	0.008*
*Considered Method Detection Limit									

Table 2. 2017/18 Water Year Monthly Temperature and Precipitation for Park Falls, Wisconsin

Month	Highest Temp.	Lowest Temp.	Average Temp.	Departure From Normal	Heating Degree Days	Normal Degree Days	Total Precip.	Total Snowfall	Normal Precip.	% of Normal Precipitation
October - 17	75	23	45.6	2.4	594	678	3.40	11.1	2.85	74
November - 17	47	-5	25.7	-3.1	1170	1088	1.31	10.5	2.09	80
December - 17	43	-26	10.5	-4.3	1683	1556	0.83	13.4	1.21	80
January – 18	45	-22	11.0	10.2	1666	1699	0.63	44.1	0.96	76
February – 18	43	-17	10.3	15.1	1526	1399	1.73	24.2	0.81	68
March – 18	48	-4	26.1	0.2	1197	1210	0.44	5.1	1.49	64
April – 18	71	2	32.8	-6.8	958	762	1.39	18.5	2.43	58
May – 18	92	29	57.7	6.3	259	426	2.21	0.00	3.23	59
June – 18	85	40	61.8	1.7	125	179	4.64	0.00	4.23	71
July – 18	89	49	69.1	3.3	6	63	3.28	0.00	3.85	70
August – 18	91	48	67.5	3.2	35	86	3.86	0.00	3.70	76
September - 18	81	30	59.1	3.5	219	298	3.51	0.00	4.11	75

Source: NOAA/Duluth, MN

Table 3. Flambeau Crowley Project Sampling Comparison Table: 2012 Thru Current Year										
Year	**Month**	**Secchi Depth**	**Chlorophyll *a***	**Color (True)**	**Total Phosphorus**	**Total Phosphorus**	**Low D.O.**	**High D.O.**	**Low Water Temp.**	**High Water Temp.**
		Feet	**µg/L**	**C.P.U. Units**	**Below Surface mg/L**	**Above Bottom mg/L**	**mg/L**	**mg/L**	**° C**	**° C**
2012	April	3.30	1.70	120.00	0.041	*	9.30	10.37	8.80	11.80
2013	May	*	*	*	*	*	*	*	*	*
2014	June	3.50	1.70	150.00	0.031	0.029	6.61	6.97	19.00	21.90
2015	April	3.50	5.10	13.00	0.047	0.036	9.52	9.78	9.00	11.70
2016	March	3.60	0.41	40.00	0.030	0.030	11.35	11.61	2.90	3.70
2017	April	3.90	3.40	30.00	0.025	0.028	9.16	9.46	8.20	10.10
2018	May	4.00	5.20	40.00	0.036	0.032	7.65	8.10	14.5	14.8
Minimum	March/April/May/June	3.30	0.41	13.00	0.025	0.028	6.61	6.97	2.90	3.70
Maximum	March/April/May/June	4.00	5.20	150.00	0.047	0.036	11.35	11.61	19.00	21.90
Average	March/April/May/June	3.63	2.92	65.50	0.035	0.031	8.93	9.38	10.40	12.33
2012	July	3.20	17.00	120.00	0.061	0.087	1.67	7.38	25.30	28.00
2013	July	3.00	5.50	150.00	0.046	0.045	3.83	5.65	24.60	25.20
2014	July	3.25	5.30	130.00	0.046	0.044	5.78	6.38	21.70	22.20
2015	July	4.00	4.60	80.00	0.032	0.034	6.09	6.47	22.80	22.50
2016	July	3.40	6.50	55.00	0.036	0.030	5.60	6.10	22.70	26.50
2017	July	4.00	8.30	35.00	0.033	0.033	5.42	7.36	23.10	26.00
2018	July	4.00	10.00	35.00	0.061	0.043	6.12	7.18	24.70	27.70
Minimum	July	3.00	4.60	35.00	0.032	0.030	1.67	5.65	21.70	22.20
Maximum	July	4.00	17.00	150.00	0.061	0.087	6.12	7.38	25.30	28.00
Average	July	3.55	8.17	86.43	0.045	0.045	4.93	6.65	23.56	25.44
2012	August	3.00	17.00	80.00	0.043	0.042	5.22	9.27	23.70	25.30
2013	August	3.10	4.80	130.00	0.099	0.063	5.65	6.24	20.60	21.80
2014	August	1.30	6.90	100.00	0.047	0.051	5.11	5.65	22.80	24.30
2015	August	3.00	17.00	60.00	0.039	0.030	6.48	7.32	22.70	23.10
2016	August	4.20	15.00	40.00	0.030	0.030	3.57	8.07	23.30	25.70
2017	August	4.20	13.00	30.00	0.032	0.030	5.55	8.71	20.30	22.90
2018	August	4.30	10.00	45.00	0.033	0036	6.02	7.69	23.10	23.10
Minimum	August	1.30	4.80	30.00	0.030	0.030	3.57	5.65	20.30	21.80
Maximum	August	4.30	17.00	130.00	0.099	0.063	6.48	9.27	23.70	25.70
Average	August	3.30	11.96	69.29	0.046	0.040	5.37	7.60	22.34	23.76

*no sample taken

Appendix C – Crowley Impoundment Project Sampling Logs

IMPOUNDMENT SAMPLING LOG

Water Quality Study Location Crowley

Hydroelectric Project – FERC # 2473

Date: 5-9-18

Pre-Sampling Data:

HWL 1429.22 TWL 1409.0 CFS 1470

Sample Location: N45° 52.287' W90° 35.099'

Performed by: Angie Stine, Cammbae Ryan

Time: 1305 Barometer: 29.7

Air Temp: 55 °F Wind Speed: SSE 1 mph

Sky Conditions: 100 Clouds

Precipitation within Last 24 Hours: 0.4"

D.O. Meter Calibration:

Instrument Model Used: HQ40D

Were the batteries changed? ☐ Yes ☒ No

If yes, when were they changed: _____

Battery Status: 110 % Charge

Calibration Method: Factory

Sampling Depth Profile: Measured depth to bottom of impoundment: 21 Feet

Secchi Depth (± 0.1)		
Time 13:18	4.0	Feet

Comments:

Chlorophyll *a* (3 feet below surface horizontal sampler)		
Lab Sample I.D. #:		
Time 13:07	Quantity (ml)	Filtered
	1000	In Lab
Preservative	$MgCO_3$	

True Color (3 feet below surface horizontal sampler)
Lab Sample I.D. # :
Time: 13:07

Total Phosphorus (3 feet below surface horizontal sampler)	
Lab Sample I.D. # :	
Time 13:07	Preservative
	H_2SO_4

Total Phosphorus (3 feet above bottom horizontal sampler)	
Lab Sample I.D. # :	
Time 13:14	Preservative
	H_2SO_4

D.O. and Temperature Profile			
Depth (Feet)	Time	D.O. (mg/L)	Temperature ° C
0.5 below surface	13:07:56	8.10	14.8
3	13:08:36	7.93	14.7
6	13:09:05	7.90	14.7
9	13:09:33	7.88	14.7
12	13:10:01	7.85	14.7
15	13:10:29	7.82	14.7
18	13:11:11	7.80	14.7
21	13:12:24	7.65	14.5
24			
0.5 above bottom	13:13:14	7.69	14.6

*If D.O. is below 5.0 mg/L notify agency and measure D.O. at 1.0 foot intervals if <5.0 mg/L.

WHITE WATER ASSOCIATES, INC.

IMPOUNDMENT SAMPLING LOG

Water Quality Study Location Crowley

Hydroelectric Project – FERC # 2473

Date: 7-18-14

Pre-Sampling Data:

HWL 1427.32 TWL 1407.0 CFS 1177 cfs

Sample Location: N45° 52.287' W90° 30.099'

Performed by:
Stine Wormbe

Time: 13:05 Barometer: 30.1

Air Temp: 71 °F Wind Speed: WSW 5 mph

Sky Conditions: partly cloudy

Precipitation within Last 24 Hours: no

D.O. Meter Calibration:

Instrument Model Used: HQ40D

Were the batteries changed? ☐ Yes ☒ No

If yes, when were they changed: _____

Battery Status: 40 % Charge

Calibration Method: Factory

Sampling Depth Profile: Measured depth to bottom of impoundment: 21 Feet

Secchi Depth (± 0.1)		
Time 13:10	4	Feet

Comments:

Chlorophyll *a* (3 feet below surface horizontal sampler)		
Lab Sample I.D. #:		
Time 13:11	Quantity (ml)	Filtered
	1000	In Lab
Preservative	$MgCO_3$	

True Color (3 feet below surface horizontal sampler)
Lab Sample I.D. # :
Time: 13:11

Total Phosphorus (3 feet below surface horizontal sampler)	
Lab Sample I.D. # :	
Time 13:11	Preservative
	H_2SO_4

Total Phosphorus (3 feet above bottom horizontal sampler)	
Lab Sample I.D. # :	
Time 13:16	Preservative
	H_2SO_4

D.O. and Temperature Profile			
Depth (Feet)	Time	D.O. (mg/L)	Temperature °C
0.5 below surface	13:11:05	7.10	27.7
3	13:11:56	7.18	26.5
6	13:12:32	6.90	25.5
9	13:13:09	6.32	25.1
12	13:13:46	6.29	25.0
15	13:14:19	6.23	24.9
18	13:15:04	6.18	24.8
21	13:15:39	6.14	24.8
24			
0.5 above bottom	13:16:31	6.12	24.7

*If D.O. is below 5.0 mg/L notify agency and measure D.O. at 1.0 foot intervals if <5.0 mg/L.

WHITE WATER ASSOCIATES, INC.

IMPOUNDMENT SAMPLING LOG

Water Quality Study Location Crawley

Hydroelectric Project – FERC # 2473

Date: 8-21-18

Pre-Sampling Data:

HWL 1427.31 TWL 1416.6 CFS 733

Sample Location: N45° 52.287' W90° 35.099'

Performed by:
Angie Stine Warmbold, Ryan

Time: 14:09 Barometer: 30

Air Temp: 65 °F Wind Speed: N9mpH

Sky Conditions: 100% Clouds

Precipitation within Last 24 Hours: yes

D.O. Meter Calibration:

Instrument Model Used: HQ40D

Were the batteries changed? ☐ Yes ☒ No

If yes, when were they changed: _____

Battery Status: 85 % Charge

Calibration Method: Factory

Sampling Depth Profile: Measured depth to bottom of impoundment: 21.5 Feet

Secchi Depth (± 0.1)		
Time 14:20	4.3	Feet

Comments:

Chlorophyll *a* (3 feet below surface horizontal sampler)		
Lab Sample I.D. #:		
Time 14:11	Quantity (ml)	Filtered
	1000	In Lab
Preservative	$MgCO_3$	

True Color (3 feet below surface horizontal sampler)
Lab Sample I.D. # :
Time: 14:11

Total Phosphorus (3 feet below surface horizontal sampler)	
Lab Sample I.D. # :	
Time 14:11	Preservative
	H_2SO_4

Total Phosphorus (3 feet above bottom horizontal sampler)	
Lab Sample I.D. # :	
Time 14:15	Preservative
	H_2SO_4

D.O. and Temperature Profile			
Depth (Feet)	Time	D.O. (mg/L)	Temperature °C
0.5 below surface	14:10:15	7.69	23.0
3	14:10:39	7.62	23.1
6	14:11:24	7.20	23.1
9	14:11:54	7.13	23.1
12	14:12:22	7.11	23.2
15	14:12:45	7.12	23.2
18	14:13:11	7.04	23.2
21	14:13:15	6.02	23.1
24			
0.5 above bottom	14:15:05	6.05	23.1

*If D.O. is below 5.0 mg/L notify agency and measure D.O. at 1.0 foot intervals if <5.0 mg/L.

WHITE WATER ASSOCIATES, INC.

Appendix D – Crowley Hydroelectric Project Lab Reports and Chains of Custody

ANALYTICAL REPORT

WHITE WATER ASSOCIATES, INC.
429 River Lane • PO Box 27 Amasa, MI 49903 • Ph (906) 822-7889 • Fax -7977

Cover Page

Client: RWE **WWA Job #:** 75738

Project: Monitoring

Date Received: 5/9/2018 **Date Reported:** 6/5/2018

Sample Number	Client Sample ID	Date Sampled	Sample Matrix
75738-001	Upper Flambeau Surface	05/09/18	Water
75738-002	Upper Flambeau Bottom	05/09/18	Water
75738-003	Lower Flambeau Surface	05/09/18	Water
75738-004	Lower Flambeau Bottom	05/09/18	Water
75738-005	Pixley Surface	05/09/18	Water
75738-006	Pixley Bottom	05/09/18	Water
75738-007	Crowley Surface	05/09/18	Water
75738-008	Crowley Bottom	05/09/18	Water

WHITE WATER ASSOCIATES, INC.
429 River Lane • PO Box 27 Amasa, MI 49903 • Ph (906) 822-7889 • Fax -7977

Cover Page..continued

Client: RWE **WWA Job #:** 75738

Comments (if any):

Key to Laboratory Flags:

*: RPD exceeds limits.
B: The analyte was found in the associated blank as well as in the sample.
J: The quantitation is an estimated value because the result is less than the sample quantitation limit but greater than the detection limit.
M: A matrix effect was present.
Q: Batch QC data associated with the analysis does not meet the stated objectives
H: Indicates analytical holding time exceedance.
U: The analyte was analyzed for, but not detected.
P: A manual peak selection or manual integration was performed to correct an erroneous software selection.

ND = Not Detected, MDL = Method Detection Limit, MQL = Method Quantitation Limit
ppm = mg/L (liquid) or mg/kg (solid), ppb = ug/L (liquid) or ug/kg (solid)
For coliform, Negative = No coliform bacteria detected, Positive = Coliform bacteria detected

Sample Types:
S = Solids, DW = Drinking water, D = Dissolved, T = Total, TC = TCLP extract, SP = SPLP extract

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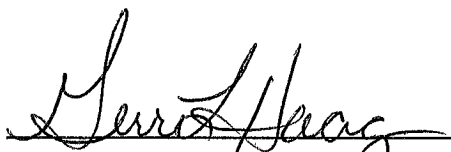
This report satisfies the requirements of your project but has not been prepared to comply with NELAP reporting requirements.

I certify that the data contained in this Final Report has been generated and reviewed in accordance with approved methods and White Water Associates Standard Operating Procedures. Exceptions, if any, are discussed in the accompanying sample narrative. Release of this Final Report is authorized by White Water Associates management, as is verified by the following signature.

Approved By: 

WI DNR Lab Certification Number: 999971280
MI DEQ Certification Number: 9306
DoD-ELAP Accreditation Number: 65802
ISO/IEC 17025:2005 Accredited

ANALYTICAL REPORT

WHITE WATER ASSOCIATES, INC.

429 River Lane • PO Box 27 Amasa, MI 49903 • Ph (906) 822-7889 • Fax -7977

Client: RWE **WWA Job #:** 75738

Project: Monitoring

Date Received: 5/9/2018 **Date Reported:** 6/5/2018

Sample Results

Sample No. / ID / Description / Matrix	Result	Flags	Units	Date/Time	Method	MDL	MQL	Analyst
75738-001 / Upper Flambeau Surface / Water								
General Chemistry Parameters								
Chlorophyll a	0.69		mg/m3	6/1/2018 8:30	10200H	NA	NA	CA
Color	50		CU	5/10/2018 13:10	2120B	5	5	AH
Total Phosphorus LL (t)	0.022	J	mg/L	5/25/2018 16:55	365.4	0.008	0.050	NK
75738-002 / Upper Flambeau Bottom / Water								
General Chemistry Parameters								
Total Phosphorus LL (t)	0.022	J	mg/L	5/25/2018 16:56	365.4	0.008	0.050	NK
75738-003 / Lower Flambeau Surface / Water								
General Chemistry Parameters								
Chlorophyll a	2.1		mg/m3	6/1/2018 8:30	10200H	NA	NA	CA
Color	55		CU	5/10/2018 13:10	2120B	5	5	AH
Total Phosphorus LL (t)	0.038	J	mg/L	5/25/2018 16:57	365.4	0.008	0.050	NK
75738-004 / Lower Flambeau Bottom / Water								
General Chemistry Parameters								
Total Phosphorus LL (t)	0.030	J	mg/L	5/25/2018 16:57	365.4	0.008	0.050	NK

ND = Not Detected, MDL = Method Detection Limit, MQL = Method Quantitation Limit,
ppm = mg/L (liquid) or mg/kg (solid), ppb = ug/L (liquid) or ug/kg (solid)

WHITE WATER ASSOCIATES, INC.
429 River Lane • PO Box 27 Amasa, MI 49903 • Ph (906) 822-7889 • Fax -7977

Client: RWE **WWA Job #:** 75738

Project: Monitoring

Date Received: 5/9/2018 **Date Reported:** 6/5/2018

Sample Results

Sample No. / ID / Description / Matrix	Result	Flags	Units	Date/Time	Method	MDL	MQL	Analyst
75738-005 / Pixley Surface / Water								
General Chemistry Parameters								
Chlorophyll a	8.0		mg/m3	6/1/2018 8:30	10200H	NA	NA	CA
Color	45		CU	5/10/2018 13:10	2120B	5	5	AH
Total Phosphorus LL (t)	0.038	J	mg/L	5/25/2018 16:58	365.4	0.008	0.050	NK
75738-006 / Pixley Bottom / Water								
General Chemistry Parameters								
Total Phosphorus LL (t)	0.033	J	mg/L	5/25/2018 16:59	365.4	0.008	0.050	NK
75738-007 / Crowley Surface / Water								
General Chemistry Parameters								
Chlorophyll a	5.2		mg/m3	6/1/2018 8:30	10200H	NA	NA	CA
Color	40		CU	5/10/2018 13:10	2120B	5	5	AH
Total Phosphorus LL (t)	0.036	J	mg/L	5/25/2018 16:59	365.4	0.008	0.050	NK
75738-008 / Crowley Bottom / Water								
General Chemistry Parameters								
Total Phosphorus LL (t)	0.032	J	mg/L	5/25/2018 17:01	365.4	0.008	0.050	NK

ND = Not Detected, MDL = Method Detection Limit, MQL = Method Quantitation Limit,
ppm = mg/L (liquid) or mg/kg (solid), ppb = ug/L (liquid) or ug/kg (solid)

VGW 5/11/18

Job # (WWA office use): 75738

CHAIN-OF-CUSTODY RECORD

WHITE WATER ASSOCIATES, INC.
429 River Lane, P.O. Box 27
Amasa, Michigan 49903
Phone: (906) 822-7889, Fax -7977
Web: white-water-associates.com

CLIENT NAME / BILL TO: RWE	EMAIL ADDRESS:
ADDRESS:	TELEPHONE:
CITY: / STATE: / ZIP:	CONTRACT / PO / PROJECT NAME / WSSN#: Monitoring
SAMPLER NAME (print first/last name): Ryan Warmboe	COUNTY OF LOCATION: / PAGE 1 OF 1 (Indicate if more than one page of COC records used)
SAMPLER'S SIGNATURE: Ryan Warmboe	Check off preservatives for each bottle and indicate total number of bottles. WWA database contains bottle preservation details.

Instructions to White Water
Send my report by:
____ email
____ mail

Unless otherwise noted, drinking water report copies are sent to MDEQ and Health Dept.

REMARKS (Note any special instructions provided by client or conditions of receipt noted by WWA lab staff. Also note any residual chlorine.)

	SAMPLE ID AND LOCATION (Containers for each sample may be combined on one line.)	DATE	TIME	SAMPLE MATRIX: Drinking water	Aqueous	Sed.	Soil	Other:	CONTAINERS / PRESERVATIVES: None	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Na Thio	Total Number of Containers	ANALYSIS TYPE REQUESTED (Attach list if needed): Chl a (corr cor)	T Phos	Color
1	Upper Flambeau Surface	5-9-18	8:03		X				X	X						3	X	X	X
2	Upper Flambeau Bottom	"	8:10		|					|						1		X	
3	Lower Flambeau Surface	"	9:13		|				X	|						3	X	X	X
4	Lower Flambeau Bottom	"	9:18		|					|						1		X	
5	Pixley Surface	"	10:41		|				X	|						3	X	X	X
6	Pixley Bottom	"	10:47		|					|						1		X	
7	Crowley Surface	"	13:07		|				X	|						3	X	X	X
8	Crowley Bottom	"	13:14		|					|						1		X	

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Ryan Warmboe	5/9/18	17:10			
Relinquished by:	Date:	Time:	Received by: [signature] Login	Date: 5-10-18	Time: 1148

Comments / Sample temperature on receipt: 1°C Cooler/ice WWA

WHITE - RETURN W/ REPORT CANARY - W/ SAMPLES PINK - CUSTOMER

ANALYTICAL REPORT

WHITE WATER ASSOCIATES, INC.
429 River Lane • PO Box 27 Amasa, MI 49903 • Ph (906) 822-7889 • Fax -7977

Cover Page

Client: RWE **WWA Job #:** 77698

Project: Monitoring

Date Received: 7/18/2018 **Date Reported:** 8/6/2018

Sample Number	Client Sample ID	Date Sampled	Sample Matrix
77698-001	Upper Flambeau	07/18/18	Water
77698-002	Upper Flambeau	07/18/18	Water
77698-003	Lower Flambeau	07/18/18	Water
77698-004	Lower Flambeau	07/18/18	Water
77698-005	Pixley	07/18/18	Water
77698-006	Pixley	07/18/18	Water
77698-007	Crowley	07/18/18	Water
77698-008	Crowley	07/18/18	Water

ANALYTICAL REPORT

WHITE WATER ASSOCIATES, INC.

429 River Lane • PO Box 27 Amasa, MI 49903 • Ph (906) 822-7889 • Fax -7977

Cover Page..continued

Client: RWE **WWA Job #:** 77698

Comments (if any):

Key to Laboratory Flags:

*: RPD exceeds limits.
B: The analyte was found in the associated blank as well as in the sample.
J: The quantitation is an estimated value because the result is less than the sample quantitation limit but greater than the detection limit.
M: A matrix effect was present.
Q: Batch QC data associated with the analysis does not meet the stated objectives
H: Indicates analytical holding time exceedance.
U: The analyte was analyzed for, but not detected.
P: A manual peak selection or manual integration was performed to correct an erroneous software selection.

ND = Not Detected, MDL = Method Detection Limit, MQL = Method Quantitation Limit
ppm = mg/L (liquid) or mg/kg (solid), ppb = ug/L (liquid) or ug/kg (solid)
For coliform, Negative = No coliform bacteria detected, Positive = Coliform bacteria detected

Sample Types:
S = Solids, DW = Drinking water, D = Dissolved, T = Total, TC = TCLP extract, SP = SPLP extract

All samples were received intact and properly preserved unless otherwise noted. The results reported relate only to the samples tested. This report shall not be reproduced, except in full, without the written approval of this laboratory. The Chain of Custody is attached.

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Approved By: _____

WI DNR Lab Certification Number: 999971280
MI DEQ Certification Number: 9306
DoD-ELAP Accreditation Number: 65802
ISO/IEC 17025:2005 Accredited

ANALYTICAL REPORT

WHITE WATER ASSOCIATES, INC.
429 River Lane • PO Box 27 Amasa, MI 49903 • Ph (906) 822-7889 • Fax -7977

Client: RWE **WWA Job #:** 77698

Project: Monitoring

Date Received: 7/18/2018 **Date Reported:** 8/6/2018

Sample Results

Sample No. / ID / Description / Matrix	Result	Flags	Units	Date/Time	Method	MDL	MQL	Analyst
77698-001 / Upper Flambeau / Surface / Water								
General Chemistry Parameters								
Chlorophyll a	4.9		mg/m3	7/27/2018 13:45	10200H	NA	NA	CA
Color	40		CU	7/19/2018 14:00	2120B	5	5	AH
Total Phosphorus LL (t)	0.030	J	mg/L	8/3/2018 10:31	365.4	0.008	0.050	NK
77698-002 / Upper Flambeau / Bottom / Water								
General Chemistry Parameters								
Total Phosphorus LL (t)	0.026	J	mg/L	8/3/2018 10:35	365.4	0.008	0.050	NK
77698-003 / Lower Flambeau / Surface / Water								
General Chemistry Parameters								
Chlorophyll a	5.6		mg/m3	7/27/2018 13:45	10200H	NA	NA	CA
Color	45		CU	7/19/2018 14:00	2120B	5	5	AH
Total Phosphorus LL (t)	0.031	J	mg/L	8/3/2018 10:35	365.4	0.008	0.050	NK
77698-004 / Lower Flambeau / Bottom / Water								
General Chemistry Parameters								
Total Phosphorus LL (t)	0.029	J	mg/L	8/3/2018 10:36	365.4	0.008	0.050	NK

ND = Not Detected, MDL = Method Detection Limit, MQL = Method Quantitation Limit,
ppm = mg/L (liquid) or mg/kg (solid), ppb = ug/L (liquid) or ug/kg (solid)

ANALYTICAL REPORT

WHITE WATER ASSOCIATES, INC.
429 River Lane • PO Box 27 Amasa, MI 49903 • Ph (906) 822-7889 • Fax -7977

Client: RWE **WWA Job #:** 77698

Project: Monitoring

Date Received: 7/18/2018 **Date Reported:** 8/6/2018

Sample Results

Sample No. / ID / Description / Matrix	Result	Flags	Units	Date/Time	Method	MDL	MQL	Analyst
77698-005 / Pixley / Surface / Water								
General Chemistry Parameters								
Chlorophyll a	6.3		mg/m3	7/27/2018 13:45	10200H	NA	NA	CA
Color	45		CU	7/19/2018 14:00	2120B	5	5	AH
Total Phosphorus LL (t)	0.045	J	mg/L	8/3/2018 10:36	365.4	0.008	0.050	NK
77698-006 / Pixley / Bottom / Water								
General Chemistry Parameters								
Total Phosphorus LL (t)	0.036	J	mg/L	8/3/2018 10:37	365.4	0.008	0.050	NK
77698-007 / Crowley / Surface / Water								
General Chemistry Parameters								
Chlorophyll a	10		mg/m3	7/27/2018 13:45	10200H	NA	NA	CA
Color	35		CU	7/19/2018 14:00	2120B	5	5	AH
Total Phosphorus LL (t)	0.061		mg/L	8/3/2018 10:37	365.4	0.008	0.050	NK
77698-008 / Crowley / Bottom / Water								
General Chemistry Parameters								
Total Phosphorus LL (t)	0.043	J	mg/L	8/3/2018 10:38	365.4	0.008	0.050	NK

ND = Not Detected, MDL = Method Detection Limit, MQL = Method Quantitation Limit,
ppm = mg/L (liquid) or mg/kg (solid), ppb = ug/L (liquid) or ug/kg (solid)

VGLA 7/20/18
Version 160504

Job # (WWA office use): 77698

CHAIN-OF-CUSTODY RECORD

WHITE WATER ASSOCIATES, INC.

429 River Lane, P.O. Box 27
Amasa, Michigan 49903

Phone: (906) 822-7889, Fax -7977
Web: white-water-associates.com

CLIENT NAME / BILL TO	EMAIL ADDRESS
RWE	
ADDRESS	TELEPHONE
CITY / STATE / ZIP	CONTRACT / PO / PROJECT NAME / WSSN#
	Monitoring
SAMPLER NAME (print first/last name): Angie Shine	COUNTY OF LOCATION / PAGE 1 OF 1 (Indicate if more than one page of COC records used)
SAMPLER'S SIGNATURE	Check off preservatives for each bottle upon arrival and indicate total number of bottles. WWA database contains bottle preservation details.

ANALYSIS TYPE REQUESTED (Attach list if neeeded)

Instructions to White Water
Send my report by:
____ email
____ mail

Unless otherwise noted, drinking water report copies are sent to MDEQ and Health Dept.

REMARKS (Note any special instructions provided by client or conditions of receipt noted by WWA lab staff. Also note any residual chlorine.)

	SAMPLE ID AND LOCATION (Containers for each sample may be combined on one line.)	DATE	TIME	SAMPLE MATRIX: Drinking water	Aqueous	Sed.	Soil	Other:	CONTAINERS / PRESERVATIVES: None	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Na Thio	Total Number of Containers	Chla (mg/m3)	TPhos	Color
1	Upper Flambeau Surface	7/18/18	7:51		X				X	X						3	X	X	X
2	Upper Flambeau Bottom	7/18/18	7:56		"					"						1		X	
3	Lower Flambeau Surface	"	9:00		"				X	"						3	X	X	X
4	Lower Flambeau Bottom	"	9:05		"					"						1		X	
5	Pixley Surface	"	10:55		"				X	"						3	X	X	X
6	Pixley Bottom	"	10:58		"					"						1		X	
7	Crowley Surface	"	13:11		"				X	"						3	X	X	X
8	Crowley Bottom	"	13:16		"					"						1		X	

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
[signature]	7/18/18	16:58	Nicole A. Kwak	7/18/18	16:58

Comments/Sample temp. on receipt: T = 2°C

Packing: Ice ✓ Cooler ____

UPS☐ FedEx☐ USPS☐ Client☐ Other WWA

WHITE - RETURN W/ REPORT CANARY - W/ SAMPLES PINK - CUSTOMER

Cover Page

ANALYTICAL REPORT

WHITE WATER ASSOCIATES, INC.

429 River Lane • PO Box 27 Amasa, MI 49903 • Ph (906) 822-7889 • Fax -7977

Client: RWE **WWA Job #:** 78452

Project: Monitoring

Date Received: 8/22/2018 **Date Reported:** 9/4/2018

Sample Number	Client Sample ID	Date Sampled	Sample Matrix
78452-001	Upper Flambeau	08/21/18	Water
78452-002	Upper Flambeau	08/21/18	Water
78452-003	Lower Flambeau	08/21/18	Water
78452-004	Lower Flambeau	08/21/18	Water
78452-005	Pixley	08/21/18	Water
78452-006	Pixley	08/21/18	Water
78452-007	Crowley	08/21/18	Water
78452-008	Crowley	08/21/18	Water

Client: RWE **WWA Job #:** 78452

Comments (if any):

Key to Laboratory Flags:

*: RPD exceeds limits.
B: The analyte was found in the associated blank as well as in the sample.
J: The quantitation is an estimated value because the result is less than the sample quantitation limit but greater than the detection limit.
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Q: Batch QC data associated with the analysis does not meet the stated objectives
H: Indicates analytical holding time exceedance.
U: The analyte was analyzed for, but not detected.
P: A manual peak selection or manual integration was performed to correct an erroneous software selection.

ND = Not Detected, MDL = Method Detection Limit, MQL = Method Quantitation Limit
ppm = mg/L (liquid) or mg/kg (solid), ppb = ug/L (liquid) or ug/kg (solid)
For coliform, Negative = No coliform bacteria detected, Positive = Coliform bacteria detected

Sample Types:
S = Solids, DW = Drinking water, D = Dissolved, T = Total, TC = TCLP extract, SP = SPLP extract

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Approved By: _____

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MI DEQ Certification Number: 9306
DoD-ELAP Accreditation Number: 65802
ISO/IEC 17025:2005 Accredited

ANALYTICAL REPORT

WHITE WATER ASSOCIATES, INC.
429 River Lane • PO Box 27 Amasa, MI 49903 • Ph (906) 822-7889 • Fax -7977

Client: RWE **WWA Job #:** 78452

Project: Monitoring

Date Received: 8/22/2018 **Date Reported:** 9/20/2018

Sample Results

Sample No. / ID / Description / Matrix	Result	Flags	Units	Date/Time	Method	MDL	MQL	Analyst
78452-001 / Upper Flambeau / Surface / Water								
General Chemistry Parameters								
Chlorophyll a	7.3		mg/m3	8/29/2018 15:30	10200H	NA	NA	CA
Color	50		CU	8/23/2018 11:10	2120B	5	5	AH
Total Phosphorus LL (t)	0.023	J	mg/L	8/31/2018 18:03	365.4	0.008	0.050	NK
78452-002 / Upper Flambeau / Bottom / Water								
General Chemistry Parameters								
Total Phosphorus LL (t)	0.024	J	mg/L	8/31/2018 18:04	365.4	0.008	0.050	NK
78452-003 / Lower Flambeau / Surface / Water								
General Chemistry Parameters								
Chlorophyll a	12		mg/m3	8/29/2018 15:30	10200H	NA	NA	CA
Color	45		CU	8/23/2018 11:10	2120B	5	5	AH
Total Phosphorus LL (t)	0.027	J	mg/L	8/31/2018 18:05	365.4	0.008	0.050	NK
78452-004 / Lower Flambeau / Bottom / Water								
General Chemistry Parameters								
Total Phosphorus LL (t)	0.033	J	mg/L	8/31/2018 18:05	365.4	0.008	0.050	NK

ND = Not Detected, MDL = Method Detection Limit, MQL = Method Quantitation Limit,
ppm = mg/L (liquid) or mg/kg (solid), ppb = ug/L (liquid) or ug/kg (solid)

WHITE WATER ASSOCIATES, INC.
429 River Lane • PO Box 27 Amasa, MI 49903 • Ph (906) 822-7889 • Fax -7977

Client: RWE **WWA Job #:** 78452

Project: Monitoring

Date Received: 8/22/2018 **Date Reported:** 9/20/2018

Sample Results

Sample No. / ID / Description / Matrix	Result	Flags	Units	Date/Time	Method	MDL	MQL	Analyst
78452-005 / Pixley / Surface / Water								
General Chemistry Parameters								
Chlorophyll a	19		mg/m3	8/29/2018 15:30	10200H	NA	NA	CA
Color	50		CU	8/23/2018 11:10	2120B	5	5	AH
Total Phosphorus LL (t)	0.040	J	mg/L	8/31/2018 18:06	365.4	0.008	0.050	NK
78452-006 / Pixley / Bottom / Water								
General Chemistry Parameters								
Total Phosphorus LL (t)	0.040	J	mg/L	8/31/2018 18:09	365.4	0.008	0.050	NK
78452-007 / Crowley / Surface / Water								
General Chemistry Parameters								
Chlorophyll a	10		mg/m3	8/29/2018 15:30	10200H	NA	NA	CA
Color	45		CU	8/23/2018 11:10	2120B	5	5	AH
Total Phosphorus LL (t)	0.033	J	mg/L	8/31/2018 18:11	365.4	0.008	0.050	NK
78452-008 / Crowley / Bottom / Water								
General Chemistry Parameters								
Total Phosphorus LL (t)	0.036	J	mg/L	8/31/2018 18:11	365.4	0.008	0.050	NK

ND = Not Detected, MDL = Method Detection Limit, MQL = Method Quantitation Limit,
ppm = mg/L (liquid) or mg/kg (solid), ppb = ug/L (liquid) or ug/kg (solid)

Version 8/24/18

Version 160504

Job # (WWA office use): 78452

CHAIN-OF-CUSTODY RECORD

WHITE WATER ASSOCIATES, INC.

429 River Lane, P.O. Box 27
Amasa, Michigan 49903

Phone: (906) 822-7889, Fax -7977
Web: white-water-associates.com

CLIENT NAME / BILL TO	EMAIL ADDRESS
RWE	
ADDRESS	TELEPHONE
CITY / STATE / ZIP	CONTRACT / PO / PROJECT NAME / WSSN#
	Monitoring
SAMPLER NAME (print first/last name)	COUNTY OF LOCATION / PAGE 1 OF 1 (Indicate if more than one page of COC records used)
Ryan Warmbee	
SAMPLER'S SIGNATURE	Check off preservatives for each bottle upon arrival and indicate total number of bottles. WWA database contains bottle preservation details.

ANALYSIS TYPE REQUESTED (Attach list if neeeded)

Instructions to White Water
Send my report by:
____ email
____ mail

Unless otherwise noted, drinking water report copies are sent to MDEQ and Health Dept.

REMARKS (Note any special instructions provided by client or conditions of receipt noted by WWA lab staff. Also note any residual chlorine.)

	SAMPLE ID AND LOCATION (Containers for each sample may be combined on one line.)	DATE	TIME	SAMPLE MATRIX: Drinking water	Aqueous	Sed.	Soil	Other:	CONTAINERS / PRESERVATIVES: None	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Na Thio	Total Number of Containers	Chla (ugs Cl2)	T phos	Color
1	Upper Flambeau Surface	8-21-18	7:55		X				X	X						3	X	X	X
2	Upper Flambeau Bottom	"	8:00													1		X	
3	Lower Flambeau Surface	"	10:35						X							3	X	X	X
4	Lower Flambeau Bottom	"	10:40													1		X	
5	Pixley Surface	"	12:20						X							3	X	X	X
6	Pixley Bottom	"	12:25													1		X	
7	Crowley Surface	"	14:11						X							3	X	X	X
8	Crowley Bottom	"	14:15													1		X	

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Ryan Warmbee	8/22/18				
Relinquished by:	Date:	Time:	Received by:	Date:	Time:
				8-22-18	1550

Comments/Sample temp. on receipt: 2

Packing: Ice ✓ Cooler ____

WHITE - RETURN W/ REPORT CANARY - W/ SAMPLES PINK - CUSTOMER

UPS☐ FedEx☐ USPS☐ Client☐ Other WWA