Appendix B

Correspondence

(continued)

American Electric Power
1 Riverside Plaza
Columbus, OH 43215
aep.com

Via Electronic Filing

April 14, 2020

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

Subject: Constantine Hydroelectric Project (FERC No. 10661)
Initial Study Report
Virtual Webex Meeting Scheduled for April 23, 2020

Dear Secretary Bose:

Indiana Michigan Power Company (I&M), a unit of American Electric Power (AEP), is the Licensee, owner, and operator of the 1.2 megawatt Constantine Hydroelectric Project (Project) (FERC Project No. 10661). The Project is located along the St. Joseph River in St. Joseph County, Michigan.

I&M operates and maintains the Project under a license from the Federal Energy Regulatory Commission (FERC or Commission). The Project's existing license expires on September 30, 2023. I&M is pursuing a subsequent license for the Project using the Commission's Integrated Licensing Process (ILP) as defined in 18 Code of Federal Regulations (CFR) Part 5.

I&M has conducted studies as provided in the March 15, 2019 Revised Study Plan (RSP) and approved in the Commission's April 9, 2019 Study Plan Determination (SPD) for the Project. In accordance with 18 CFR § 5.15, I&M is hereby filing the Initial Study Report (ISR) with the Commission. The ISR describes I&M's overall progress in implementing the study plan and schedule, summarizes available data, and describes any variances from the study plan and schedule approved by the Commission. Concurrent with this filing, the ISR is being made available to stakeholders on the Project's public relicensing website at www.aephydro.com/HydroPlant/Constantine.

The Commission's regulations at 18 C.F.R. § 5.15(c) require I&M to hold an ISR Meeting with participants and FERC staff within 15 days of filing the ISR. Accordingly, I&M will hold an ISR Meeting (via Webex) from 9 AM to 4 PM on April 23, 2020.

To allow for adequate planning, I&M respectfully requests that those planning on joining the ISR Webex Meeting RSVP by emailing Jon Magalski at jmmagalski@aep.com on or before close of business April 21, 2020.

If there are any questions regarding this filing, please do not hesitate to contact me at (614) 716-2240 or jmmagalski@aep.com.

Sincerely,

Jonathan M. Magalski
Environmental Specialist Consultant
American Electric Power Services Corporation, Environmental Services

Cc: Distribution List
Liz Parcell (AEP)
Rob Quiggle (HDR)

Constantine Hydroelectric Project (FERC No. 10661)
Distribution List

Federal Agencies

Mr. John Eddins
Office of Federal Agency Programs
Advisory Council on Historic Preservation
401 F Street NW, Suite 308
Washington, DC 20001-2637

Ms. Kimberly Bose
Secretary
Federal Energy Regulatory Commission
888 1st St NE
Washington, DC 20426

FEMA Region 5
536 South Clark Street, 6th Floor
Chicago, IL 60605

Mr. Michael Pentony
Regional Administrator
NOAA Fisheries Service
Greater Atlantic Regional Fisheries Office
55 Great Republic Drive
Gloucester, MA 01930-2276

Mr. Martin J. Rosek
State Soil Scientist
US Department of Agriculture
Natural Resources Conservation Service
3001 Coolidge Road, Suite 250
East Lansing, MI 48823

Ms. Mary Manydeeds
Bureau of Indian Affairs, Midwest Region
US Department of the Interior
Norman Pointe II Building
5600 W. American Boulevard, Suite 500
Bloomington, MN 55437

Office of the Solicitor
US Department of the Interior
1849 C Street, NW
Washington, DC 20240

Mr. Lindy Nelson
Regional Environmental Officer, Office of
Environmental Policy & Compliance
US Department of the Interior
Philadelphia Region
Custom House, Room 244
200 Chestnut Street
Philadelphia, PA 19106

Ms. Liz Pelloso
Wetland/Environmental Scientist, Region 5
US Environmental Protection Agency
77 West Jackson Boulevard (E19-J)
Chicago, IL 60604

Mr. Ken Westlake
Chief, NEPA Implementation Section - Region 5
US Environmental Protection Agency
77 West Jackson Boulevard (E19-J)
Chicago, IL 60604

Mr. Jack Dingledine
Assistant Field Office Supervisor/Michigan
Ecological Services Field Office
US Fish and Wildlife Service
2652 Coolidge Road, #101
East Lansing, MI 48823

Ms. Alisa Shull
Chief, Endangered Species - Midwest Region
(Region 3)
US Fish and Wildlife Service
5600 American Boulevard West, Suite 990
Bloomington, MN 55437-1458

Mr. Derrick Hubbell
Michigan Water Science Center
US Geological Survey
6520 Mercantile Way, Suite 5
Lansing, MI 48911-5991

Mr. Tom Weaver
Michigan Water Science Center
US Geological Survey
6520 Mercantile Way, Suite 5
Lansing, MI 48911-5991

US Geological Survey
1451 Green Road
Ann Arbor, MI 48105

Hon. Aaron Miller
US Congressman, 59th District
US House of Representatives
N-993 House Office Building
PO Box 30014
Lansing, MI 48909

Constantine Hydroelectric Project (FERC No. 10661)
Distribution List

Mr. Michael Reynolds
Acting Director, Headquarters
US National Park Service
1849 C Street, NW
Washington, DC 20240

Hon. Gary Peters
US Senate
Hart Senate Office Building
Washington, DC 20510

Hon. Debbie Stabenow
US Senate
713 Hart Senate Office Building
Washington, DC 20510-2204

State Agencies

Michigan Department of Agriculture
525 West Allegan Street
Lansing, MI 48933

Mr. Chris Antieau
Great Lakes Shorelands Unit - Water Resources Division
Michigan Department of Environmental Quality
525 West Allegan Street
PO Box 30473
Lansing, MI 48909-7973

Kalamazoo District Office
Michigan Department of Environmental Quality
7953 Adobe Road
Kalamazoo, MI 49009-5025

Ms. Jessica Mistak
Michigan Department of Natural Resources
PO Box 30028
Lansing, MI 48909

Mr. Kyle Kruger
Senior Fisheries Biologist
Michigan Department of Natural Resources
Mio Field Office
191 S. Mt. Tom Road
Mio, MI 48647

Ms. Kesiree Thiamkeelakul
Michigan Department of Natural Resources
Mio Field Office
191 S. Mt. Tom Road
Mio, MI 48647

Mr. Brian D. Conway
State Historic Preservation Officer, Lansing Office
State Historic Preservation Office
735 East Michigan Avenue
PO Box 30044
Lansing, MI 48909

Local Governments

Ms. Korie Blyveis
District Manager
Cass County Conservation District
1127 East State St.
Cassopolis, MI 49031

Mr. Robert Hile
Mayor
City of Sturgis
130 North Nottawa
Sturgis, MI 49091

Friends of the St. Joe River Association, Inc.
PO Box 1794
South Bend, IN 46634

St. Joseph County
PO Box 189
Centreville, MI 49032

Ms. Carolyn Grace
Administrator
St. Joseph County Conservation District
693 E. Main Street
Centerville, MI 49032

Mr. Mark R. Brown
Supervisor
Township of Constantine
425 Centreville Street
Constantine, MI 49042

Constantine Hydroelectric Project (FERC No. 10661)
Distribution List

Mr. George E. Morse
Supervisor
Township of Sturgis
70669 Stubey Road
Sturgis, MI 49091

Mr. Donald E. Gloy, Jr.
Supervisor
Township of White Pigeon
16825 Tomahawk Trail
White Pigeon, MI 49099

Mr. Mark Honeysett
Village Manager
Village of Constantine
115 White Pigeon Street
Constantine, MI 49042

Ms. Marcia Skelton
Village of Constantine
115 White Pigeon Street
Constantine, MI 49042

Mr. Tyler Royce
President
Village of White Pigeon
103 South Kalamazoo
PO Box 621
White Pigeon, MI 49099

Tribes

Mr. Michael LaRonge
Tribal Historic Preservation Officer
Forest County Potawatomi Community
5320 Wensaut Lane
PO Box 340
Crandon, WI 54520

Ms. Kelly Curran
Pokagon Band of Potawatomi Indians
58620 Sink Road
PO Box 180
Dowagiac, MI 49047

Nottawaseppi Huron Band of the Potawatomi
1485 Mno-Bmadzewen Way
Fulton, MI 49052

Non-governmental Organizations

Mr. John Seebach
American Rivers
1104 14th St NW, Suite 1400
Washington, DC 20005

Mr. Kevin Richard Colburn
National Stewardship Director
American Whitewater
PO Box 1540
Cullowhee, NC 28779

Michigan Audubon Society
2311 Science Parkway, Suite 200
Okemos, MI 48864

Michigan Citizens for Water Conservation
PO Box 1
Mecosta, MI 49332

Michigan Environmental Council
602 West Ionia Street
Lansing, MI 48933

Mr. Bob Stuber
Fisheries Biologist
Michigan Hydropower Relicensing Coalition
1620 High Street
Traverse City, MI 49684

Michigan Loon Preservation Association
10181 Sheridan Road
Millington, MI 48746

Michigan Nature Association
2310 Science Parkway, Suite 100
Okemos, MI 48864

Mr. Matt Meersman
Director
St. Joseph River Basin Commission
227 West Jefferson Boulevard
1120 County-City Boulevard
South Bend, IN 46601

Initial Study Report

Constantine Hydroelectric Project (FERC No. 10661)

April 14, 2020

Prepared by:

HDR

Prepared for:

INDIANA MICHIGAN POWER

An AEP Company

BOUNDLESS ENERGY

This page is intentionally left blank

Contents

List of Tables

List of Figures

Appendices

List of Acronyms

ADCP	Acoustic Doppler Current Profiler
AEP	American Electric Power Company
APE	Area of Potential Effects
BEHI	Bank Erosion Hazard Index
C.F.R.	Code of Federal Regulations
Commonwealth	Commonwealth Heritage Group
cm/s	centimeters per second
DLA	Draft License Application
DO	dissolved oxygen
ERL	Effect Range Low
ERM	Effect Range Median
FERC	Federal Energy Regulatory Commission (or Commission)
fps	feet per second
GIS	Geographic Information System
GPS	global positioning system
GLEC	Great Lakes Environmental Center, LLC
ILP	Integrated Licensing Process
I&M	Indiana Michigan Power Company
ISR	Initial Study Report
LRSS	Lower Reservoir
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
NA	not applicable
NOI	Notice of Intent
NWI	National Wetland Inventory
PAD	Pre-Application Document
PEL	Probable Effect Level
Project	Constantine Hydroelectric Project
PSP	Proposed Study Plan
RSP	Revised Study Plan
SD1	Scoping Document 1
SD2	Scoping Document 2
SHPO	State Historic Preservation Office
SPD	Study Plan Determination
SQG	sediment quality guidelines
TEL	Threshold Effect Levels
YES	Young Energy Services

This page is intentionally left blank

1 Introduction and Background

1.1 Introduction

Indiana Michigan Power Company (I&M), a unit of American Electric Power (AEP), is the Licensee, owner, and operator of the 1.2-megawatt Constantine Hydroelectric Project (Project) (FERC No. 10661).

I&M operates and maintains the Project under a license from the Federal Energy Regulatory Commission (FERC or Commission). The Project's existing license expires on September 30, 2023. I&M is pursuing a subsequent license for the Project using the Commission's Integrated Licensing Process (ILP) as defined in 18 Code of Federal Regulations (C.F.R.) Part 5.

In accordance with 18 C.F.R. § 5.15, I&M has initiated studies and information gathering activities as provided in the study plan and schedule approved by the Commission. This Initial Study Report (ISR) describes the Licensee's overall progress in implementing the study plan and schedule, the data collected, and any variances from the study plan and schedule.

The Commission's regulations at 18 C.F.R. § 5.15(c) require I&M to hold a meeting with participants and FERC staff within 15 days of filing the ISR. Accordingly, **I&M will hold an ISR Meeting via Webex from 9 AM to 4 PM on April 23, 2020. An agenda for the ISR Meeting is presented in** Error! Reference source not found. **to this ISR.**

To allow for adequate planning, I&M respectfully requests that those planning on joining the ISR Webex Meeting RSVP by emailing Jon Magalski at jmmagalski@aep.com on or before close of business April 21, 2020.

1.2 Background

The Project is located along the St. Joseph River in St. Joseph County, Michigan. On June 4, 2018, I&M initiated the ILP by filing a Pre-Application Document (PAD) and Notice of Intent (NOI) with the Commission. Major ILP milestones to-date are presented in Table 1.2-1. Major ILP Milestones Completed.

Table 1.2-1 Major ILP Milestones Completed

Date	Milestone
06/04/2018	PAD and NOI Filed
07/25/2018	Scoping Document 1 (SD1) Issued by FERC
08/28-8/29/2018	FERC Agency and Public Scoping Meetings Conducted
08/28/2018	Project Site Visit Held
11/13/2018	Scoping Document 2 (SD2) Issued by FERC
11/16/2018	Proposed Study Plan (PSP) Filed
12/11/2018	PSP Meeting Conducted

Date	Milestone
03/15/2019	Revised Study Plan (RSP) Filed
04/09/2019	FERC Issued Study Plan Determination (SPD)
04/14/2020	Initial Study Report (ISR) Filed

I&M has continued consultation with stakeholders regarding approved studies as required by the Commission's SPD. In accordance with the schedule presented in the RSP, I&M has also provided stakeholders with Quarterly ILP Study Progress Reports that include a description of study activities conducted during the previous quarter, activities expected to occur in the next quarter, and identified variances from the approved study plan.[1]

1.3 Study Plan Implementation

On April 9, 2019, the Commission issued a SPD for the Project. The SPD directed I&M to conduct 8 studies:

1. Botanical Resources Study
2. Shoreline Stability Assessment
3. Water Quality Study
4. Fisheries Survey
5. Mussel Survey
6. Wetlands Study
7. Recreation Study
8. Cultural Resources Study

I&M initiated the approved studies in accordance with the schedule and methods described in the RSP and SPD. Section 2 of this ISR describes I&M's overall progress in implementing the study plan and schedule, the data collected, and any variances from the study plan and schedule.[2] All of the studies have been completed and technical study reports are attached as appendices to this ISR.

1.4 Proposals to Modify Ongoing Studies or for New Studies

At this time, I&M is not proposing any modifications to the studies approved in the Commission's April 9, 2019 SPD or any new studies. As described above, I&M will hold an ISR Meeting via Webex on April 23, 2020. I&M will file an ISR Meeting Summary with the Commission within 15 days of the ISR Meeting (on or before May 8, 2020).

[1] To date, Quarterly ILP Study Progress Reports were filed with the Commission and distributed to the Project's mailing list on July 9, 2019, October 9, 2019, January 9, 2020 and April 9, 2020.

[2] I&M notes that stakeholders have also previously been made aware of certain variances from the study plan and schedule in the Quarterly ILP Study Progress Reports.

After review of the ISR Meeting Summary, stakeholders may file disagreements with the meeting summary, request modifications to studies, or request new studies. Disagreements with the ISR Meeting Summary and any requests to amend the study plan to include new or modified studies must be filed with the Commission no later than 30 days after the filing of the ISR Meeting Summary (on or before June 7, 2020). In requesting modifications to studies or new studies, stakeholders must take into account the following criteria:

- *Criteria for Modification of Approved Study (18 C.F.R. 5.15(d))*. Any proposal to modify a study must be accompanied by a showing of good cause why the proposal should be approved, and must include, as appropriate to the facts of the case, a demonstration that:

  (1) Approved studies were not conducted as provided for in the approved study plan; or

  (2) The study was conducted under anomalous environmental conditions or that environmental conditions have changed in a material way.

- *Criteria for New Study (18 C.F.R. 5.15(e)).* Any proposal for new information gathering or studies must be accompanied by a showing of good cause why the proposal should be approved, and must include, as appropriate to the facts of the case, a statement explaining:

  (1) Any material changes in the law or regulations applicable to the information request;

  (2) Why the goals and objectives of any approved study could not be met with the approved study methodology;

  (3) Why the request was not made earlier;

  (4) Significant changes in the project proposal or that significant new information material to the study objectives has become available; and

  (5) Why the new study request satisfies the study criteria in 18 C.F.R. § 5.9(b).

I&M will have 30 days to respond to any disagreements or requests to amend the study plan (July 7, 2020). The Commission's Director of the Office of Energy Projects will resolve any disagreement and amend the approved study plan, as appropriate, within 30 days of the due date for I&M's response (no later than August 6, 2020).

2 Status and Summaries of Studies

This section describes I&M's overall progress in implementing the study plan and schedule, the data collected, and any variances from the study plan and schedule. Study methods and available study results are summarized for each of the 8 studies approved in the Commission's SPD.

2.1 Botanical Resources Study

2.1.1 Study Status

I&M has completed the Botanical Resources Study in accordance with the RSP and the Commission's SPD. The technical report including the results of the Botanical Resources Study is included as Appendix B to this ISR.

2.1.2 Summary of Study Methods and Results

In accordance with the Commission's SPD, I&M conducted a Botanical Resources Study. Great Lakes Environmental Center, LLC (GLEC) led the Botanical Resources Study and performed desktop mapping of vegetation in the Project area using existing aerial imagery along with field surveys to document rare, threatened and endangered (RTE) and invasive plant species present in the Project study area.

The Project's FERC-approved Project boundary was surveyed and locations of RTE and invasive species were mapped and photographed. The approximate density and area of coverage was documented for observed invasive species. General observations were also noted regarding habitat and site conditions, including type, density, and quality. GLEC ground-truthed the information presented in the cover type base maps that were developed using existing aerial imagery. Cover type maps were updated as necessary based on field verification and the results of the RTE and invasive species field surveys. Additionally, GLEC searched for and documented the presence of any wild rice beds.

The botanical resources of the Constantine Project boundary were inventoried in August and September of 2019. Specific attention was given to the discovery of state and federal RTE species, such as wild rice, American water willow (*Justicia americana*) and eastern prairie fringed orchid (*Platanthera leucophaea*), as well as the presence and abundance of invasive plant species, such as, Eurasian watermilfoil (*Myriophyllum spicatum*), purple loosestrife (*Lythrum salicaria*), Carolina fanwort (*Cabomba caroliniana*) and crispy pondweed (*Potamogeton crispus*).

Principal habitat types were described as a result of the inventory and consisted primarily of a mixture of floodplain forested communities, residential areas and scrub/shrub and emergent wetlands.

Results were compared to historical inventories from the Michigan Natural Features Inventory, previous assessments and historical (pre-reservoir) maps. Notable differences were noted between the southern, midsection and northern reaches of the Project. A diverse community of a total of 159 native and non-native plant species were identified in the 2019 assessment (presented in Section 5.3 in Table 2 of the Botanical Resources Study Report). American water willow was documented during the inventory, whereas other RTE plants species (i.e., wild rice and eastern prairie fringed orchid) were absent from the Project boundary.

Twenty-three non-native plants were discovered in the inventory, including Siberian elm (*Ulmus pumila*), narrow leaf cattail (*Typha angustifolia*), bittersweet nightshade (*Solanum dulcamara*), broad-leaved dock (*Rumex obtusifolius*), multiflora rose (*Rosa multiflora*), locust, crispy pondweed, Canada bluegrass (*Poa compressa*), reed canary grass (*Phalaris arundinaceae*), Eurasian watermilfoil, forget-me-not (*Myosotis scorpioides*),

white mulberry (*Morus alba*), yellow sweet clover (*Melilotus officinalis*), purple loosestrife, moneywort *(Lysimachia nummularia)*, amur honey suckle (*Lonicera maackii*), common pivet (*Ligustrum vulgare*), Dame's rocket (*Hesperis matronalis*), ground ivy (*Glechoma hederacea*), autumn olive (*Elaeagnus umbellata*), oriental bittersweet (*Celastrus orbiculatus*), northern catalpa (*Catalpa speciosa*), Carolina fanwort and velvetleaf (*Abutilon theophrasti*). The Constantine PAD outlined four species; Carolina fanwort, purple loosestrife, Eurasian watermilfoil, and crispy pondweed from the above list as non-native, special concern species. Locations of these invasive plants were recorded in the field during the Botanical Resources Survey and referenced 2019 map data from the annual Constantine Invasive Species Survey conducted by GLEC for I&M (GLEC 2019). The locations of these invasive plant species are presented in Figure 2.1-1. The remaining non-native/invasive species of concern were found to be much less abundant.

Purple loosestrife abundance was noted as a specific threat to the existing wetlands, particularly in the northern sections of the Project boundary. Eurasian watermilfoil was also noted as becoming more abundant than previously noted in the other assessments. Both purple loosestrife and Eurasian watermilfoil have the greatest potential to significantly alter the native habitats in the wetland and off-shore aquatic communities in the Project area.

Based on this assessment and the annual invasive species assessments, it continues to appear that in general, the light and heavy infestations within the Project boundary continue to increase including the Eurasian watermilfoil. The overall assessment of the botanical resources at the Constantine Project remains similar to that described in the PAD and the 1993 assessment (FERC 1993).

2.1.3 Variances from FERC-Approved Study Plan

The actual Botanical Resources Survey and study methods applied some interpretations of and minor variances from the method details outlined in Section 6 Botanical Resources Study of the March 15, 2019 RSP. Under Task 6.6.1 Desktop Mapping of Vegetation, the RSP indicates that I&M "will obtain high-resolution aerial imagery to characterize the vegetation in the Project area, to the extent practical." For this study, the research biologists and Geographic Information System (GIS) specialists utilized standard satellite imagery provided by Google Earth and ESRI ArcMap streaming services for feature interpretation. No other "special" high resolution imagery was obtained or utilized for the study.

Existing information regarding botanical resources in the Project area, presented in Section 5.5 of the PAD, classifies the vegetation as a "mixed hardwood community of predominantly oak, with some ash, beech, hickory, maple, cottonwood, and aspen" and falling within the Beech-Maple Association of Eastern Deciduous Forest (I&M 1988, Bailey 1978). For this study, the classification and description scheme developed by the Michigan Natural Features Inventory was used to update and further expound upon the forest cover types (Kost et al. 2007). Preliminary descriptions of the Project area state that along its lower third, the reservoir is largely within pre-existing river banks and is bordered by a fringe of trees, while along the upper two-thirds of the reservoir the river often covers more extensive (up to 1,200 feet) widths of lowland areas (I&M 1988). Upon

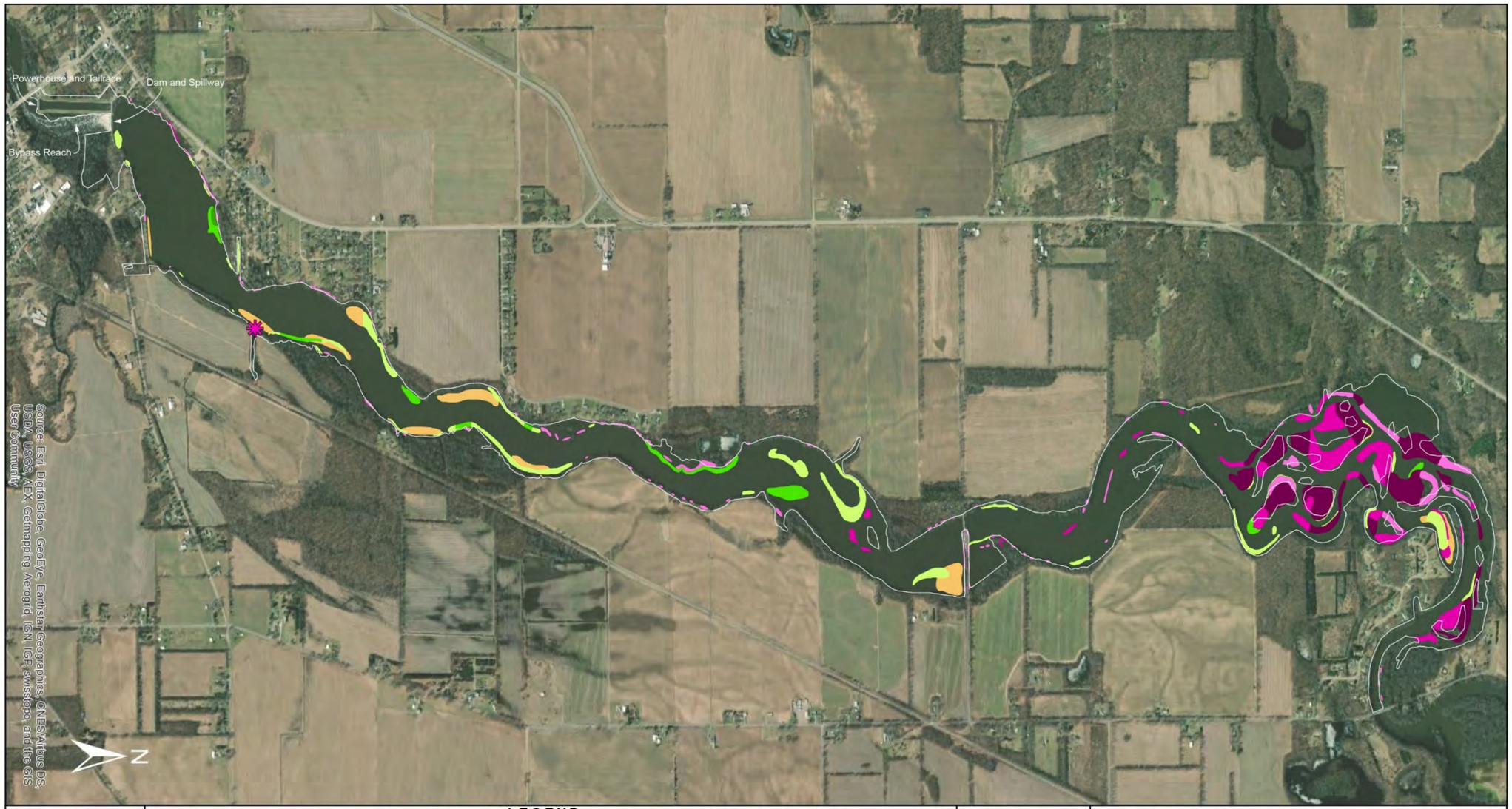


Figure 1.1-1. Invasive Plant Species Locations

the completion of Meander surveys and a full species list, this study determined that this fringe of trees within the lower third, to half, of the reservoir is more specifically classified as floodplain forest and the lowland areas within the upper reaches of the reservoir are primarily forested and emergent wetlands, dominated by willow (Salix spp.) and silver maple trees.

2.2 Shoreline Stability Assessment

2.2.1 Study Status

I&M has completed the Shoreline Stability Assessment in accordance with the RSP and the Commission's SPD. The technical report including the results of the Shoreline Stability Assessment is included as Appendix C to this ISR.

2.2.2 Summary of Study Methods and Results

In accordance with the Commission's SPD, I&M conducted a Shoreline Stability Assessment of the Project's reservoir and downstream areas. This study consisted of a literature review and field survey, which was led by GLEC.

Prior to conducting field surveys, a literature review was performed to review any existing information on geology and soils in the study area that may be useful to assess bank composition and erosion potential in the study area.

Observations for the 2019 Shoreline Stability Assessment of the reservoir and bypass reach were made June 2-4 and September 24-27, 2019. Assessed sites were located at various points along the shoreline within the reservoir and bypass reach. Sites were labeled according to their location in the bypass reach or the reservoir. During the June survey event, 57 sites were evaluated, and the results are listed in Table 2 in Section 8 of Shoreline Stability Assessment Report. Of the 57 sites evaluated, 12 were located in the bypass reach and 45 were located in the reservoir. During the September survey event, 31 sites were evaluated, and the results are listed in Table 3 in the Shoreline Stability Assessment Report. Of the 31 sites evaluated, 8 were located in the bypass reach and 23 were located in the reservoir. Examples of the assessed locations are provided in Figures 2-20 in Section 7 of the Shoreline Stability Assessment Report.

In summary, primary observations and conclusions from the Shoreline Stability Assessment are:

- In June, modified Bank Erosion Hazard Index (BEHI) scores in the Project area ranged from Very Low to Moderate at 57 individual sites. In the bypass reach, sites were scored as; 5 Very Low, 1 Low, 3 Moderate, and 3 not applicable (NA). In the reservoir area, sites were scored as; 2 Very Low, 20 Low, 12 Moderate, and 11 NA.
- In September, BEHI scores in the Project area ranged from Low to Moderate at 39 sites. In the bypass reach, sites scored as; 5 Low, 2 Moderate, and 1 NA. In the reservoir area, sites were scored as; 19 Low and 12 Moderate.

- Based on observations used to calculate the modified BEHI, three areas may require additional assessment to confirm and possibly mitigate potential future erosion hazards within the Project:
  1) Site BA03 located at the downstream end of the Project. This site has an area of erosion located against concrete at the base of the bridge extending under the overhanging vegetation. This erosion area is likely caused by current hitting the bank from the tailrace.
  2) Site BA16 located at the upstream end of the bypass reach. This isolated point has no vegetation and soil is actively falling into the bypass reach.
  3) In the reservoir, the area from site SJR05 to SJR12. This area is located in a more riverine section of the Project along an outside bend in the river channel. This area has had the riparian vegetation removed for home construction and maintained turf grass lawns.

2.2.3 Variances from FERC-Approved Study Plan

The Shoreline Stability Assessment was conducted in full conformance with the Commission's SPD.

2.3 Water Quality Study

2.3.1 Study Status

I&M has completed the Water Quality Study in accordance with the RSP and the Commission's SPD. The technical report including the results of the Water Quality Study is included as Appendix D to this ISR.

2.3.2 Summary of Study Methods and Results

In accordance with the study plan approved in the Commission's SPD, I&M conducted a Water Quality Study in the Project's reservoir, bypass reach and downstream area.

GLEC led the Water Quality Study and monitored water quality at five locations (reservoir, power canal, tailrace and two locations in the bypass reach) as shown in Figure 2.3-1. Calibrated Onset® HOBO U26 dissolved oxygen (DO) Data Loggers set to record water temperature and DO at 15-minute intervals were deployed at the five monitoring locations for continuous *in situ* measurements. Discrete multi-parameter water quality measurements of temperature, DO, pH, and specific conductance were also collected at the monitoring locations using a calibrated YSI ProDSS water quality meter.

Continuous water temperature and DO measurements were recorded from May 1, 2019 through October 31, 2019. Discrete multi-parameter water quality measurements were collected at each of the five monitoring locations on a monthly basis from May through October.

Additionally, GLEC conducted sediment contaminant sampling along three transects in the Project reservoir (Figure 2.3-1). Although FERC's SPD did not require I&M to perform

Figure 2.3-1. Water Quality Monitoring and Sediment Sampling Locations

sediment contaminant sampling, based on I&M's experience at other projects (i.e., Mottville Project) and the resource agencies' interest in these data, I&M agreed to conduct the sampling and provide this information to resource agencies.

In general, the DO and water temperature plots demonstrate a typical diurnal fluctuation that is reflective of day and night respiration (dissolved oxygen) and the relatively rapid change in water temperature due to changes in air temperature. However, there were several instances when this pattern was interrupted possibly due to meter malfunctioning, meter desiccation (temporarily out of the water) or vandalism. Specifically;

- the mid-June and mid-July DO data for the tailrace,
- rapidly declining DO and temperature data in late August for the bypass reach upstream of the Fawn River,
- the rapid decline and then increase in water temperature mid- to late September in the tailrace, and
- spikes in DO to levels greater than saturation in late September in the bypass reach upstream of the Fawn River.

In each instance the anomalies were investigated by reviewing the field conditions, maintenance and calibration logs and the data from the secondary data logger (if available) to determine the problem.

Primary observations from the Water Quality Study include:

- DO readings fell within state threshold limits for the entire duration of the study in both the reservoir and power canal. Water temperature readings were below the monthly maximum threshold limits in the reservoir, power canal, tailrace, and the bypass reach upstream of the Fawn River.
- The monthly water temperature threshold was exceeded on October 1 and 2, 2019 in the bypass reach downstream of the Fawn River for 26 consecutive instantaneous measurements. However, 14 of the 26 measurements were above the threshold by only 0.2°C, which is within the accuracy range of the temperature probe. It's possible that water temperature at this location may be heavily influenced by warm water coming from the Fawn River rather than exceedances only attributable to influences in the St. Joseph River.
- In the tailrace, instantaneous DO readings as well as the daily average DO were below state thresholds on July 16, 2019. Due to probe damage and malfunction as listed in Section 5.1 of the Water Quality Study Report (Appendix D), only one logger was recording in the tailrace in July and so there was not a second set of data to verify these low readings. DO values recorded at all other water quality monitoring stations were above the thresholds on this day.
- Instantaneous DO readings below the state threshold were recorded on August 7, 18, and 19, 2019 in the bypass reach downstream of the Fawn River. The daily average DO fell below the threshold on July 21, 2019 and August 19, 2019 for this location.

In the bypass reach upstream of the Fawn River, instantaneous DO values below the threshold were recorded on eight days in August and ten days in September. For five of those days in August and five in September, the daily average DO also fell below the state threshold. During the data download event on August 29, 2019, the field crew observed that no significant river flow was present in the bypass reach due to the fact that the water surface elevation at that time was below the top surface of the control structure. The DO data suggests that this diversion of water to the power canal began somewhere between August 14 and August 20, 2019. On August 20, 2019, both the instantaneous DO threshold of 4.0 milligrams per liter (mg/L) and the daily average threshold of 5.0 mg/L were exceeded in the bypass reach upstream of the Fawn River. These exceedances persisted on and off through September 25, 2019. During the fish collection event on September 26-28, 2019, conducted as part of the Fisheries Survey for the Project relicensing, the field crew noted that the water surface elevation at that time was again below the top surface of the control structure. Heavy rain was observed during the fish collection event and the DO data shows that concentrations rose shortly after that. The majority of the DO exceedances observed during the Water Quality Study correspond to water diversion out of the bypass reach and into the power canal.

Sediment Chemistry

Sediment analysis results were compared to published sediment quality guidelines (SQG) (MacDonald et al. 2000, Ingersoll et al. 2002, GeoEngineer 2015, and WDNR 2003) to determine the relative risk to aquatic life and human health. Relative risk to aquatic life was determined by comparing the sediment analysis to Probable Effect Levels (PEL), Threshold Effect Levels (TEL), Effect Range Median (ERM) and Effect Range Low (ERL). Sediment concentrations of various contaminants that exceed the SQG may adversely affect aquatic life. Total PCB and mercury were also assessed, but those chemicals are likely to have a greater effect on human health than aquatic life and are also discussed in the fish tissue results section of the Fisheries Survey study report.

With the exception of mercury, lead and arsenic, each analyte concentration in the Constantine reservoir sediments were measured at concentrations less than the most restrictive SQG (TEL). Sediment chemistry is typically affected by agricultural runoff within the basin and is not considered to be the result of Project operations.

Mercury

The sediment mercury concentration in the Lower Reservoir (LRSS) duplicate sample slightly exceeded the TEL (0.17 milligrams per kilogram [mg/kg]) at 0.19 mg/kg in the duplicate sample. Mercury was measured at 0.16 mg/kg in the other sample. These concentrations were less than the other three SQG values. Mercury concentrations at or below the TEL are unlikely to cause adverse effects to aquatic life.

Lead

Lead concentrations in the LRSS duplicate sample were equal to the TEL and ERL SQG at 35 mg/kg. Lead concentrations in the other LRSS sample and in the other two reservoir locations (middle reservoir and upper reservoir) were all less than any

of the SQGs used. Lead concentrations at or below the TEL and ERL are unlikely to cause adverse effects to aquatic life.

Arsenic

Arsenic concentrations in the LRSS samples exceeded the PEL (17 mg/kg). The LRSS lead concentration was measured at 28.8 mg/kg. Arsenic levels at this concentration may cause adverse effects to aquatic life.

With the above noted exceptions, the contaminants measured in the Constantine reservoir are not likely to have an adverse effect on aquatic life or human health. Mercury and lead concentrations were measured at or near the TEL and ERL which would indicate a very low risk to aquatic life. Arsenic concentrations in the LRSS were measured at concentrations that may adversely affect aquatic life, but were at concentrations less than the median effects level (85 mg/kg). Site specific conditions (e.g., total organic carbon, pH, biotic ligands) will affect the bioavailability and are likely to lessen the effect of arsenic at these concentrations. Consequently, this concentration of arsenic in sediment is likely not a great concern to aquatic life in the sediment. Finally, it is unclear whether the elevated concentrations, especially arsenic, in the sediments are naturally occurring or are from anthropogenic sources.

2.3.3 Variances from FERC-Approved Study Plan

The Water Quality Study was conducted in full conformance with the RSP, with the exception of the following variances:

- On or around May 21, 2019, it is suspected that both loggers in the tailrace were pushed up onto the concrete ledge due to upwelling. The primary logger was damaged during this action and quit recording on May 21 while the secondary logger continued to record data from what could have been a position above the water. Because of the damage to the primary logger, data from the secondary logger was used for the month of May. The primary logger was replaced on May 30, 2019.
- Both the primary and secondary continuous temperature and DO loggers were discovered to be missing from the bypass reach upstream of the Fawn River during the monthly download on August 1, 2019. No data exists for that location for June 27 to August 1, 2019. A new primary logger was placed at the site on August 1, 2019. A secondary logger was added the following month. The data collected during this time period from the other water quality monitoring stations suggests that no major adverse events occurred between June 27 and August 1, 2019.
- The Commission's SPD did not require that I&M conduct the sediment contaminant sampling component. However, based on I&M's experience at other projects on the St. Joseph River, I&M decided to proceed with the data collection and analysis.

2.4 Fisheries Survey

2.4.1 Study Status

I&M has completed the Fisheries Survey in accordance with the RSP and the Commission's SPD. The technical report including the results of the Fisheries Survey is included as Appendix E to this ISR.

2.4.2 Summary of Study Methods and Results

In accordance with the study plan approved in the Commission's SPD, I&M conducted a Fisheries Survey in the Project's reservoir and bypass reach[3]. This study was led by GLEC and was designed to collect a comprehensive baseline for existing fishery resources in the vicinity of the Project and collect information to compare to the previous entrainment and impingement study that was conducted for the Project.

Prior to conducting field surveys, GLEC obtained the required scientific collector's permit from the Michigan Department of Natural Resources (MDNR). GLEC conducted two sampling events during daylight hours in the late spring/early summer (May-June) and the late summer/early fall (August-September) of 2019. Fish sampling was conducted using boat electrofishing and fyke nets.

Both near-shore (shallow) and mid-channel (deep) habitats were sampled to characterize fish communities and life stages that use these different habitat types. Supporting data was recorded at each sampling location, including: (1) location (Global Positioning System [GPS]); (2) sampling gear type; (3) mesohabitat; (4) representative photographs; (5) time and date; (6) weather; (7) general descriptions of depth, flows, and substrate; and (8) cover type and estimated percentage of cover. In addition to this supporting data, GLEC collected discrete water quality measurements of water temperature, DO, pH and specific conductance at each sampling location. A secchi disk reading was also taken at each sampling site.

As part of the Fisheries Survey, GLEC measured the average approach velocities 1-foot in front of the existing trashrack structure. Measurements were collected at the Project's maximum and efficient generation rates using an Acoustic Doppler Current Profiler (ADCP).

Additionally, GLEC collected fish tissue samples from ten Largemouth Bass (*Micropterus salmoides*) (resident predator fish) and ten Shorthead Redhorse (*Moxostoma macrolepidotum*) in the Project reservoir that were analyzed for mercury and PCBs. Contaminants that affect fish in the St. Joseph River often come from agricultural runoff and other local sources of pollution within the basin. Any potential contaminants present in fish in the Project area are not considered to be the result of Project operations. Although FERC's SPD did not require I&M to perform fish tissue sampling, based on

[3] The RSP included the Project's power canal. However, during the field season there were concerns regarding safety and access to the power canal for effective sampling due to lack of boat access and that the canal is too deep and swift to use other sampling methods safely. GLEC consulted with MDNR's Fisheries Division, Southern Lake Michigan Management Unit regarding the potential for eliminating sampling in the power canal. Brian Gunderman, the Unit Manager, notified GLEC that the nearby collections in the Project's reservoir and bypass reach, along with the relocation collections in the power canal conducted during maintenance work in the spring of 2019 (unrelated to the relicensing), made collections in the power canal by GLEC unnecessary.

I&M's experience at other projects (i.e., Mottville Project) and the resource agencies' interest in these data, I&M agreed to conduct the sampling and provide this information to resource agencies. The results of the fish tissue sampling have not been received from the lab at the time the ISR was submitted. The Fisheries Survey Report will be supplemented with this information when available.

Fish Community Baseline Survey Compared to Historical Community Data

During fish collections in June and September of 2019 GLEC documented a diverse and abundant fish community. The 2,343 fish representing 46 species are equal in species richness to collections made in the area in the historical record. The June and September fish sampling collected the same or more species than historical sampling records as shown in Table 2.4-1. It appears that the community has not changed significantly since the last major survey.

Species collected in the past, but missing from this year's collections included Brook (*Lampetra planeri*) and Silver Lamprey (*Ichthyomyzon unicuspis*), Central Stoneroller (*Campostoma anomalum*), Common Shiner (*Luxilus cornutus*), Creek Chub (*Semotilus atromaculatus*), Fathead Minnow (*Pimephales promelas*), Spotted Gar (*Lepisosteus oculatus*), and Stonecat (*Noturus flavus*). During the 2019 fish collection, six species were collected that were not seen in past records including: Brown Bullhead (*Ameiurus nebulosus*), Emerald Shiner (*Notropis atherinoides*), Flathead Catfish, Northern Sunfish (*Lepomis peltastes*), Pirate Perch (*Aphredoderus sayanus*), and White Crappie (*Pomoxis annularis*). Most species collected remain the same from the last broad survey completed by AEP in 1990-1991.

Table 2.4-1 Comparison of Fish Species Collected Near the Constantine Project in Various Surveys

Common Name	Shepherd 1975	AEP 1991	MDNR 1998	Cardno 2019	GLEC 2019
American Brook Lamprey		X			
Black Crappie	X	X	X	X	X
Black Redhorse		X			X
Blackside Darter		X		X	X
Bluegill	X	X	X	X	X
Bluntnose Minnow	X	X			X
Bowfin		X	X		X
Brook Silverside		X	X	X	X
Brown Bullhead					X
Central Stoneroller		X			
Channel Catfish		X	X	X	X
Chestnut Lamprey		X			X
Common Carp	X	X	X		X

Common Name	Shepherd 1975	AEP 1991	MDNR 1998	Cardno 2019	GLEC 2019
Common Shiner	X	X		X	
Creek Chub		X			
Emerald Shiner					X
Fathead Minnow		X			
Flathead Catfish					X
Gizzard Shad					X
Golden Redhorse		X		X	X
Golden Shiner	X	X			X
Grass Pickerel		X			X
Greater Redhorse		X			X
Green Sunfish	X	X		X	X
Greenside Darter				X	X
Johnny Darter		X		X	X
Largemouth Bass	X	X	X	X	X
Logperch	X	X	X	X	X
Longear Sunfish		X			
Longnose Gar	X	X	X		X
Mimic Shiner		X		X	X
Northern Hogsucker	X	X			X
Northern Pike	X	X	X		X
Northern Sunfish					X
Pirate Perch					X
Pumpkinseed	X	X	X		X
Rainbow Darter		X		X	X
River Redhorse		X			X
Redhorse Sp.			X		
Rock Bass	X	X	X	X	X
Rosyface Shiner		X			
Sand Shiner		X			X
Shorthead Redhorse		X		X	X
Silver Lamprey		X			
Silver Redhorse		X			X
Smallmouth Bass	X	X	X	X	X

Common Name	Shepherd 1975	AEP 1991	MDNR 1998	Cardno 2019	GLEC 2019
Spotfin Shiner	X	X			X
Spotted Gar	X				
Spotted Sucker	X	X	X		X
Stonecat				X	
Striped Shiner		X			X
Walleye		X	X	X	X
Warmouth	X	X			X
White Crappie					X
White Sucker	X	X	X		X
Yellow Bullhead	X	X		X	X
Yellow Perch		X	X	X	X

Intake Velocities for Fish Impingement and Entrainment Potential

The intake velocities recorded at two locations within the power canal were similar to those reported in the entrainment survey completed in 1991 (AEP 1991). As reported in the PAD, during original licensing in 1988, velocities were measured as 1.8 feet per second (fps) through the trackracks and 1.3 fps at the face of the trackracks (I&M 2018). This is very similar to average velocities measured in the power canal by the ADCP sensors in June, 2019 of 1.57 fps (47.9 centimeters per second [cm/s]) just downstream of the headgate structure (Transect 1) and 1.33 fps (40.5 cm/s) upstream of the trashracks (Transect 2). This supports the assumption made in the PAD that velocities would likely remain unchanged as there have been no change to Project operations or modification of significant Project features.

Table 2.4-2 is a comparison of published swim speeds for several freshwater fish that include the species collected during the 2019 Constantine assessment. Entrainment susceptibility may be judged in part by the ability of a fish to swim against the current upstream of the powerhouse. The average swim speeds reported are very similar to the measured water velocity in the power canal, whereas the published maximum or burst swim speeds often exceed the velocity measurements in the power canal.

Table 2.4-2 Experimental Observations of Prolonged Swimming Speeds Grouped by Genus

Family	Genus	Number Fish Tested	Average of Minimum Swim Speed	Average of Swim Speed	Average of Maximum Swim Speed	Unit of Swim Speed
Catostomidae	*Catostomus*	4		48.7		cm/s

Family	Genus	Number Fish Tested	Average of Minimum Swim Speed	Average of Swim Speed	Average of Maximum Swim Speed	Unit of Swim Speed
Centrarchidae	*Lepomis*	5		30.0		cm/s
Centrarchidae	*Micropterus*	11	50.0 [1]	43.0 [2]	118.0 [1]	cm/s
Cyprinidae	*Campostoma*	1	27.9	39.9	53.6	cm/s
Cyprinidae	*Cyprinus*	2	64.9	98.1	131.0	cm/s
Cyprinidae	*Notemigonus*	1	30.9		71.3	cm/s
Cyprinidae	*Notropis*	4		33.5		cm/s
Esocidae	*Esox*	2	19.0		47.4	cm/s
Percidae	*Etheostoma*	3	14.3	29.6	42.1	cm/s
Percidae	*Sander*	9	36.5	31.0	90.5	cm/s
Petromyzontidae	*Lampetra*	4	15.2	62.8	45.7	cm/s

[1] Minimum and Maximum Speed from *Micropterus dolomieui*

[2] Average Speed from *Micropterus salmoides*

Source: FishXing Version 3.0 Beta, 2006.

Fish entrainment is also affected by the downstream migration or movement of fish and the downstream drift of larval and juvenile fish. No estimates of fish entrainment were completed with this study.

2.4.3 Variances from FERC-Approved Study Plan

Visual estimates of the water clarity were made by recording the depth at which a Secchi disk disappeared at fish collection sites, recorded to the nearest tenth of a meter. However, at some fish collection locations the current was too swift to accurately measure transparency using a Secchi disk, these locations were marked as Secchi depth NA.

During the measurement of intake velocities in the power canal interference to the surveying unit was encountered while trying to record measurements 1-foot upstream of the Project's trashracks as specified in the RSP. In order to record useable measurements, the velocity profile transect for this location was shifted slightly upstream in the power canal to the point where interference was alleviated and velocities could be successfully recorded.

The Project's power canal was initially included in the fish sampling study area pursuant to the RSP, but there were concerns regarding safety and access to the power canal for effective sampling due to lack of boat access and that the canal is too deep and swift to use other sampling methods safely. The power canal was excluded from the sampling area based on communication with MDNR staff from the Fisheries Division in the Southern Lake Michigan Unit, who agreed that the stranded fish survey of the power

canal in spring 2019 provided sufficient data to predict the species present (McCauley, personal communication, July 10-11, 2019). No additional fish collections were made in the power canal during this survey.

During collection of fish tissue samples field staff were unable to collect enough individuals of either of the preferred bottom-feeding species identified in the RSP, Common Carp or Channel Catfish. Field staff substituted (10) Shorthead Redhorse to represent the bottom feeder fish species.

2.5 Mussel Survey

2.5.1 Study Status

I&M has completed the Mussel Survey in accordance with the RSP and the Commission's SPD. The technical report including the results of the Mussel Survey is included as Appendix F to this ISR.

2.5.2 Summary of Study Methods and Results

In accordance with the study plan approved in the Commission's SPD, I&M conducted a Mussel Survey in the Project's reservoir, bypass reach and downstream of the powerhouse.

EnviroScience, Inc. (EnviroScience) led the Mussel Survey, and prior to conducting field surveys, obtained the appropriate required scientific collector's permit from the MDNR. EnviroScience conducted mussel surveys in August of 2019. Surveys were conducted according to MDNR's Michigan Freshwater Mussel Survey Protocols and Relocation Procedures[4].

A qualitative mussel survey was conducted at two sites in the reservoir, one site in the bypass reach, and one site downstream of the Project's powerhouse (including multiple sub-reaches). Mussel survey locations are depicted in Figure 2.5-1. Basic habitat information such as substrate type (e.g., gravel, cobble, boulder), water depth, habitat type (e.g., riffle, run, pool), cover type (e.g., woody debris), stream width, and qualitative water velocity was recorded at each sampling location. Representative photographs were also taken of each species. Additionally, water quality data, including water temperature, DO, pH, and specific conductance were collected from representative locations in the survey areas during the mussel survey.

Mussel assemblage in the Project study area was similar to historic records near the area as presented in Table 4 of the Mussel Survey Report (Appendix F). Nineteen (19) species have been documented in this portion of the St. Joseph River and 12 were observed live in this study. Species observed in this study and not documented downstream by Wesley and Duffy (1999) included the Mapleleaf (*Quadrula quadrula*), Lilliput (*Toxolasma parvum*), and Paper Pondshell (*Utterbackia imbecillis*). Conversely, species observed pre-1999 and not recorded in this study included Cylindrical Papershell (*Anodontoides ferrussacianus*), Purple Wartyback (*Cyclonaias tuberculata*), Ohio Pigtoe

[4] Michigan Freshwater Mussel Survey Protocols and Relocation Procedures, 2018 is available at https://www.fws.gov/midwest/eastlansing/te/pdf/MIFreshwaterMusselSurveyProtocolsRelocationProceduresFeb2018.pdf.

(*Pleuorbema cordatum*), and Rainbow (*Villosa iris*). An undetectable, and not very diverse, mussel community may occupy the region upstream of the dam. Only six species were reported by Wesley and Duffy (1999) near Three Rivers, Michigan. A study performed near the dam headrace in 2019, associated with a separate project, collected 11 species. Species collected in that survey were like those observed at Sites 2 and 3 in this study, except for Round Pigtoe (live; *Pleurobema sintoxia*) and live Purple Wartyback.

No federally listed mussel species were detected within the Project area. An undetectable mussel community may occupy the region upstream of the dam, and mussel scarcity is likely due to a lack of habitat and unstable conditions in Sites 1 and 4. There appears to be a stable, recruiting mussel community below the dam that has likely persisted for several years based on the diversity and abundances observed in this survey and historical records. The mussels observed would likely not be affected by continued operation assuming relicensing would not alter the existing hydraulics.

2.5.3 Variances from FERC-Approved Study Plan

The Mussel Survey was conducted in full conformance with the Commission's SPD.

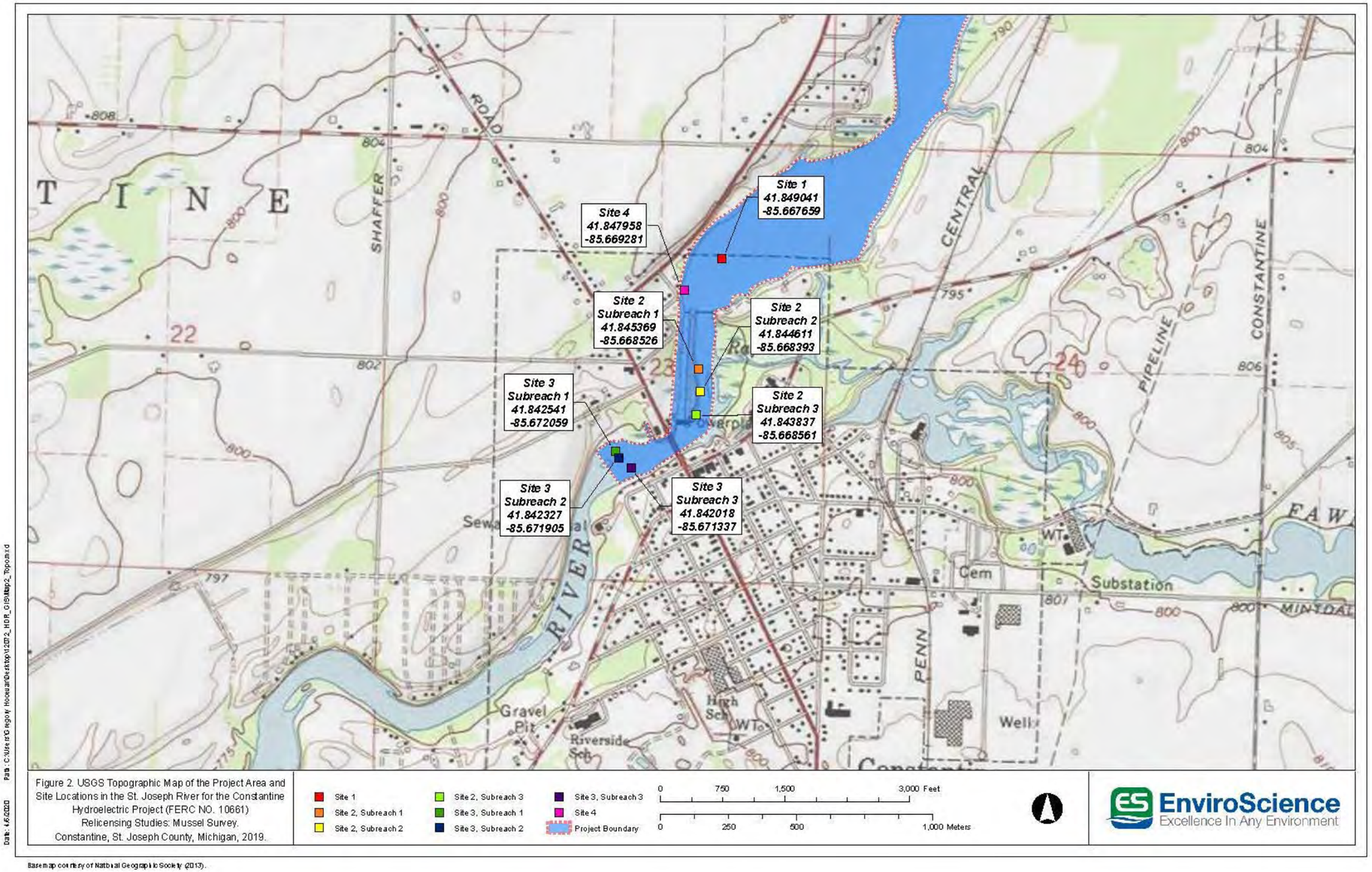


Figure 2. USGS Topographic Map of the Project Area and Site Locations in the St. Joseph River for the Constantine Hydroelectric Project (FERC NO. 10661) Relicensing Studies: Mussel Survey. Constantine, St. Joseph County, Michigan, 2019.

Figure 3.5-1. Mussel Survey Locations

2.6 Wetlands Study

2.6.1 Study Status

I&M has completed the Wetlands Study in accordance with the RSP and the Commission's SPD. The technical report including the results of the Wetlands Study is included as Appendix G to this ISR.

2.6.2 Summary of Study Methods and Results

In accordance with the study plan approved in the Commission's SPD, I&M conducted a Wetlands Study to document all wetlands located within and adjacent to the Project boundary that may potentially be impacted due to continued Project operations.

GLEC led the Wetlands Study, and prior to conducting field surveys, developed base maps in GIS of wetland cover types in the Project study area using source data from National Wetlands Inventory (NWI) and Michigan Department of Environmental Quality (MDEQ) wetland databases. The base maps include riparian and wetland vegetation throughout the study area. Wetlands are generally classified into four classification groups according to Cowardin et al. (1979): Palustrine Emergent, Palustrine Scrub-Shrub, Palustrine Forested, and Open Water.

On August 14, 15, and 16, 2019, two field biologists surveyed the wetland complexes in the Constantine reservoir, bypass reach and tailrace areas within the Project boundary. The purpose of the survey was to verify the wetland map features in the Project NWI wetland map that was provided in the PAD. The survey was conducted by boat and walking nearshore areas over the length of the Project. Observations were recorded at 48 stations generally adjacent to or overlying the NWI wetlands features within the Project boundary. Observations of wetland habitats near the Project boundary were recorded at 8 stations (14, 24, 25, 37, 38, 39, 40), not immediately adjacent to or overlying NWI map clipped features and are provided in Figure 2.6-1. The Wetlands Study was coincidental with the Botanical Resources Study, and field survey notes (Section 7 of the Wetlands Study Report) describe the vegetative cover, species composition, and wetland classifications which imply successional stage - including degree of inundation (e.g., seasonally flooded, permanently flooded) for each station, based upon information obtained from this study as well as the annual Constantine Invasive Species Survey conducted by GLEC for I&M (GLEC 2019). Any changes in wetland type or characteristics to the existing NWI classification were noted when relevant. Coordinate positions were recorded with a Global Positioning System (GPS) device at 40 of the 48 stations and marked on a large-scale field map for the remaining 8 stations. As prescribed by the RSP, delineations/field measurements were not conducted to verify the size or extent of the wetland features.

Wetlands are generally defined as those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support vegetation typically adapted for life in saturated soil conditions. The Constantine Project area is in the Beach-Maple Association of the Eastern Deciduous Forest Province (Bailey 1978). Dominant vegetation in the Project area is a mixed hardwood community consisting of oak, ash, beach, hickory, maple, cottonwood, and aspen. Plant species of the aquatic

wetland community include American white waterlily (*Nymphaea odorata*), Eurasian watermilfoil, and crispy pondweed. Arrow arum is a dominant species in the emergent wetland class. Cattails are a minor component of the wetland plant community in the Constantine reservoir.

The classification of wetlands and the acreages observed in this study vary very little from the results from previous assessments described in the PAD. The most notable change documented was the reclassification of the island between the tailrace and bypass reach from PEM1C Freshwater Emergent Wetland to PFO1C Forested Shrub Wetland. This change was made due to the ground-truthing and identification of a discrepancy in the NWI wetland map.

Total wetland acreage strictly within the Project boundary was estimated to remain at approximately 35.8 acres across five NWI categories that fall under the system/class categories palustrine forested and palustrine scrub-shrub wetland habitats. The majority of the Project wetland area (20.8 acres) is classified as: PF01Ch Palustrine, Forested, Broad Leaved Deciduous, Seasonally Flooded, and Diked/Impounded. These observations are consistent with the information presented in the PAD.

Modifications to existing NWI wetlands map classifications were attributable to invasive species competition; purple loosestrife overwhelming the scrub-shrub communities in the modified zones. Modifications are described for each station in Section 7 of the Wetlands Study, which is included in Appendix G of this ISR. As noted in the RSP and PAD, the Constantine Project is operated as run-of-river and has little effect on reservoir levels that could potentially impact wetlands within the Project boundary.

1.1.1 Variances from FERC-Approved Study Plan

Actual wetlands survey and study methods applied some interpretations of and minor variances from the method details outlined in Section 11 Wetlands Study of the March 15, 2019 RSP. Section 11 subsections variously describe wetlands of concern and the study area as “wetlands within or adjacent to the Project boundary”, “wetlands in the Project boundary”, and “wetland cover types in the Project study area”. The survey and mapping tasks prescribed in the RSP were followed to address wetlands within the FERC Project boundary as it appears on the approved Exhibit G maps, since only areas within the Project boundary are relevant to Project operations. Wetland areas adjacent to (i.e., outside) the Project boundary were referenced in some areas to support and verify observations, but were not re-classified or studied to update wetland features relating to the Project. The Task 1 Desktop Mapping approach in the RSP suggests source data could include soil maps and maps from NWI and MDEQ. As mentioned in Section 4.1 above, it was determined that the best source data for wetlands in the study area was the U.S. Fish and Wildlife Service NWI wetlands map already used in the PAD to produce the Project NWI wetlands map layer.

Soil maps were not used in the wetlands survey or post-survey mapping exercises. Field notes and the Summary and Discussion section above discuss soil regimes in the study area. However, there is no doubt that the soils are hydric and either somewhat “dried” due to low river conditions, or wet depending on the size of the wetland adjacent to the Project boundary or juxtaposition of the riverine habitat.

Task 2 Field Verification of Wetland Maps in the RSP prescribes that any map change recommendations include species composition, successional stage, and extent of

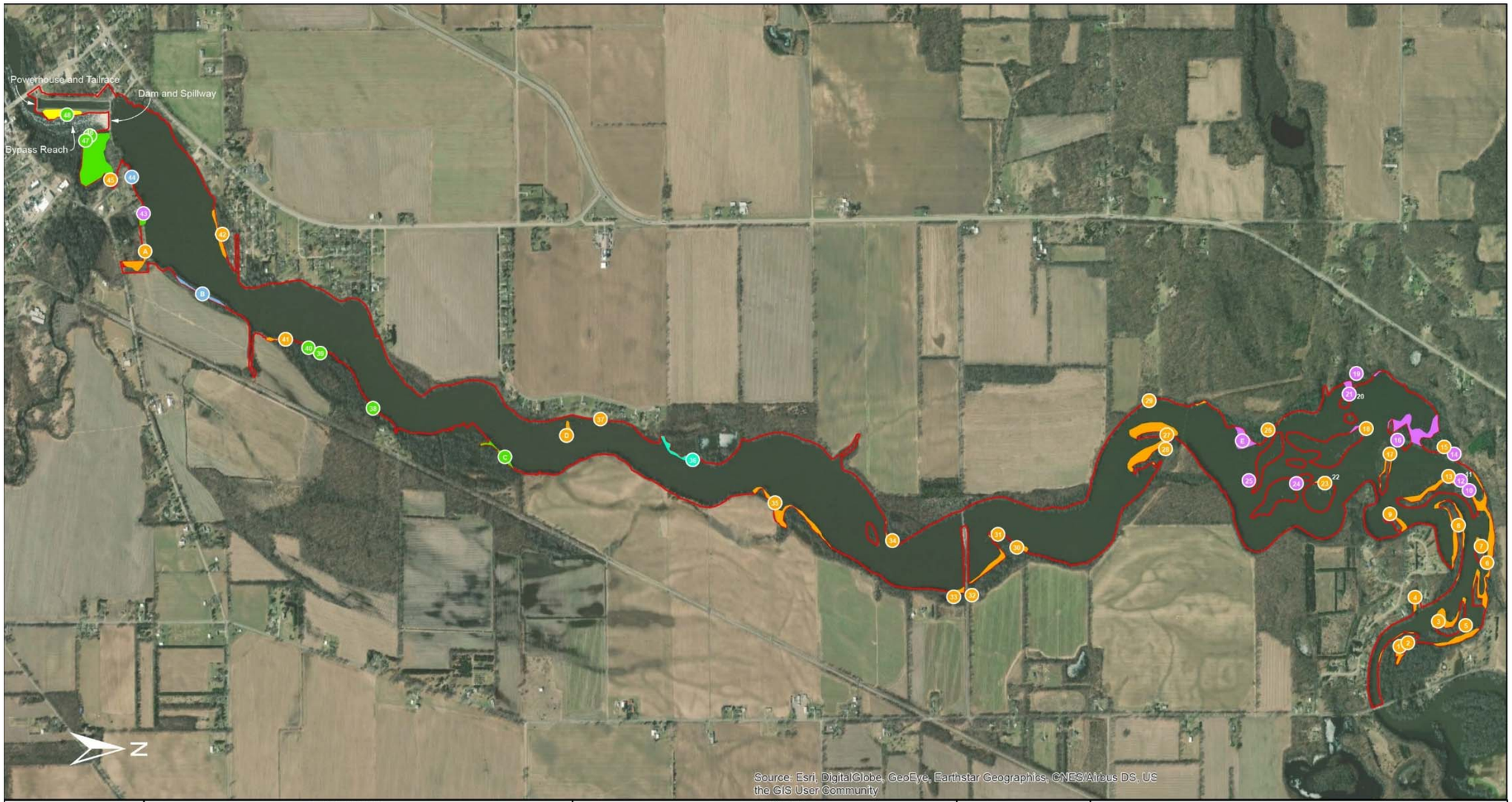


Figure 4.6-1. Wetlands Survey Map

shoreline. Where changes to Project NWI wetland features were recommended, field measurements were not taken to verify extent of shoreline where the feature was re-classified.

2.7 Recreation Study

2.7.1 Study Status

I&M has completed the Recreation Study in accordance with the RSP and the Commission's SPD. The technical report including the results of the Recreation Study is included as Appendix H to this ISR.

2.7.2 Summary of Study Methods and Results

In accordance with the study plan approved in the Commission's SPD, I&M conducted a Recreation Study to assess the adequacy of existing public access and recreational facilities to meet current and future recreation needs.

Young Energy Services (YES) performed a field inventory to document existing formal and informal recreation facilities in the Project area (within and adjacent to the Project boundary). YES recorded the following information for each of the inventoried recreation areas:

(1) A description of the type and location of existing recreation facilities;

(2) The type of recreation provided (boat access, angler access, picnicking, etc.);

(3) Length and footing materials of any trails;

(4) Existing facilities, signage, and sanitation;

(5) The type of vehicular access and parking (if any);

(6) Suitability of facilities to provide recreational opportunities and access for persons with disabilities (i.e., compliance with current Americans with Disabilities Act standards for accessible design); and

(7) Photographic documentation of recreation facilities and GPS location.

In combination with the facility inventory, YES performed a qualitative assessment of the condition of the recreation facilities. The recreation amenities available at each recreation facility were rated using the following criteria: (N) Needs replacement (broken or missing components, or non-functional); (R) Needs repair (structural damage or otherwise in obvious disrepair); (M) Needs maintenance (ongoing maintenance issue, primarily cleaning); and (G) Good condition (functional and well-maintained).

YES collected visitor use data at the FERC-approved recreation sites, formal non-Project recreation sites, and other informal recreation sites through a combination of in-person surveys, field reconnaissance, and photographic documentation. Recreation visitor use data was collected from May through September of 2019. Surveys were conducted from 8:00 AM until 6:00 PM according to the schedule presented in Table 2.7-1.

Table 2.7-1 Visitor Use Survey Schedule

Month	Survey and Reconnaissance
May	▪ One weekend day (Memorial Day Weekend) ▪ One randomly selected weekday
June	▪ One weekend day that coincides with the Father's Day boat race[1] ▪ One randomly selected weekday
July	▪ One weekend day ▪ One randomly selected weekday
August	▪ One weekend day ▪ One randomly selected weekday
September	▪ One weekend day (Labor Day Weekend) ▪ One randomly selected weekday

[1] The Michigan Hydroplane Racing Association typically holds an annual boat race on the St. Joseph River in Constantine on or about Father's Day weekend. To the extent practicable, I&M will attempt to collect visitor use data during one weekend race day. However, the boat race has been cancelled or postponed in previous years due to permitting issues, weather events, or other circumstances. If the boat race is postponed in 2019, I&M will attempt to reschedule a weekend survey day to accommodate the rescheduled boat race.

The actual dates that field reconnaissance took place in 2019 were as follows:

- May 22 and 27 (Memorial Day)
- June 15, 16 (Father's Day) and 28
- July 1 and 21 (Boat Race)
- August 15 and 25
- September 27 and 29

A team of two technicians rotated between the recreation sites in random order and conducting interviews with willing participants. Technicians also recorded relevant conditions, including observed recreational activities, estimated number of vehicles, and number of recreational users. General information regarding date, time, and weather conditions was also recorded. A total of 21 recreation surveys were completed in the field.

In addition to the personal interviews, I&M developed an online version of the interview questions for respondents to provide survey responses electronically. The online survey was available from May 1 through September 30, 2019. A notice of the online survey was posted to AEP's relicensing website and signs were posted at each of the Project's recreation facilities notifying recreationists of how to complete the online survey. A total of seven surveys were completed online during the study period.

The existing recreation facilities, both Project and Non-Project, are well maintained and utilized by the public. Overall, the public is pleased with the recreation facilities provided by I&M, St. Joseph County, and the Village of Constantine. The cooperative effort of I&M and local governments has resulted in recreation facilities that not only meet the goals and objectives of the relevant recreation plans but contribute to the economies of the

area. This is evidenced by individuals from outside of St. Joseph County visiting to boat on the Constantine Project reservoir, canoe/kayak the St. Joseph River, and fish the river and reservoir. According to the comments received, the existing facilities contribute to the enjoyment of all participating in those activities.

The primary recreation activities for the Constantine Project observed are fishing by boat, bank fishing, fishing from the tailwater fishing access platform located adjacent to the powerhouse, and pleasure boating. Results from the in-person and online surveys, provided below in Table 2.7-2, substantiate those observations.

Table 2.7-2 Activities Participated in by Survey Respondents

	Bank Fishing	Boat Fishing	Pleasure Boating	Canoe/ Kayak	Picnic	Swim	Sight-Seeing	Hunt	View Wildlife	Other
Number	5	5	6	1	0	0	1	0	0	0
Percent	27.8	27.8	33.3	5.6	0	0	5.6	0	0	0

Those surveyed indicated that the overall experience had recreating at the Constantine Project was totally acceptable. Table 2.7-3 presents the results of the surveys relative to rating the overall experience of the respondents.

Table 2.7-3 Overall Experience of Survey Respondents

	Totally Unacceptable	Unacceptable	Neutral	Acceptable	Totally Acceptable
Safety			1 (4.8%)		20 (95.2%)
Enjoyment				1 (4.8%)	20 (95.2%)
Crowding	1 (4.8%)			2 (10.5%)	17 (89.5%)
Overall Experience				1 (5.9%)	16 (94.1%)

Overall, survey respondents appear to be very satisfied with the existing recreation facilities in the Project area. Suggested improvements for each of the existing Project recreation sites are detailed in Section 2.3.1 of the Recreation Study Report included in Appendix H of this ISR. The recommended improvements primarily reflect the need for signage improvements, identifying Americans with Disabilities-accessible parking areas, and improvements to vegetation management. The Project recreation site with the most suggested improvements is the canoe portage below the Project spillway. Suggested improvements include: better signage, upgraded walking surface, and increasing the trail width.

2.7.3 Variances from FERC-Approved Study Plan

The Recreation Study was conducted in full conformance with the Commission's SPD.

2.8 Cultural Resources Study

2.8.1 Study Status

I&M has completed the Cultural Resources Study in accordance with the RSP and the Commission's SPD. The technical reports including the results of the Cultural Resources Study are included as Appendix I to this ISR, and are being filed with FERC as privileged.

2.8.2 Summary of Study Methods and Results

By notice dated July 25, 2018, FERC designated I&M as its non-federal representative for purposes of conducting informal consultation pursuant to Section 106 of the National Historic Preservation Act (Section 106).[5] Pursuant to 36 C.F.R. § 800.4(a)(1) and the approved Cultural Resources Study Plan, I&M consulted with the Michigan State Historic Preservation Office (SHPO), Forest County Potawatomi Community, Pokagon Band of Potawatomi Indians, and Nottawaseppi Huron Band of the Potawatomi Tribes regarding Project's Area of Potential Effects (APE). By letter dated March 5, 2019, I&M proposed to define the APE for this undertaking as:

> *The APE for the Constantine Project includes lands within the FERC-approved Project boundary. The APE also includes lands outside of the Project boundary where Project operations, Project-related recreation activities, or other enhancements may cause changes in the character or use of historic properties, if any such properties exist.*

I&M received a response from the Forest County Potawatomi on March 7, 2019, concurring with the general APE as defined by I&M, but noted that field surveys should be conducted in order to adequately determine the potential impact of hydro operations on cultural and historic properties. I&M did not receive a response from the Michigan SHPO or other Tribes.

I&M retained Commonwealth Heritage Group (Commonwealth) to conduct the cultural resources studies at the Project. Commonwealth conducted: (1) records and literature review, (2) architecture history/field investigations, and (3) archaeological field investigations.

Background research to identify previously recorded above-ground resources was conducted in July 2019, prior to field survey. Research was conducted at the Michigan SHPO in Lansing, Michigan, and by utilizing online resources including the National Park Service database. Background investigations revealed that there were no previously recorded historic properties in the APE. The cultural resources field survey for above-ground resources was completed in July 2019.

Commonwealth surveyed all above-ground properties over 50 years of age in the APE. As a result of this survey, one property, the Constantine Hydroelectric Plant, was identified as retaining historic integrity. Further investigation of the complex, including the powerhouse, headgates, power canal and earthen embankments, dam and spillway,

[5] 54 U.S.C. § 306108

substation, and machine shop led Commonwealth to recommend the property as eligible for listing in the National Register of Historic Places.

Commonwealth conducted an archaeology survey on July 22 through July 24, 2019, in accordance with the guidelines established by the U.S. Secretary of the Interior and acceptable to the Michigan SHPO. The topographic relief from the water surface to the maximum height of the bank in any portion of the Project's APE is limited, heavily vegetated, and most of the adjacent properties are privately owned. Thus, Commonwealth archaeologists found accessing and inspecting the riverbanks by canoe to be the most efficient method for visual inspection.

No previously unrecorded archaeological sites were identified during the survey. Commonwealth found no historic properties to be affected by the proposed continued operation of the Project. Based on the results of the Cultural Resources Study, I&M will consult with federally-recognized Indian Tribes to develop and conduct an inventory of properties of traditional religious and cultural importance (often referred to as "traditional cultural properties") within the APE and will provide the Commission with an inventory report in conjunction with the DLA filing.

2.8.3 Variances from FERC-Approved Study Plan

The Cultural Resources Study was conducted in full conformance with the Commission's SPD.

3 Upcoming ILP Milestones and Study Reporting

Table 2.8-1 presents upcoming ILP milestones.

Table 2.8-1 Upcoming Major ILP Milestones

Date	Milestone
4/23/2020	ISR Meeting
5/8/2020	File ISR Meeting Summary
6/7/2020	Stakeholders file disagreements with ISR Meeting Summary and/or requests for modified/new studies
7/7/2020	I&M files response to disagreements with ISR Meeting Summary and/or requests for modified/new studies
8/6/2020	FERC Director of the Office of Energy Projects makes a determination on disputes/amendments to the approved study plan
3/1/2021 – 9/30/2021	Conduct Second Year of Studies (if necessary)
4/14/2021	File Updated Study Report (USR), if necessary
4/23/2021	USR Report Meeting
5/8/2021	File USR Meeting Summary

Date	Milestone
5/3/2021	File Draft License Application (DLA)
8/1/2021	Comments on DLA Due
9/30/2021	File Final License Application

4 Notice of Intent to File Draft License Application

As required by 18 CFR § 5.16(c), I&M hereby advises the Commission of its intent to file a Draft License Application, which will include the contents of a license application, rather than a Preliminary Licensing Proposal. The draft license application will be filed no later than May 3, 2021.

5 Literature Cited

American Electric Power (AEP). 1991. 1990-1991 Studies of Fish Entrainment and St. Joseph River Fish Populations near the Constantine Hydroelectric Project, FERC Project 10661. [Online] URL: https://www.ferc.gov/docs-filing/elibrary.asp. Accessed December 10, 2019.

Bailey, RG. 1978. Descriptions of the EcoRegions of the United States. US Department of Agriculture. Forest Service, Intermtn Reg. Ogden, UT. 77pp.

Baxter, R. M. 1977. The environmental effects of dams and impoundments. Annual Review of Ecology and Systematics. 8:255-283.

Cardno. 2019. Stranded Fish and Mussel Survey Report Constantine Dam Head Race, St. Joseph River Drawdown St. Joseph County, Michigan May 13, 2019. Internal Report to American Electric Power.

Federal Energy Regulatory Commission (FERC). 1993. Environmental Assessment for the Constantine Hydroelectric Project FERC No. 10661. February 24, 1993.

FishXing Version 3.0 Beta, 2006. Swim Speed Table. 2006. [Online] URL: http://www.fsl.orst.edu/geowater/FX3/help/SwimData/Swim_Speed_Table.htm.

GeoEngineer. 2015. Sediment Quality Guidelines (SQGs): A Review and Their Use in Practice. https://www.geoengineer.org/education/web-class-projects/cee-549-geoenvironmental-engineering-fall-2015/assignments/sediment-quality-guidelines-sqgs-a-review-and-their-use-in-practice

Great Lakes Environmental Center (GLEC). 2019. Invasive Species Survey. Constantine Hydroelectric Project. AEP Indiana Michigan Power Company, 13840 E. Jefferson Rd., Mishawaka, IN 46545.

Haag, W. (2012). North American Freshwater Mussels. In North American Freshwater Mussels: Natural History, Ecology, and Conservation. Cambridge: Cambridge University Press.

Indiana Michigan Power Company (I&M). 1988. Constantine Hydroelectric Project. Application for License for a Minor Water Power Project.

Indiana Michigan Power Company (I&M). 2018. Pre-Application Document for the Constantine Hydroelectric Project FERC No. 10661. June 4, 2018.

Ingersoll, Christopher G., Wenning, Richard J. 2002. “Use of Sediment Quality Guidelines and Related Tools for the Assessment of Contaminated Sediments: Executive Summary of a SETAC Pellston Workshop”. Society of Environmental Toxicology and Chemistry.

Kost, M.A., D.A. Albert, J.G. Cohen, B.S. Slaughter, R.K. Schillo, C.R. Weber, and K.A. Chapman. 2007. Natural Communities of Michigan: Classification and Description. Michigan Natural Features Inventory, Report No. 2007-21, Lansing, MI.

Layzer J.B. and E.W. Scott. 2006. Restoration and Colonization of Freshwater Mussels and Fish in a Southeastern United States Tailwater. River Research and Applications. 22: 475–491.

Ligon F.K., W.E. Dietrich and W.J. Trush. 1995 Downstream ecological effects of dams. Bioscience 45, 183–92.

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. Arch. Environ. Contam. Toxicol. 39:20- 31.

McCauley DJ. 2019. Personal Communication. Email communication between Dennis McCauley of Great Lakes Environmental Center, Inc. (GLEC) and the Michigan DNR’s Fisheries Division, Southern Lake Michigan Management Unit, Brian Gunderman, Unit Manager. July 11, 2019.

Michigan Department of Natural Resources (MDNR). 1998. Saint Joseph River (Constantine) Water Survey. 6/22/1998 – 07/16/1998.

Neck, R.W. 1994. Status survey of Texas heelsplitter, Potamilus amphicaenus (Frierson, 1898). Unpublished report, Texas Parks and Wildlife Department, Resource Protection Division and Inland Fisher Division, Austin 47 pp.

Petts, G.E. 1980. Long-term consequences of upstream impoundments. Environmental Conservation &:325-332.

Shepherd, R. 1975. Inventory of Fish and Evaluation of Water Quality During Minimum Flow Period in the St. Joseph River. Michigan Dept. Nat. Resource, Tech. Rep. No. 75-9, 84 pp.

Ward, J.V and J.A. Stanford. 1987. The ecology of regulated streams; past accomplishments and directions for future research. Pages 391-409 in J.F. Craig and J.B. Kemper, editors. Regulated streams. Plenum Press, New York.

Watters, G.T. 1996. Small dams as barriers to freshwater mussels (Bivalvia, Unionoida) and their hosts. Biological Conservation 75:79-85.

Wesley, J.K. and J.E. Duffy. 1999. St. Joseph River Assessment. Michigan Department of Natural Resources Fisheries Division. Online [URL]:

https://quod.lib.umich.edu/cache/4/9/6/4968779.0001.001/00000001.tif.251.pdf#page=241;zoom=75 (Accessed October 18, 2017).

Wisconsin Department of Natural Resources (WDNR). 2003. “Consensus-Based Sediment Quality Guidelines: Recommendations for Use & Application.” Contaminated Sediment Standing Team.

Appendix A. ISR Meeting Agenda

Agenda

Project:	Constantine Hydroelectric Project (FERC No. 10661)
Subject:	Initial Study Report Meeting
Date:	Thursday, April 23, 2020
Location:	Webex (Virtual Meeting)

9:00 a.m. – 9:10 a.m.	**Welcome and Introduction**
9:10 a.m. – 9:50 a.m.	Botanical Resources Study
9:50 a.m. – 10:30 a.m.	Shoreline Stability Assessment
10:30 a.m. – 11:10 a.m.	Water Quality Study
11:10 a.m. – 11:20 a.m.	Break
11:20 a.m. – 12:00 p.m.	Fisheries Survey
12:00 p.m. – 12:40 p.m.	Mussel Survey
12:40 p.m. – 1:30 p.m.	Lunch
1:30 p.m. – 2:10 p.m.	Wetlands Study
2:10 p.m. – 2:50 p.m.	Recreation Study
2:50 p.m. – 3:30 p.m.	Cultural Resources Study
3:30 p.m. – 4:00 p.m.	**Discussion and Questions**

Appendix B. Botanical Resources Study

Botanical Resources Study Report

Constantine Project (FERC No. 10661)
March 31, 2020

Contents

Tables

Figures

1. Project Introduction and Background

Indiana Michigan Power Company (I&M), a unit of American Electric Power (AEP), is the Licensee, owner, and operator of the run-of-river, 1.2 megawatt Constantine Hydroelectric Project (Project) (FERC Project No. 10661). The Project is located along the St. Joseph River in the Village of Constantine in St. Joseph County, Michigan.

I&M operates and maintains the Project under a license from the Federal Energy Regulatory Commission (FERC or Commission). The Project's existing license expires on September 30, 2023. I&M is pursuing a subsequent license for the Project using the Commission's Integrated Licensing Process (ILP) as defined in 18 Code of Federal Regulations (CFR) Part 5.

In accordance with 18 CFR § 5.15, I&M has conducted studies as provided in the March 15, 2019 Revised Study Plan (RSP) and schedule approved in the Commission's April 9, 2019 Study Plan Determination (SPD) for the Project. This report describes the methods and results of the Botanical Resources Study conducted in support of preparing an application for a subsequent license for the Project.

Existing relevant and reasonably available information pertinent to the scope of the RSP including botanical resources in the Project area was included in the Pre-Application Document (PAD) (I&M 2018) Sections 5.5 Wildlife and Botanical Resources, 5.6 Wetlands, Littoral, and Riparian Habitat, and 5.7 Rare, Threatened and Endangered (RTE) Species. The Constantine reservoir lies within Southwest Michigan's Beech-Maple Association of Eastern Deciduous Forest Provence (Bailey 1978). Historic vegetation maps of the area (circa 1800) show the forest types as Mixed Hardwood Swamp, Oak-Hickory Forest, Black Oak Barrens, and Mixed Oak Savanna (Corner et al. 1995). Current vegetation in the general area is primarily floodplain forested, scrub/shrub and emergent wetlands (Kost et al. 2007). The area surrounding the Constantine reservoir is largely agricultural. Along its lower third, the reservoir is largely within pre-existing river banks and is bordered by a fringe of trees, while along the upper two-thirds of the reservoir the river often covers more extensive (up to 1,200 feet) widths of lowland areas (I&M 1988). Prior to this study, limited information was available regarding botanical resources in the Project area.

2. Study Goals and Objectives

In accordance with I&M's RSP and the Commission's SPD for the Project, the goal of the Botanical Resources Study was to document botanical resources within the Project boundary. The specific objectives of this study were as follows:

- Describe vegetation types within the Project boundary;
- Document historic and/or current presence of wild rice beds;
- Identify and map any RTE plant species, specifically the federally-threatened eastern prairie fringed orchid and the state-threatened water willow; and
- Document the presence, abundance, and location of invasive plant species.

3. Study Area

The study area for the Botanical Resources Study is the FERC Project boundary, defined by the Constantine Project boundary map as provided in Appendix C of the PAD. The ArcGIS shapefile P-10661 Project Boundary Data 05-13-2016 ('Project Boundary' in Figures 1, 2, and 3) was used to guide field investigations, conduct Geographic Information System (GIS) analyses, and create map figures for this report.

4. Methodology

Pursuant to the RSP, the Botanical Resources Study included a field survey and inventory of botanical resources within the Constantine Project boundary during the period from August 15 to September 18, 2019. The survey was undertaken by contractor botanist field biologist from the Constantine dam located at Race Street, north to the Constantine Road Bridge. The survey was completed using a combination of satellite image interpretation and the Meander Search technique to maximize coverage of habitats and the location of RTE and invasive species (Nelson, 1987). Field biologists surveyed for the target plant species of interest list provided in the RSP (Table 1). Additionally, field biologists documented other notable species within the Project boundary. Vegetation and land cover were mapped and classified using Global Positioning System (GPS) technology and satellite imagery in the field. A comprehensive plant inventory list (Table 2) was created in addition to the species of interest list prescribed by the RSP. Population locations of species of interest such as *Justicia americana* (American water willow), *Lythrum salicaria* (purple loosestrife), *Myriophyllum spicatum* (Eurasian watermilfoil), and *Cabomba caroliniana* (Carolina fanwort) were plotted in the field with a GPS device , converted into GIS features and included in report map figures describing Rare, Threatened or Endangered Species, Invasive Plant Species, and Vegetation and Land Cover.

4.1. Desktop Mapping of Vegetation

A series of three map themes were developed to organize and map the botanical survey field data into six GIS feature layers presented on three map deliverables:

- Rare, Threatened or Endangered Species Locations (Figure 1)
- Invasive Plant Species Locations (Figure 2)
- Vegetation and Land Cover (Figure 3)

Satellite imagery base maps were used both in the field and in post-survey GIS processing to reference field collected GPS data. Imagery used for field work was current streaming Google Earth imagery for the Project area, while post processing work and map production utilized current ESRI ArcGIS streaming base map imagery. RTE species field data were comprised of GPS point coordinates for American water willow that describe discrete locations (smaller area centroid) or larger extents using beginning and ending point coordinates (polylines with point ends) and are displayed in Figure 1.

For the invasive plant species map layers, the field botanist used maps from the 2018 Constantine Invasive Species Survey (Great Lakes Environmental Center [GLEC] 2018) to check and update the

extents of purple loosestrife and Eurasian watermilfoil (*Myriophyllum spicatum*), the principal invasive species found in the Project area. Field notes and drawings were applied to the 2018 loosestrife and watermilfoil polygons which were then updated post-survey in ArcMap. In addition to updating the extents of loosestrife and watermilfoil, one incidence of crispy pondweed (*Potamogeton crispus*) was plotted and mapped and polygons describing beds of Carolina fanwort were drawn in the field over Google Earth imagery and edited post-survey in ArcMap using streaming imagery as a reference layer. No other invasive species of interest were detected or mapped.

For the vegetation and land cover map layer, polygons for emergent wetlands, forested wetlands, floodplain forested, residential, and scrub/shrub wetland features were drawn in the field over Google Earth imagery and edited post-survey in ArcMap using streaming imagery as a reference layer.

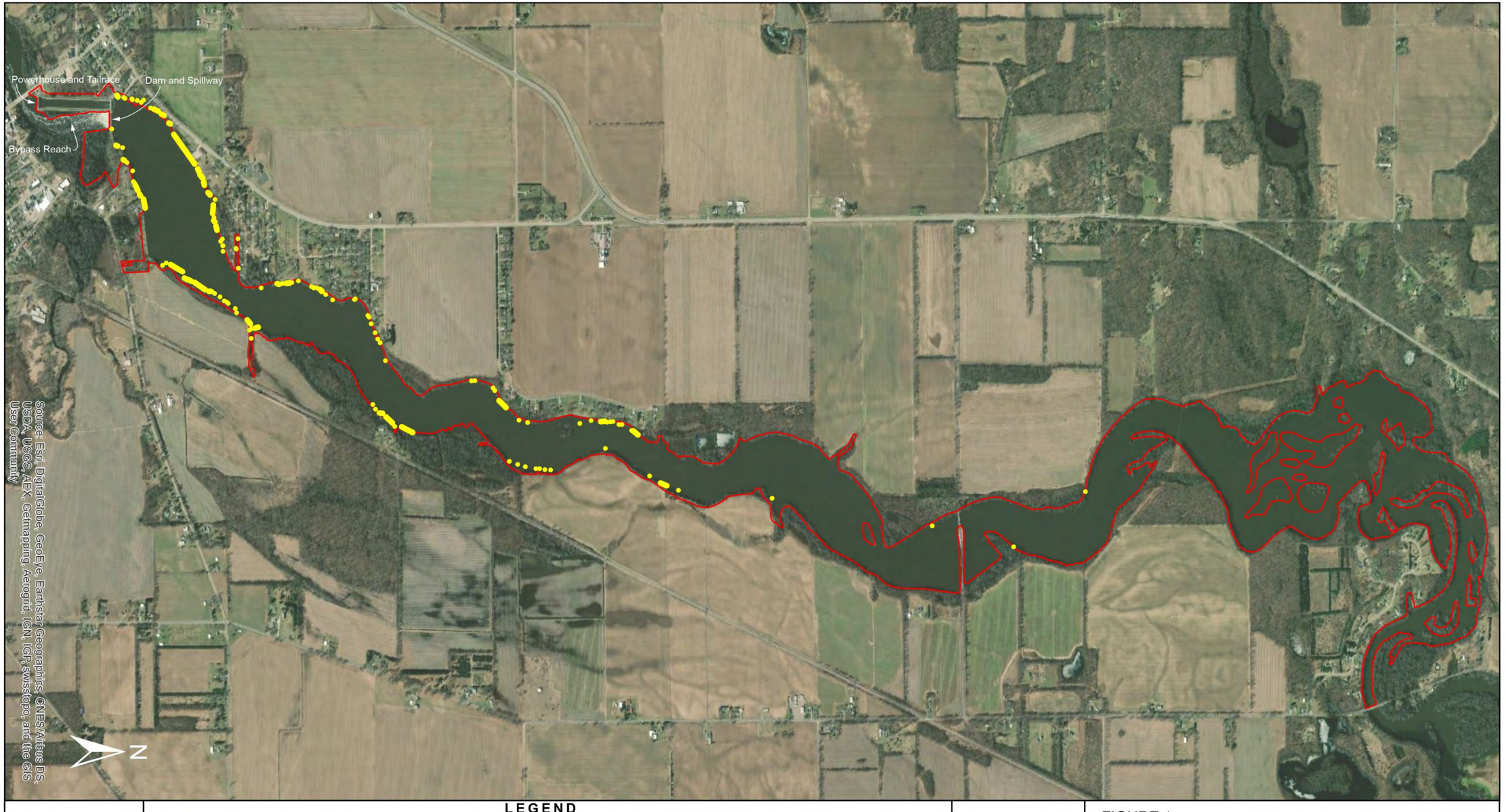


Figure 1. Rare, Threatened or Endangered Species Locations

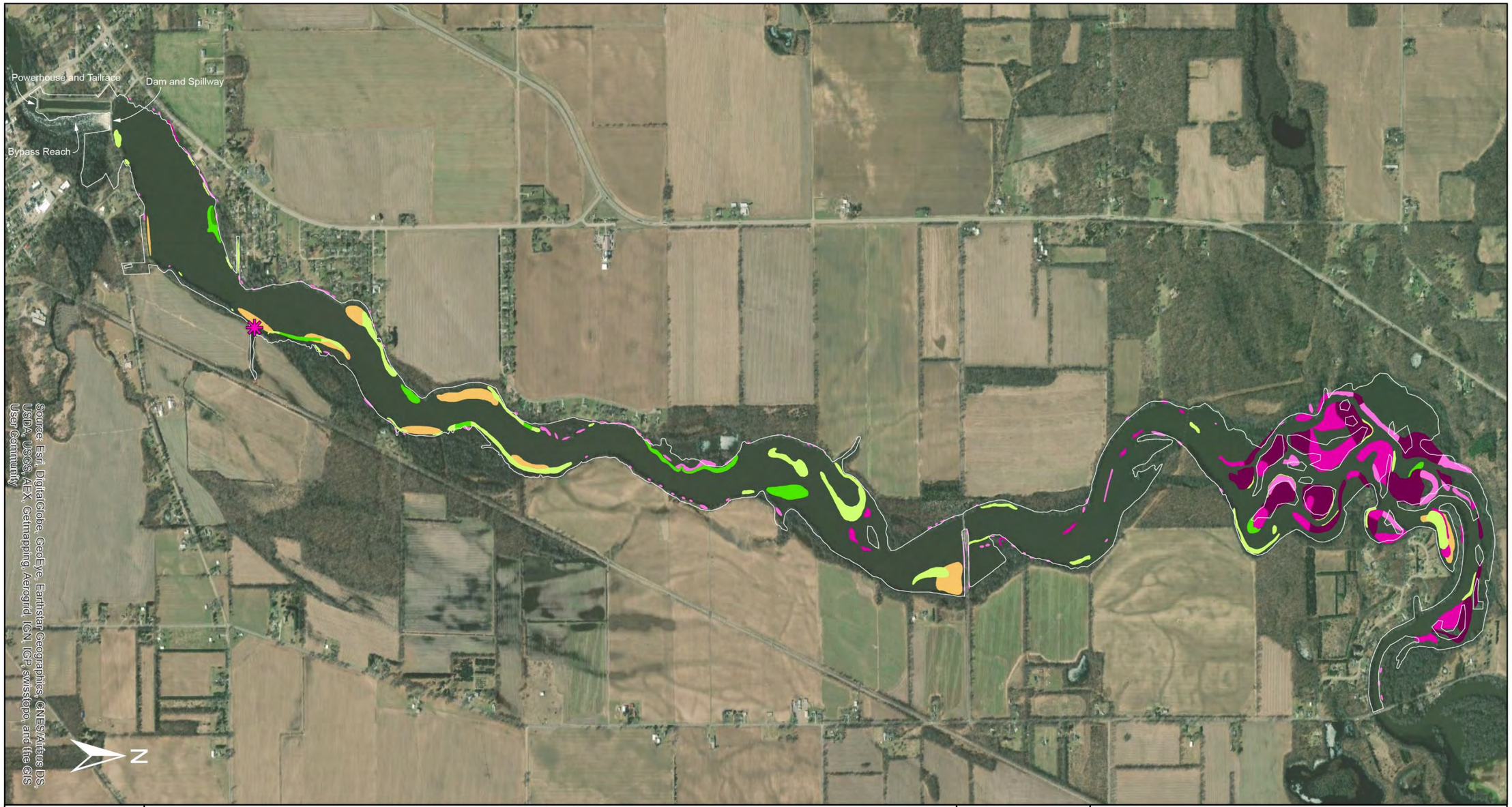


Figure 2. Invasive Plant Species Locations

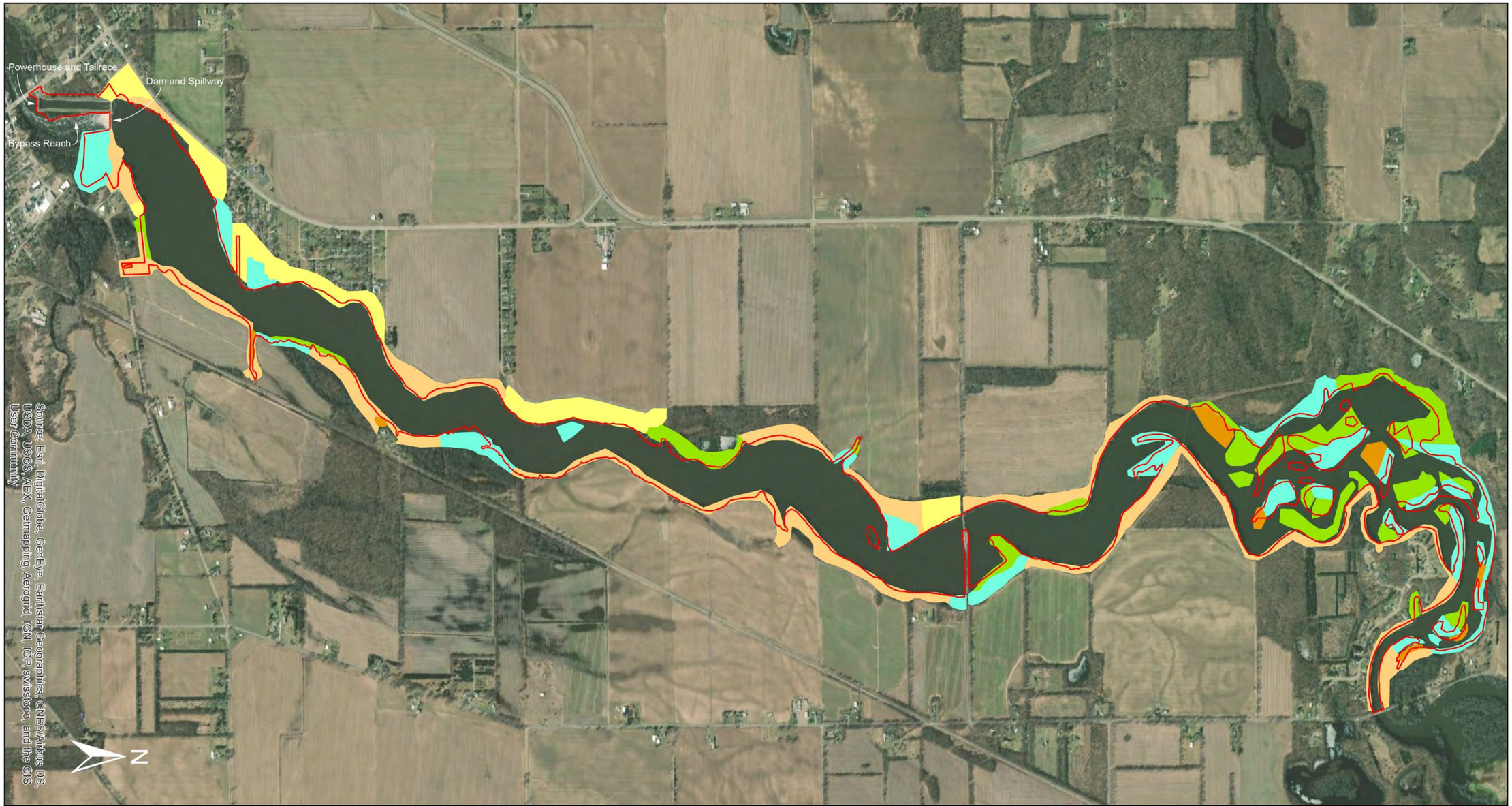


Figure 3. Vegetation and Land Cover

4.2.Develop Plant Species List

In consultation with resource agencies and stakeholders, a list of target plant species of interest to detect and map during the field survey was developed along with the characterization of other botanical resources (other species, vegetative cover, habitats and forest types). These species of interest were either invasive nuisance species or RTE species. The species of interest were provided in the RSP in Table 6.1 and are listed in Table 1 below along with their respective status.

Table 1. Plant Species of Interest

Common Name	Scientific Name	Status
Eastern Prairie Fringed Orchid	*Platanthera leucophaea*	Federally threatened
Water Willow	*Justicia americana*	State Threatened, S2 Rank
Purple Loosestrife	*Lythrum salicaria*	Non-native/Invasive
Eurasian Watermilfoil	*Myriophyllum spicatum*	Non-native/Invasive
Japanese Knotweed	*Fallopia japonica*	Non-native/Invasive
European Frogbit	*Hydrocharis morsus-ranae*	Non-native/Invasive
Starry Stonewort	*Nitellopsis obtusa*	
Curly-Leaf Pondweed	*Potamogeton crispus*	
Pond Water-Starwort	*Callitriche stagnalis*	
Common Reed	*Phragmites australis*	
Carolina Fanwort	*Cabomba caroliniana*	Non-native/Invasive

Survey findings regarding these species of interest are provided in Section 5.0 Study Results, along with survey results of an expanded list of all native, non-native and RTE species observed during the Botanical Resources Survey.

4.3.Survey for RTE and Invasive Plant Species and Field Verification of Vegetation Cover Types

The field botanist for the Project conducted field surveys in August and September of 2019 to document RTE and invasive plant species, based on the target species list provided in Table 1. RTE and invasive species were mapped using GPS coordinates to define discrete species population locations and to define the beginning and end points of larger population extents in the case of American water willow. For Carolina fanwort populations, polygons were drawn in the field using Google Earth imagery and density attributes was noted as “dense” for all fanwort beds. For purple loosestrife and Eurasian watermilfoil, 2018 Constantine Invasive Species Survey maps (GLEC 2018) were used as a reference to update population extents in the Project boundary. The special interest species list was checked during the survey. In addition to the special species list, the field botanist surveyed and recorded the presence of all species present in the Project boundary (see Table 2 in Section 5.0 Study Results)

The Botanical Resources Survey included general observations regarding habitat, vegetative cover, forest types, and land cover. Narrative descriptions and map polygons were created in the field to describe vegetation and land cover for the entire Project boundary area classified as either emergent wetlands, forested wetlands, floodplain forested, residential, or scrub/shrub wetlands.

Photographs of select species and shoreline habitats were taken per the RSP and are provided in Section 7.0. The RSP also required documenting the presence of any wild rice beds. No wild rice beds were identified within or adjacent to the Project boundary.

5. Study Results

5.1. General Description of Project Botanical Resources

Aquatic vegetation, occurring throughout the entirety of the reservoir, is dominated by coontail (*Ceratophyllum demersum*). Plant lists are associated with each polygon on the Vegetation and Land Cover map (Figure 3). Historic county data show that wild rice beds have existed in similar habitats as the Constantine reservoir within St. Joseph County in the past, however none were found during this survey (M.R. Penskar, et al. 2000).

Directly east of the Constantine dam lies a diverse mixed hardwood community, which drops into forested wetland to the south. The overstory of this hilly floodplain forest consists of three species of maple, with oak, basswood, cottonwood, elm, ash, walnut and northern catalpa (*Catalpa speciosa*) associates. The mid/understory is dominated by spice bush (*Lindera benzoin*) and buttonbush (*Cephalanthus occidentalis*), mixed with white mulberry (*Morus alba*), honeysuckle and black raspberry (*rubus occidentalis*). The understory dominants include Virginia wildrye (*Elymus virginicus*), asters, vervain, American germander (*Teucrium canadense*), bedstraw, New York fern (*Thelypteris noveboracensis*), sensitive fern (*Onoclea sensibilis*) and wild ginger (*Asarum canadense*). The low pockets of forested wetland in the southern portion have a similar overstory, with green ash (*Fraxinus pennsylvanica*), silver maple (*Acer saccharinum*), swamp white oak (*Quercus bicolor*) and black walnut (*Juglans nigra*) dominating. Understory species in this southern section including sensitive fern, interrupted fern (*Osmunda claytoniana*), southern blue flag (*Iris virginica*), false nettle (*Bohmeria cylindrical*) and meadow rue (*Thalictrum daisycarpum*). Small embedded scrub/shrub and emergent wetlands in this area are composed of buttonbush, southern blue flag, watercress, sensitive fern and Canada clearweed (*Pilea pumila*) (Figure 3).

The southern and mid-section of the Project area is a mixture of floodplain forested, residential, and small inlets of scrub/shrub and emergent wetlands**.** The majority of the reservoir is lined with broadleaf arrowhead (*Sagittaria latifolia*), which then transitions into green arrow arum (*Peltandra virginica*) in the northern sections of the reservoir. Lizard's tail (*Saururus cernuus*) and two species of *Persecaria (P. amphibia and P. hydropiperoides)* are also dominant along the reservoir shoreline. Offshore species, primarily in coves and inlets, include variegated pond-lily (*Nuphar variegata*) and American white waterlily (*Nymphaea odorata*), with some large sections of large-leaf cattail (*Typha latifolia*), and a few populations of narrow-leaf cattail (*Typha angustifolia*). Numerous populations of the state-threatened water willow line the southern and mid-section of the Project area of the reservoir (Figure 1). Nearshore aquatic species occur throughout the entirety of the reservoir. Primary aquatic species include coontail, Carolina fanwort, Eurasian watermilfoil, sago pondweed (*Stuckenia pectinata*), common waterweed (*Elodea canadensis),* tape-grass *(Vallisneria americana*), and pondweed (*Potamogeton berchtoldii*).

The northern reaches of the reservoir (north of Withers Road Bridge) are dominated by floodplain forested and forested wetland. Scrub/shrub wetlands and emergent wetlands are also present in this section of the reservoir. Silver maple and various species of willow dominate the canopy. The understory is primarily

buttonbush, swamp loosestrife (*Decodon verticillatus*) and purple loosestrife. The islands in the northern reaches are dominated by purple loosestrife (Figure 2).

No wild-rice (*Zizania aquatica*), beds were found within the Project boundary at the time of the survey. Additionally, the federally-threatened eastern prairie fringed orchid (*Platanthera leucophaea*) was also not observed during the assessment.

5.2.Species of Interest

***Justicia americana*, American water willow (State Threatened, S2 Rank)**

American water willow is a native willow of special concern in Michigan. Populations of the American water willow are located along both the eastern and western shorelines of the reservoir from the Constantine dam, northward approximately two-thirds of the length of the Project area. Populations begin to dwindle when purple loosestrife increases, in the northern reaches of the reservoir. All populations of *Justicia* were mapped using GPS technology (Figure 2).

***Cabomba caroliniana*, Carolina fanwort (Non-native/Invasive)**

Carolina fanwort is present throughout the length of the Project area in varying densities. This species is commonly associated with coontail and is present in dense populations along much of the shoreline. The largest populations were documented during the survey and shown in Figure 1.

***Lythrum salicaria*, Purple loosestrife (Non-native/Invasive)**

Purple loosestrife was documented at a total of 150 locations in the Constantine reservoir in 2019 (GLEC 2019). The majority of these infestations were characterized by a single plant or a few scattered plants. However, there were 29 documented instances of moderate purple loosestrife infestations and 16 heavy purple loosestrife infestations, characterized by nearly pure stands of purple loosestrife.

Historical purple loosestrife infestations in the Constantine reservoir indicate that light infestations consistently increased between 1998 and 2017, with a significant reduction in light infestations in 2018, and the number of light purple loosestrife infestations remained nearly constant between 2018 and 2019. Moderate infestations have remained relatively stable between 1998 and 2018, however in 2019 there were more moderate purple loosestrife infestations than observed during previous assessments (GLEC 2019).

Purple loosestrife populations in 2019 are similar to 2018 surveys and range from light/moderate in the southern reaches of the Project area to dense in the northern sections of the Project area, throughout the islands and shoreline (Figure 2).

***Myriophyllum spicatum*, Eurasian watermilfoil (Non-native/Invasive)**

A total of 49 Eurasian watermilfoil infestations were observed in the Constantine reservoir in 2019 (GLEC 2019). Most of these infestations were characterized by a single plant or a few scattered plants, but there were nine instances of moderate infestations and one instance characterized by dense plants crowding out native vegetation. Where not chocking out native vegetation, Eurasian watermilfoil was often mixed with coontail, pondweeds and Carolina fanwort.

Excluding year-to-year variability, light infestations of Eurasian watermilfoil in the Constantine reservoir have increased since 1998 (GLEC 2019). Eurasian watermilfoil populations were significantly larger than those found in 2018 than 2019, and span the length of the reservoir, increasing in density within the northern reaches of the reservoir (Figure 2).

***Zizania aquatica*, Southern wild-rice (State Threatened, S2S3 Rank)**

There was no presence of wild rice throughout the Project boundary. Historic county data show that wild rice beds may have been present in the area in the past (M.R. Penskar, et al. 2000).

***Potamogeton crispus*, Crispy pondweed (Non-native/Invasive)**

Crispy pondweed was found in one location along the southeastern shoreline on the reservoir (Figure 2). The presence of this invasive species may be more widespread throughout the reservoir, requiring further investigation.

5.3.Vegetation, Land Cover, Forest Types and Habitat Descriptions

Floodplain Forest:

Floodplain forest exists throughout the majority of the Project boundary. The overstory tree species composition changes slightly moving from the south to the northern reaches of the reservoir boundary, therefore this cover type is described in additional detail. Digital polygons of the cover type map have associated attribute data showing the dominant species in each region of floodplain forest (Figure 1). Much of this forest type's edge is lined with populations of the state-threatened American waterwillow.

East of the Constantine dam, the Floodplain forest canopy consists of a diverse overstory of various maples (*Acer saccharum, Acer saccharinum, and Acer negudo*), oak (*Quercus macrocarpa)*, basswood (*Tilia Americana),* cottonwood *(Populus deltioides),* elm *(Ulmus Americana), ash (Fraxinus americana, Fraxinus pennsylvanica),* hickory *(Carya ovata),* walnut *(Juglans nigra),* redbud (*Cercis canadensis)* and Catalpa *(Catalpa speciosa).* The mid and understory of this floodplain forest is dominated by the woody shrubs buttonbush, blackberry (*Rubus alleghaniensis)* and honeysuckle *(Lonicera spp.)* as well as mulberry. The understory/herbaceous layer is composed primarily of the following herbs, grasses and forbes: Virginia wildrye, aster (*Symphyotrichum lateriflorum),* vervain *(Verbena urticifolia), Missouri ironweed (Veronica missurica),* bedstraw *(Galium triflorum),* moneywort *(Lysimachia nummularia),* ferns *(Thelypteris noveboracensis*, *Osmunda claytoniana)*, ginger (*Asarum canadense*) and woodsorrel *(Oxalis dillenii).*

The southwestern shoreline of the Project area, is still dominated by oak species, as mapped circa 1800 as Mixed Oak Savanna (Corner et al. 1995). Canopy species include white oak (*Quercus alba),* bur oak *(Quercus macrocarpa),* red oak *(Quercus rubra)* and pin oak *(Quercus palustris).* Other canopy species include silver maple*,* elm *(Ulmus americana),* and willow *(Salix petiolaris).* The mid/understory of this floodplain forest is primarily composed of buttonbush*,* purple loosestrife, broadleaf arrowhead, lizard's tail and waterwillow.

The mid-section of the reservoir shoreline, up to the Withers Road Bridge, has a forest canopy dominated by silver maple*,* elm*, sycamore (Plantanus occidentalis), ash (Fraxinus americana, Fraxinus nigra), willow (Salix petiolaris, Salix nigra)* and black oak *(Quercus nigra),* with mulberry*, pin oak,* basswood *(Tilia americana),* walnut *(Juglans nigra*), hickory *(Carya cordiformis)* and sugar maple *(Acer saccharum*) intermixed*.* Occasional

red cedar *(Juniperus virginiana)* and honey locust (*Gleditsia triacanthos)* are also present along these sections. This floodplain forest mid/understory is dominated by broadleaf arrowhead, lizard's tail and waterwillow.

North of the Withers Road Bridge, the floodplain forest canopy is dominated by silver maple and willow (*Salix petiolaris, Salix nigra)*, merging into significant areas of forested wetland. Other canopy species include basswood (*Tilia americana),* mulberry*,* hickory *(Carya cordiformis),* cottonwood *(Populus deltoides), green and black* ash *(Fraxinus pennsylvanica and F. nigra),* elm *(Ulmus americana),* and honey locust*.* The mid-story/shrub layer of this section is primarily rose (*Rosa multiflora),* privit *(Ligustrum vulgare),* buttonbush and loosestrife *(Lythrum salicaria, Decodon verticilatus).* Understory species include false nettle*,* riverbank grape *(Vitis riparia),* avens *(Geum canadense), wild yam (Dioscorea villosa),* black currant *(Ribes americanum),* cardinal flower *(Lobelia cardinalis),* aster *(Symphyotrichum lateriflora),* Virginia wildrye and bluegrass (*Poa compressa).*

Forested Wetland:

Forested wetland areas within the Project boundary have a canopy dominated primarily by silver maple and willow trees *(Salix nigra*). Other canopy dominants are green ash*,* elm and red oak*,* with Tulip tree *(Liriodendron tulipifera)* and alder (*Alnus incana*) also common. The woody shrub/mid-story layer is composed of willow (*Salix petiolaris*), dogwoods (*Cornus racemosa, C. foemina),* buttonbush, spicebush *(Lindera benzoin*), and loosestrife (*Lythrum salicaria, Decodon verticillatus*). Understory plants include southern blue flag, water parsnip *(Sium suave), meadow rue*, crowfoot *(Ranunculus flabellaris)* and sensitive fern and multiple sedge and grass species *(Carex gracilima, Carex vulpinoidea, Carex gracilima, Cyperus strigosus, Leersia virginica).* Low pockets of forested wetland in the south near the dam include canopy species of pin oak and black walnut*,* whereas forested wetland in the northern reaches of the Project boundary are primarily silver maple, willow and ash dominated.

Scrub/Shrub Wetland:

Scrub/shrub wetlands are dominant in the northern reaches of the Project boundary and less common to the south. These wetlands are composed of buttonbush*,* loosestrife (*Decodon verticillatus, Lythrum salicaria),* willow *(Salix petiolaris and Salix sericea),* with understory plants of smartweed *(Persicaria amphibia),* water-pepper *(Persicaria hydropiperoides)*, southern blue flag*,* watercress *(Nasturtium officinale),* sensitive fern and clearweed *(Pilia pumila).* Grasses and sedges are dominated by Virginia wildrye with sedges*, Carex gracilima* and *C. vulpinoidea.*

Emergent Wetland:

Emergent wetlands occur within pockets of forested wetland, inside of reservoir inlets, and along much of the northern shoreline of the Project boundary. Some of these areas to the north are being overtaken by purple loosestrife. The majority of the reservoir is lined with broadleaf arrowhead, which then transitions into green arrow arum in the northern sections of the reservoir. Dominant species of emergent wetlands include cattail (*Typha latifolia* (with some small pockets of *Typha angustifolia*)*,* arrowhead*,* green arrow arum*,* smartweed *(Persicaria amphibia),* water-pepper*,* jewelweed *(Impatiens capensis*), false nettle*,* pickerelweed *(Pontedaria cordata),* variegated pond-lily *(Nuphar variegate),* American white waterlily *(Nymphaea odorata*), lizard's tail*,* and Virginia wildrye*.*

Less common species include sensitive fern *(Onoclea sensibilis),* water parsnip *(Sium suave),* goldenrod *(Solidago rugosa),* aster *(Symphyotrichium puniceum),* nightshade *(Solanum dulcmara),* clearweed *(Pilea pumila),* watercress *(Nasturtium officinale),* southern blue flag*,* meadow rue*, and* duckweed *(Lemna trisulcata).*

Aquatic Vegetation:

Nearshore submerged/aquatic species occur throughout the entirety of the reservoir. Coontail occurs throughout the entire reservoir in high densities. This is followed by fanwort, which is very common. Highest densities of this non-native invasive species are mapped (Figure 2). Eurasian watermilfoil, is fairly common within the Project boundary (Figure 2). Other common aquatic species include pondweed (*Potamogeton berchtoldii, Stuckenia pectinate)*, common waterweed (*Elodea canadensis),* and tape-grass*.* Crispy pondweed*,* also a non-native invasive species, was found in one location within the reservoir and but would require intensive further investigation to map its full extent.

Residential:

Residential areas throughout the Project boundary are mostly partially forested, but some of these areas have been cleared into manicured lawns. Canopy trees include cottonwood (*Populus deltoides*), maples (*Acer saccharum, Acer saccharinum*) and willow (*Salix nigra*). The shrub/mid-story layer is a mixture of native and non-native plants, including purple loosestrife, multiflora rose (*Rosa multiflora*) and dogwood (*Cornus sericia*). The herbaceous layer is made up of American water willow, Joe-pye weed *(Eutrochium maculatum),* lizard's tail*,* goldenrod*,* riverbank grape *(Vitis riparia), Bidens trichosperma,* jewelweed *(Impatiens capensis),* mint *(Mentha canadensis),* milkweed *(Asclepias syriaca),* false nettle*,* moneywort *(Lysimachia nummularia)* and Virginia wildrye*,* shining flat-sedge *(Cyperus bipartitus)* and white beaks-edge *(Rhynchospora alba).* Common dodder *(Cuscuta gronovii)* was also found growing amongst much of the American water willow.

Table 2. List of Species at Constantine Reservoir, August-September 2019

Scientific Name	Common Name	Status
Abutilon theophrasti	Velvetleaf	Non-native
Acalypha rhomboidea	Common copperleaf	Native
Acer negundo	Boxelder maple	Native
Acer saccharinum	Silver maple	Native
Acer saccharum	Sugar maple	Native
Alnus incana	Speckled alder	Native
Ambrosia artemisiifolia	Common ragweed	Native
Amphicarpaea bracteata	Hog peanut	Native
Asarum canadense	Canadian wild ginger	Native
Asclepias incarnata	Swamp milkweed	Native
Asclepias syriaca	Common milkweed	Native
Asimina triloba	Common pawpaw	Native
Asplenium platyneuron	Ebony spleenwort	Native
Bidens cernua	Nodding beggarticks	Native
Bidens frondosa	Devil's beggarticks	Native
Bidens trichosperma	Marsh Tickseed	Native
Boehmeria cylindrica	False nettle	Native
Cabomba caroliniana	Carolina fanwort	Non-native
Carex gracillima	Sedge	Native
Carex vulpinoidea	Fox sedge	Native
Carya glabra	Pignut hickory	Native
Carya cordiformis	Bitternut hickory	Native

Scientific Name	Common Name	Status
Catalpa speciosa	Northern catalpa	Non-native
Celastrus orbiculatus	Oriental bittersweet	Non-native
Cephalanthus occidentalis	Buttonbush	Native
Ceratophyllum demersum	Coontail	Native
Cercis canadensis	Eastern redbud	Native
Cicuta bulbifera	Water hemlock	Native
Cicuta maculata	Water hemlock	Native
Clematis virginica	Virgin's bower	Native
Cornus amomum	Silky dogwood	Native
Cornus foemina	Gray dogwood	Native
Cornus sericea	Red osier dogwood	Native
Cuscuta gronovii	Common dodder	Native
Cyperus bipartitus	Shining flatsedge	Native
Cyperus strigosus	Long scaled nut sedge	Native
Decodon verticillatus	Swamp loosestrife	Native
Dioscorea villosa	Wild yam	Native
Elaeagnus umbellata	Autumn olive	Non-native
Elodea canadensis	Common waterweed	Native
Elymus virginicus	Virginia wildrye	Native
Equisetum arvense	Field horsetail	Native
Erigeron annuus	Annual fleabane	Native
Erigeron strigosus	Daisy fleabane	Native
Eutrochium maculatum	Spotted Joe-pye weed	Native
Fraxinus americana	White ash	Native
Fraxinus nigra	Black ash	Native
Fraxinus pennsylvanica	Green ash	Native
Galium triflorum	Fragrant bedstraw	Native
Geum canadense	White avens	Native
Glechoma hederacea	Ground-ivy	Non-native
Gleditsia triacanthos	Honey locust	Native
Hesperis matronalis	Dame's rocket	Non-native
Hydrocotyle americana	American Water-pennywort	Native
Hypericum ascyron	Great St. John's wort	Native
Impatiens capensis	Common jewelweed	Native
Iris virginica	Southern blue flag	Native
Juniperus virginiana	Red-cedar	Native
Juglans nigra	Eastern black walnut	Native
Justicia americana	American water willow	Native, S2
Leersia oryzoides	Cut grass	Native
Leersia virginica	White grass	Native
Lemna turionifera	Red duckweed	Native
Ligustrum vulgare	Common privet	Non-native
Lindera benzoin	Northern spicebush	Native
Liriodendron tulipifera	Tulip tree	Native
Lobelia cardinalis	Cardinal flower	Native

Scientific Name	Common Name	Status
Lobelia siphilitica	Great blue lobelia	Native
Lonicera maackii	Amur honeysuckle	Non-native
Lonicera spp.	Honeysuckle	*
Lycopus americanus	Common water horehound	Native
Lysimachia ciliata	Fringed loosestrife	Native
Lysimachia nummularia	Moneywort	Non-native
Lythrum salicaria	Purple loosestrife	Non-native
Lysimachia thyrsiflora	Tufted loosestrife	Native
Melilotus officinalis	Yellow sweet clover	Non-native
Mentha canadensis	American corn mint	Native
Morus alba	White mulberry	Non-native
Myosotis scorpioides	Forget-me-not	Non-native
Myriophyllum spicatum	Eurasian watermilfoil	Non-native
Nasturtium officinale	Watercress	Native
Nuphar variegata	Variegated pond-lily	Native
Nymphaea odorata	American white waterlily	Native
Oenothera biennis	Common evening-primrose	Native
Onoclea sensibilis	Sensitive fern	Native
Osmunda claytonii	Interrupted fern	Native
Oxalis dillenii	Common yellow wood sorrel	Native
Peltandra virginica	Green arrow arum	Native
Persicaria hydropiperoides	Water-pepper	Native
Persicaria amphibia	Water smartweed	Native
Persicaria robustior	Stout smartweed	Native
Persicaria sagittata	Arrow-leaved tearthumb	Native
Persicaria virginiana	American jumpseed	Native
Phalaris arundinaceae	Reed canary grass	Non-native
Physostegia virginiana	False dragonhead	Native
Phytolacca americana	American pokeweed	Native
Pilea pumila	Canada clearweed	Native
Platanus occidentalis	American sycamore	Native
Poa compressa	Canada bluegrass	Non-native
Poa spp.	Meadow-grass	*
Podophyllum peltatum	Mayapple	Native
Polystichum acrostichoides	Christmas fern	Native
Pontederia cordata	Pickerelweed	Native
Populus deltoides	Eastern cottonwood	Native
Populus grandidentata	Bigtooth aspen	Native
Potamogeton berchtoldii	Pondweed	Native
Potamogeton crispus	Crispy pondweed	Non-native
Quercus alba	White oak	Native
Quercus bicolor	Swamp white oak	Native
Quercus macrocarpa	Bur oak	Native
Quercus palustris	Pin oak	Native
Quercus rubra	Northern red oak	Native

Scientific Name	Common Name	Status
Quercus velutina	Black oak	Native
Ranunculus flabellaris	Yellow water crowfoot	Native
Rhynchospora alba	White beak-sedge	Native
Ribes americanum	Wild black currant	Native
Ribes cynosbati	Prickly gooseberry	Native
Robinia spp.	Locust	Non-native
Rosa multiflora	Multiflora rose	Non-native
Rubus occidentalis	Black raspberry	Native
Rumex obtusifolius	Broad-leaved dock	Non-native
Rumex verticillatus	Swamp dock	Native
Sagittaria latifolia	Broadleaf arrowhead	Native
Salix sericea	Silky willow	Native
Salix petiolaris	Slender willow	Native
Salix nigra	Black willow	Native
Sambucus canadensis	American black elderberry	Native
Sanicula trifoliata	Black snakeroot	Native
Sassafras albidum	Sassafras	Native
Saururus cernuus	Lizard's tail	Native
Scutellaria lateriflora	Side-flowering skullcap	Native
Sium suave	Water parsnip	Native
Smilax ecirrata	Upright carrion flower	Native
Solanum dulcamara	Bittersweet nightshade	Non-native
Solidago rugosa	Rough-leaved goldenrod	Native
Sparganium spp.	Bur-reed	Native
Stachys tenufolia	Smooth hedgenettle	Native
Stuckenia pectinata	Sago pondweed	Native
Symphyotrichum lateriflorum	Calico aster	Native
Symphyotrichum puniceum	Swamp aster	Native
Symplocarpus foetidus	Eastern skunk cabbage	Native
Teucrium canadense	American germander	Native
Thalictrum dasycarpum	Purple meadow rue	Native
Thelypteris noveboracensis	New York fern	Native
Tilia americana	Basswood	Native
Toxicodendron vernix	Poison sumac	Native
Toxicodendron radicans	Poison ivy	Native
Typha angustifolia	Narrow-leaved cattail	Non-native
Typha latifolia	Broadleaf cattail	Native
Ulmus americana	American elm	Native
Ulmus pumila	Siberian elm	Non-native
Urtica dioica	Stinging nettle	Native
Vallisneria americana	Tape-grass	Native
Verbena hastata	Blue vervain	Native
Verbena urticifolia	White vervain	Native
Vernonia missurica	Missouri ironweed	Native
Viburnum lentago	Nannyberry	Native

Scientific Name	Common Name	Status
Viola spp.	Violet	*
Vitis riparia	Riverbank grape	Native

*Not enough material for ID

6. Summary and Discussion

The botanical resources of the Constantine Hydroelectric Project boundary were inventoried in August and September 2019. Specific attention was given to the discovery of state and federal RTE species, such as wild rice, water willow and eastern prairie fringed orchid, as well as the presence and abundance of invasive plant species, such as, Eurasian watermilfoil, purple loosestrife, Carolina fanwort and crispy pondweed.

Principal habitat types were described as a result of the inventory and consisted primarily of a mixture of floodplain forested communities, residential areas and scrub/shrub and emergent wetlands.

Results were compared to historical inventories from the Michigan Natural Features Inventory, previous assessments and historical (pre-reservoir) maps. Notable differences were noted between the southern, midsection and northern reaches of the Project. A diverse community of a total of 159 native and non-native plant species were identified in the 2019 assessment (Table 2). American water willow was documented during the inventory, whereas other RTE plants species (i.e., wild rice and eastern prairie fringed orchid) were absent from the Project boundary.

Twenty-three non-native plants were discovered in the inventory, including Iberian elm, narrow leaf cattail, bittersweet nightshade, broad-leaved dock, multiflora rose, locust, crispy pondweed, Canada bluegrass, reed canary grass, Eurasian watermilfoil, forget-me-not, white mulberry, yellow sweet clover, purple loosestrife, moneywort, amur honey suckle, common pivet, Dame's rocket, ground ivy, autumn olive, oriental bittersweet, northern catalpa, Carolina fanwort and velvet leaf. The Constantine PAD outlined four species; Carolina fanwort, purple loosestrife, Eurasian watermilfoil, and crispy pondweed from the above list as non-native, special concern species. Locations of these invasive plants were recorded in the field during the Botanical Resources Survey and referenced 2019 map data from the annual Constantine Invasive Species Survey conducted by GLEC for I&M (GLEC 2019). The locations of these invasive plant species are presented in Figure 2. The remaining non-native/invasive species of concern were found to be much less abundant.

Purple loosestrife abundance was noted as a specific threat to the existing wetlands, particularly in the northern sections of the Project boundary. Eurasian watermilfoil was also noted as becoming more abundant than previously noted in the other assessments. Both purple loosestrife and Eurasian watermilfoil have the greatest potential to significantly alter the native habitats in the wetland and off-shore aquatic communities in the Project area.

Based on this assessment and the annual invasive species assessments, it continues to appear that in general, the light and heavy infestations within the Project boundary continue to increase including the Eurasian watermilfoil. The overall assessment of the botanical resources at the Constantine Project remains similar to that described in the PAD and the 1993 assessment (FERC 1993).

6.1. Variances from FERC-Approved Study Plan

The actual Botanical Resources Survey and study methods applied some interpretations of and minor variances from the method details outlined in Section 6 Botanical Resources Study of the March 15, 2019 RSP. Under Task 6.6.1 Desktop Mapping of Vegetation, the RSP indicates that I&M "will obtain high-resolution aerial imagery to characterize the vegetation in the Project area, to the extent practical." For this study, the research biologists and GIS specialists utilized standard satellite imagery provided by Google Earth and ESRI ArcMap streaming services for feature interpretation. No other "special" high resolution imagery was obtained or utilized for the study.

Existing information regarding botanical resources in the Project area, presented in Section 5.5 of the PAD, classifies the vegetation as a "mixed hardwood community of predominantly oak, with some ash, beech, hickory, maple, cottonwood, and aspen" and falling within the Beech-Maple Association of Eastern Deciduous Forest (I&M 1988, Bailey 1978). For this study, the classification and description scheme developed by the Michigan Natural Features Inventory was used to update and further expound upon the forest cover types (Kost et al. 2007). Preliminary descriptions of the Project area state that along its lower third, the reservoir is largely within pre-existing river banks and is bordered by a fringe of trees, while along the upper two-thirds of the reservoir the river often covers more extensive (up to 1,200 feet) widths of lowland areas (I&M 1988). Upon the completion of Meander surveys and a full species list, this study determined that this fringe of trees within the lower third, to half, of the reservoir is more specifically classified as floodplain forest and the lowland areas within the upper reaches of the reservoir are primarily forested and emergent wetlands, dominated by willow *(Salix spp.)* and silver maple trees (Figure 3).

7. Botanical Survey Photographs

Scrub-shrub islands in the northern reaches, typically lined with bull lily, American white lily, and green arrow arum (*Peltandra virginica*)

Dense fanwort population

Water-willow in residential area

Typical size water-willow population

Shoreline showing coontail in water, water-willow along shoreline, floodplain forest on banks

Bull lily nearshore with scrub-shrub wetland along shoreline

Water-willow and lizard's tail - common throughout the southern reaches of the reservoir

Aquatic coontail - found throughout the entirety of the reservoir

Pocket of emergent wetland along southeast project boundary

One of many small inlets along shoreline

Justica americana - American water-willow

Justica americana - American water-willow

Justica americana - American water-willow

8. References

Bailey, RG. 1978. Descriptions of the EcoRegions of the United States. US Department of Agriculture. Forest Service, Intermtn Reg. Ogden, UT. 77pp.

Corner, P.J., D.A. Albert, H.A. Wells, B.L. Hart, J.B. Raab, D.L. Price, D.M. Kashian, R.A. Corner, D.W. Schuen (Map Interpretation). M.B. Austin, T.R. Leibfreid, K.M. Korroch, L. Prange-Gregory, J.G. Spitzley, C.J. DeLain, L.J. Scrimger (Digital Map Production). 1995. Michigan Presettlement Vegetation, as interpreted from the General Land Office Surveys 1816-1856. Michigan Natural Features Inventory, Lansing, MI.

Federal Energy Regulatory Commission (FERC). 1993. Environmental Assessment for the Constantine Hydroelectric Project FERC No. 10661. February 24, 1993

GLEC. 2018. Invasive Species Survey. Constantine Hydroelectric Project. AEP Indiana Michigan Power Company, 13840 E. Jefferson Rd., Mishawaka, IN 46545.

GLEC. 2019. Invasive Species Survey. Constantine Hydroelectric Project. AEP Indiana Michigan Power Company, 13840 E. Jefferson Rd., Mishawaka, IN 46545.

Indiana Michigan Power Company (I&M). 2018. Constantine Hydroelectric Project (FERC No. 10661). Notice of Intent and Pre-Application Document. Federal Energy Regulatory Commission, Washington, D.C. June 4, 2018.

Indiana Michigan Power Company (I&M). 1988. Constantine Hydroelectric Project. Application for License for a Minor Water Power Project.

Kost, M.A., D.A. Albert, J.G. Cohen, B.S. Slaughter, R.K. Schillo, C.R. Weber, and K.A. Chapman. 2007. Natural Communities of Michigan: Classification and Description. Michigan Natural Features Inventory, Report No. 2007-21, Lansing, MI.

M.R. Penskar, E.R.G. Choberka, and P.J. Higman. 2000. Special Plant Abstract for *Zizania aquatica* (Southern wild-rice). Michigan Natural Features Inventory. Lansing, MI. 2pp.

Nelson, J.R. 1987. Rare plant surveys: techniques for impact assessment. In: T.S. Elias (ed.), Conservation and management of rare and endangered plants, pp. 159-166. Sacramento, California.

Appendix C. Shoreline Stability Assessment

Shoreline Stability Assessment Report

Constantine Project (FERC No. 10661)
March 31, 2020

Contents

Tables

Figures

Appendices

1. Project Introduction and Background

Indiana Michigan Power Company (I&M), a unit of American Electric Power (AEP), is the Licensee, owner, and operator of the run-of-river, 1.2 megawatt Constantine Hydroelectric Project (Project) (FERC No. 10661). The Project is located along the St. Joseph River in the Village of Constantine in St. Joseph County, Michigan.

I&M operates and maintains the Project under a license from the Federal Energy Regulatory Commission (FERC or Commission). The Project's existing license expires on September 30, 2023. I&M is pursuing a subsequent license for the Project using the Commission's Integrated Licensing Process (ILP) as defined in 18 Code of Federal Regulations (CFR) Part 5.

In accordance with 18 CFR § 5.15, I&M has conducted studies as provided in the March 15, 2019 Revised Study Plan (RSP) and schedule approved in the Commission's April 9, 2019 Study Plan Determination (SPD) for the Project. This report describes the methods and results of the Shoreline Stability Assessment Study conducted in support of preparing an application for a subsequent license for the Project.

During the preparation of the Pre-Application Document (PAD), I&M proposed to conduct a Shoreline Stability Assessment Study at the Project to identify sites of erosion or shoreline instability. Comments on the PAD were received from Michigan Department of Natural Resources (MDNR) related to geology and soil resources, specifically related to potential erosion as a result of Project operations. In their comments on the November 16, 2018 Proposed Study Plan (PSP), FERC suggested additional requirements for the study, which have been incorporated into Section 7.6.2 of the RSP and performed as part of the 2019 study.

Shoreline erosion is a common concern at hydroelectric projects. While the Project's run-of-river mode of operation provides protection against erosion, I&M recognizes that aspects of the Project's geological setting may contribute to the potential for shoreline erosion. Additionally, private shoreline activities may also contribute to shoreline erosion and instability.

2. Study Goals and Objectives

In accordance with I&M's RSP and the Commission's SPD for the Project, the goal of the Shoreline Stability Assessment Study was to identify sites of erosion and shoreline stability in the Project area. The specific objectives of this study were as follows:

- Survey the Project's reservoir, bypass reach and tailrace area to characterize the shoreline, with the focus on erosion or shoreline instability;
- Inventory, map, and document any areas of erosion or shoreline instability;
- Develop a scoring system to identify areas that have a potential to erode at unnaturally high rates; and
- Prioritize any areas where remedial action or further assessment may be needed.

3. Study Area

The study area for the Shoreline Stability Assessment Study is the Project's reservoir, from the Constantine Road bridge downstream to the dam, bypass reach and tailrace area downstream of the powerhouse to the Business Route 131 Bridge (Figure 1). The reservoir embankment is approximately 650 feet long. The dike has a maximum height of approximately 20 feet and is constructed of sand. In 2014, the top of the embankment was raised to elevation 790. The downstream side of the embankment was reshaped to the present slope in 1987 and 2004. In 2004, sheet piles were installed on the downstream right end of the embankment (the length of the line of sheeting was 150 feet). The side slopes are about 2:1, horizontal to vertical (estimated in the field) on the upstream side and 2:1, horizontal to vertical, to nearly flat (flush with native ground) on the downstream side (I&M 2018).

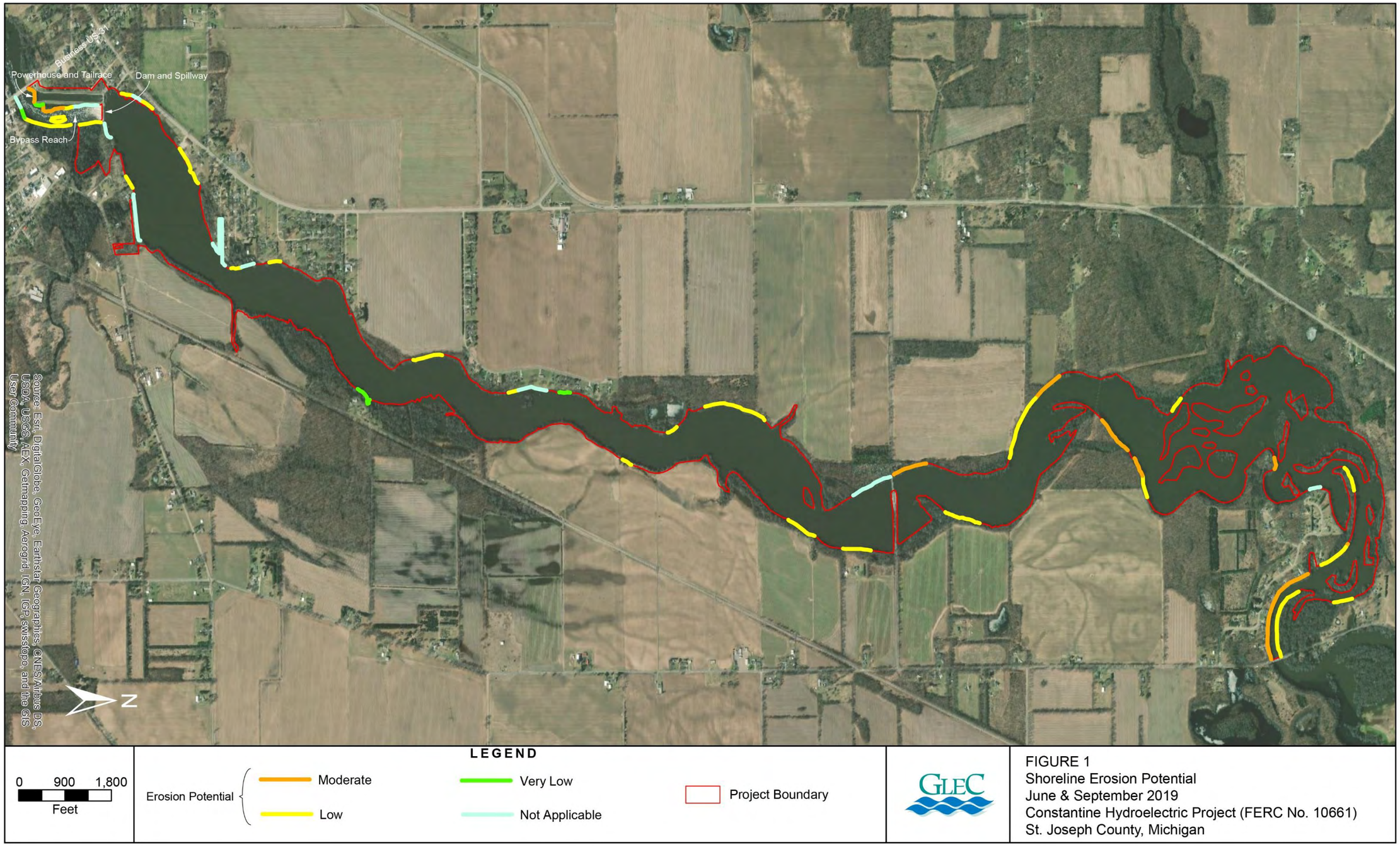


Figure 1. Shoreline Erosion Potential

4. Methodology

4.1. Literature Review

Great Lakes Environmental Center (GLEC) reviewed existing information on soils in the study area including soil survey maps and geologic maps as provided in Pre-Application Document (PAD) (I&M 2018) in Sections 5.2 Geology and 5.6 Wetlands, Littoral, and Riparian Habitat as well as the USDA soil survey of St. Joseph County (United States Department of Agriculture [USDA] 1983). Existing information was combined with information collected through field observations and field measurements to assess bank composition and erosion potential in the Project study area.

4.2. Shoreline Survey

Field surveys were conducted on June 2-4 and September 24-27, 2019 to characterize the shoreline of the Project's reservoir from the Constantine Road Bridge downstream to the US 131 Business Route Bridge in Constantine, Michigan. GLEC conducted the shoreline survey when the St. Joseph River was at a normal flow rate for June and September. Additionally, GLEC obtained hourly flow data from the U.S. Geological Survey (USGS) gage on the St. Joseph River at Mottville, Michigan (gage no. 04099000) (Appendix C) and a record of the daily maximum and minimum water surface elevations in the Constantine reservoir during the shoreline survey.

GLEC used the modified Bank Erosion Hazard Index (BEHI) method proposed by David Rosgen (Rosgen 2001) as the Standard Operating Procedure for assessing bank erosion and estimating erosion potential at the Project (Appendix A). For each area assessed, observations of vegetative cover, quantity of material, height, and slope of bank, existing erosion control mechanisms, soil or rock type, composition, and thickness of various bank materials or strata, and other relevant data were recorded on standardized field forms (Appendix B). Other factors contributing to bank erosion in the study area were identified and recorded. A Global Positioning System (GPS) was used to locate each of the assessed areas and representative photographs were taken at each location and are provided as figures in Section 7 of this report. A thematic map describing the erosion potential of the assessed areas is provided in Figure 1.

4.2.1. Modified Bank Erosion Hazard Index

The modified BEHI procedure consists of four observational metrics. A brief description of each metric is provided below. Point values for these metrics (Table 1) were assigned after a sufficient length of the river channel was examined (at least 200 feet), so that representative conditions were identified. Conditions on both banks were assessed, and scored independently.

Table 1. Metric Scores for the Modified BEHI used for the 2019 AEP Constantine Hydroelectric Project Shoreline Stability Study.

BEHI Category	Root Depth Values	Root Depth Scores	Root Density (%)	Root Density Scores	Surface Protection (Avg. %)	Surface Protection Scores	Bank Angle (degrees)	Bank Angle Scores	Total Score, by Category
Very low	90-100	1.45	80-100	1.45	80-100	1.45	0-20	1.45	**≤ 5.8**
Low	50-89	2.95	55-79	2.95	55-79	2.95	21-60	2.95	**5.8 – 11.8**
Moderate	30-49	4.95	30-54	4.95	30-54	4.95	61-80	4.95	**11.9 – 19.8**
High	15-29	6.95	15-29	6.95	15-29	6.95	81-90	6.95	**19.9 – 27.8**
Very high	5-14	8.5	5-14	8.5	10-14	8.5	91-119	8.5	**27.9 – 34.0**
Extreme	< 5	10	< 5	10	< 10	10	> 119	10	**34.1 – 40**

Ratio of root depth to bank height. Root depth is the ratio of the average plant root depth to the bank height, expressed as a percent (e.g., roots extending 2' into a 4' tall bank = 0.50).

Root density. Root density, expressed as a percent, is the proportion of the stream bank surface covered (and protected) by plant roots (e.g., a bank whose slope is half covered with roots = 50%).

Surface protection. Surface protection is the percentage of the stream bank covered (and therefore protected) by plant roots, downed logs and branches, rocks, etc. In many streams in southern Michigan, surface protection and root density are synonymous.

Bank angle. Bank angle is the angle of the bank from the waterline at base flow to the top of the bank, as opposed to benches that are higher on the floodplain. Bank angles greater than 90 degrees occur on undercut banks. Bank angle can be measured with a clinometer, though given the broad bank angle categories (Table 1), visual estimates are generally sufficient. Bank angle is perhaps the metric most often estimated incorrectly.

It is important to note that the BEHI procedure was originally developed for un-impounded rivers and streams, and BEHI scoring is confounded by hardened (armored) shorelines (e.g., rip rap, concrete, pilings etc.). Consequently, any field observation must take that into consideration and best professional judgment was exercised in this instance to account for that on the field data sheets.

4.2.2. Index Scoring and Interpretation

A draft field sheet for recording observations for the modified BEHI procedure is provided in Appendix A. Overall scores for the modified BEHI are calculated by summing the scores for each individual metric using the values in Table 1. The overall BEHI score corresponds to an erosion hazard category. Score categories are based on a scale from 5.8 to 40; a score of 5.8 or below is rated as Very Low, 5.9 to 11.8 is rated as Low, 11.9 to 19.8 is rated as Moderate, 19.9 to 27.8 is rated as High, 27.9 to 34.0 is rated as Very High, and a score greater than 34.0 is rated as Extreme. It should be noted that the overall BEHI scores and categories were created by Rosgen's work in the Rocky Mountain States, and in the future, these may be modified for conditions in Michigan.

4.2.3. Index Quality Control

Due to the subjective nature of this procedure, BEHI metric scores were verified by review of the photographs taken at each assessed site. The review was conducted by a GLEC senior field biologist familiar with the Project site. Several sites within the Project were visited in June and again in September to assess the precision of observations recorded. The senior field biologist was on the Project site during the September assessment. Several assessed sites were located in high traffic areas. According to the method outlined in Appendix A, shoreline areas located in high traffic areas such as parks, livestock crossings, highly landscaped lawns, etc. are not representative of average conditions and should be avoided unless they are the specific focus of the study. In the instances where sites were located in these high traffic areas, values for each metric were recorded, but score categories were not calculated and recorded as NA (Not Applicable). NA sites were also the result of complete armoring of the bank near the dam and powerhouse and/or extensive landscaping near homes and in parks.

5. Study Results

Observations for the 2019 Shoreline Stability Assessment of the reservoir and bypass reach were made during the June 2-4 and September 24-27, 2019 sampling events. Assessed sites were located at various points along the shoreline within the reservoir and bypass reach. Sites were labeled according to their location in the bypass reach or the reservoir. During the June sampling event, 57 sites were evaluated, and the results are listed in Table 2 in **Section 8** of this report. Of the 57 sites evaluated, 12 were located in the bypass reach and 45 were located in the reservoir. During the September sampling event, 31 sites were evaluated, and the results are listed in Table 3. Of the 31 sites evaluated, 8 were located in the bypass reach and 23 were located in the reservoir. Examples of the assessed locations are given in Figures 2-20 in **Section 7** of this study report.

5.1. Bypass Reach

5.1.1. June Assessment

Twelve individual sites were assessed during the June sampling event in the bypass reach (Table 2). BEHI scores ranged from Very Low to Moderate in applicable sites in this area. Three sites were listed as NA due to shoreline armoring. Figure 2 shows the complete armoring of the shoreline at site BA02.

Three bypass reach sites did show some limited signs of erosion and scored in the Moderate category. Site BA03 showed an area of erosion against the Business Route 131 Bridge at the downstream end of the assessment area (Figure 3). The increase in slope and a decrease in plant root density places site BA03 in the Moderate category. Sites BA05 and BA06 scored in the Moderate category due to the increased slope of the bank in this area and the decrease in surface protection of the bank at the water surface (Figures 4 and 5). The remaining sites were assessed as Very Low to Low due to the shallow bank angle, and increased surface protection and root density at these locations (Figures 6 and 7).

5.1.2. September Assessment

Eight sites were assessed during the September sampling event in the bypass reach (Table 3). BEHI scores ranged from Low to Moderate in applicable sites. Four sites were revisited, BA05 and BA06 were

assessed as a single site. The BEHI score categories remained relatively unchanged with the exception of BA10 and BA11. The score categories changed from Very Low to Low most likely due to a drop in the water levels during this sampling period. The tailrace water surface elevations were 0.8-0.9 feet lower than the June assessment period. The lower water levels likely contributed to the increase in surface protection and root density scores resulting in a slightly higher total score.

One localized spot of erosion was observed in September in the bypass reach. Figure 8 shows one localized erosion area of concern near the dam. The lack of vegetation above the steel bulkhead and concrete are allowing for increased erosion in this localized area. This site was not observed in June due to the higher water levels (Table 4) and current velocity in the bypass reach. The lower water levels in September allowed for access to the entire bypass reach up to the dam.

5.2. Reservoir Area

5.2.1. June Assessment

A total of 45 individual reservoir sites were assessed during the June sampling event. Sites were located from the Constantine Road Bridge downstream to the dam. BEHI scores ranged from Very Low to Moderate in applicable sites. Eleven sites were set aside as NA due to the high degree of armoring along the banks or the presence of intensive landscaping in the areas near homes (Table 2). An example of shoreline armoring within the reservoir from site SJR45 is shown in Figure 9, and an example of intensive landscaping from SJR17 is shown in Figure 10.

An area along the left descending bank downstream of the Constantine Road Bridge scored in the Moderate erosion category. Sites SJR05 through SJR12 are located in a more riverine section of the Project. These sites are located along an outside bend with homes located within 100 feet of the shoreline. The steep slope of the bank, removal of some riparian vegetation for lawns, and the increased current velocity along the outside bend, place this section in the Moderate erosion category. Figures 11 and 12 show the steep slopes and addition of homes along this 1,600 foot section of shoreline. Moderate erosion was also present at sites SJR15 and SJR21-23. An increase in the bank angle and a decrease in root density resulted in the higher scores at these sites. Figures 13 and 14 show examples of the increased slope and reduced root density at these locations.

The remainder of the applicable reservoir sites assessed in June scored in the Low or Very Low category. The decrease in the bank angle and increase in root density and surface protection reduce the risk of erosion at these locations. Sites SJR27 (Figure 15) and SJR39 (Figure 16) are developed with buildings and lawns, but a decreased risk of erosion.

5.2.2. September Assessment

A total of 31 reservoir sites were assessed during the September sampling visit. The BEHI scores ranged from Low to Moderate at all 31 locations. The number of sites revisited in September totaled 19. Several of the 19 sites revisited were grouped together and given an individual score. Sites grouped together are noted in Table 3. The revisited sites yielded the same results as the June sampling. Moderate erosion was again noted from SJR05V2-SJR12V2 and SJR19V2-SJR20V2. Site SJR15V2 had a slight change in score from Moderate to Low. This score change likely is the result of grouping this site with two sites that scored low in June SJR13 and SJR14. Two additional sites were scored as Moderate in September. Site

SJR49 (Figure 17) and SJR53 (Figure 18) scored in the Moderate category due to their bank angle. The remaining 19 sites scored in the low category. Figures 19 and 20 show adequate surface protection, root depth, and root density along with less steep bank angles to score in the Low erosion risk category.

5.3. Revisited Sites

During the September sampling visit, 19 sites that were assessed in June were revisited. Four sites were located in the bypass reach and 15 were located in the reservoir. The 15 reservoir sites were primarily located at the upstream portion of the Project area near the Constantine Road Bridge. Score categories remained the same between visits at 16 of the 19 sites. Two sites in the bypass reach BA05 and BA06, changed in score from the Very Low category to Low, and one site in the reservoir changed from Moderate to Low. The slight change in category was likely the result of changing water levels in the bypass reach. Water levels were lower during the September sampling visit by 0.8-0.9 feet on each sampling day (Table 4). The slight change in the reservoir at site SJR15 was likely due to grouping this site along with SJR13 and SJR14. Grouping these sites changed the bank angle score resulting in a category change to Low.

6. Summary and Discussion

In summary, primary observations and conclusions from the Shoreline Stability Study are:

- In June, modified BEHI scores in the Project area ranged from Very Low to Moderate at 57 individual sites. In the bypass reach, sites were scored as; 5 Very Low, 1 Low, 3 Moderate, and 3 NA. In the reservoir area, sites were scored as; 2 Very Low, 20 Low, 12 Moderate, and 11 NA.
- In September, BEHI scores in the Project area ranged from Low to Moderate at 39 sites. In the bypass reach, sites scored as; 5 Low, 2 Moderate, and 1 NA. In the reservoir area, sites were scored as; 19 Low and 12 Moderate.
- Based on observations used to calculate the modified BEHI, three areas may require additional assessment to confirm and possibly mitigate potential future erosion hazards within the Project:

  1) Site BA03 located at the downstream end of the Project. This site has an area of erosion located against concrete at the base of the bridge extending under the overhanging vegetation. This erosion area is likely caused by current hitting the bank from the tailrace.

  2) Site BA16 located at the upstream end of the bypass reach. This isolated point has no vegetation and soil is actively falling into the bypass reach.

  3) In the reservoir, the area from site SJR05 to SJR12. This area is located in a more riverine section of the Project along an outside bend in the river channel. This area has had the riparian vegetation removed for home construction and maintained turf grass lawns.

6.1. Variances from FERC-Approved Study Plan

There were no variations from the study approach, methods, and reporting requirements as prescribed in the March 15, 2019 RSP for the Shoreline Stability Assessment Study (RSP Section 7).

7. Shoreline Survey Photographs - AEP Constantine Project Area 2019

Figure 2. Site BA02: Example of shoreline armoring in the bypass reach area.

Figure 3. Site BA03: Area of Moderate erosion located at the Business Route US-131 Bridge.

Figure 4. Site BA05: Moderate erosion near the water surface.

Figure 5. Site BA06: Moderate erosion near the water surface.

Figure 6. Site BA10:Very Low erosion category.

Figure 7. Site BA12:Very Low erosion category.

Figure 8. Area of localized very high erosion risk in the bypass reach area

Figure 9. Site SJR45: Example of shoreline armoring.

Figure 10. Site SJR17: An example of intensive landscaping along the shoreline within the reservoir area.

Figure 11. Site SJR09: Erosion along outside bend with roof of home in the background.

Figure 12. Site SJR10: Moderate erosion located along outside bend of river with home in background.

Figure 13. Site SJR15: Moderate erosion associated with an increase in bank angle.

Figure 14. Site SJR18: Moderate erosion associated with an increase in bank angle and a decrease in root density.

Figure 15. Site SJR27: Developed site along reservoir with Low erosion.

Figure 16. Site SJR39: Shoreline along VFW Hall.

Figure 17. Site SJR49: Moderate erosion category present due to an increase in bank angle.

Figure 18. Site SJR53: Moderate erosion only due to the bank angle.

Figure 19. Site SJR02V2: Low erosion score category with low bank angle and adequate surface protection across site.

Figure 20. Site SJR55: Low erosion score category.

8. Tables

Table 2. Modified Bank Erosion Hazard Index Scores for the Assessed Locations within the AEP Constantine Hydroelectric Project Area – Data Collected June 2-4, 2019.

Site ID	Root Depth Score	Root Density Score	Surface Protection Score	Bank Angle Score	Total Score	Score Category
Bypass Area						
BA01	1.45	1.45	1.45	1.45	5.80	Very Low
BA02	2.95	2.95	1.45	6.95	14.30	NA
BA03	2.95	8.50	1.45	2.95	15.85	Moderate
BA04	1.45	1.45	1.45	1.45	5.80	Very Low
BA05	1.45	2.95	6.95	6.95	18.30	Moderate
BA06	1.45	2.95	6.95	6.95	18.30	Moderate
BA07	1.45	1.45	1.45	2.95	7.30	Low
BA08	10.00	10.00	1.45	4.95	26.40	NA
BA09	10.00	10.00	1.45	4.95	26.40	NA
BA10	1.45	1.45	1.45	1.45	5.80	Very Low
BA11	1.45	1.45	1.45	1.45	5.80	Very Low
BA12	1.45	1.45	1.45	1.45	5.80	Very Low
Reservoir Area						
SJR01	1.45	2.95	2.95	1.45	8.80	Low
SJR02	1.45	4.95	2.95	1.45	10.80	Low
SJR03	1.45	2.95	2.95	2.95	10.30	Low
SJR04	1.45	2.95	2.95	2.95	10.30	Low
SJR05	1.45	2.95	2.95	4.95	12.30	Moderate
SJR06	1.45	4.95	1.45	4.95	12.80	Moderate
SJR07	1.45	2.95	2.95	4.95	12.30	Moderate
SJR08	1.45	4.95	1.45	4.95	12.80	Moderate
SJR09	1.45	4.95	2.95	6.95	16.30	Moderate
SJR10	1.45	2.95	2.95	6.95	14.30	Moderate
SJR11	1.45	4.95	2.95	6.95	16.30	Moderate
SJR12	1.45	4.95	2.95	6.95	16.30	Moderate
SJR13	1.45	2.95	1.45	4.95	10.80	Low
SJR14	1.45	2.95	1.45	4.95	10.80	Low
SJR15	1.45	2.95	2.95	4.95	12.30	Moderate
SJR16	1.45	2.95	4.95	1.45	10.80	Low
SJR17	1.45	8.50	1.45	4.95	16.35	NA
SJR18	2.95	4.95	2.95	4.95	15.80	Moderate
SJR19	1.45	4.95	2.95	4.95	14.30	Moderate
SJR20	1.45	4.95	4.95	2.95	14.30	Moderate
SJR21	10.00	10.00	1.45	4.95	26.40	NA

SJR22	1.45	8.50	1.45	2.95	14.35	NA
SJR23	1.45	2.95	1.45	2.95	8.80	NA
SJR24	1.45	2.95	2.95	1.45	8.80	Low
SJR25	1.45	1.45	1.45	2.95	7.30	Low
SJR26	1.45	2.95	1.45	2.95	8.80	Low
SJR27	1.45	1.45	1.45	2.95	7.30	Low
SJR28	1.45	1.45	1.45	1.45	5.80	Very Low
SJR29	1.45	1.45	1.45	6.95	11.30	NA
SJR30	1.45	2.95	1.45	1.45	7.30	Low
SJR31	1.45	1.45	1.45	1.45	5.80	Very Low
SJR32	1.45	1.45	1.45	2.95	7.30	Low
SJR33	1.45	1.45	1.45	1.45	5.80	NA
SJR34	1.45	1.45	1.45	2.95	7.30	Low
SJR35	1.45	2.95	2.95	2.95	10.30	NA
SJR36	1.45	2.95	1.45	2.95	8.80	NA
SJR37	1.45	2.95	1.45	2.95	8.80	NA
SJR38	1.45	2.95	1.45	1.45	7.30	Low
SJR39	1.45	1.45	2.95	2.95	8.80	Low
SJR40	1.45	1.45	2.95	2.95	8.80	Low
SJR41	1.45	2.95	2.95	2.95	10.30	Low
SJR42	1.45	2.95	1.45	2.95	8.80	NA
SJR43	1.45	1.45	1.45	2.95	7.30	Low
SJR44	1.45	2.95	1.45	2.95	8.80	Low
SJR45	2.95	2.95	1.45	2.95	10.30	NA

NA – Not applicable due to a high degree of armoring along bank within assessment site.

Table 3. Modified Bank Erosion Hazard Index Scores for the Assessed Locations within the AEP Constantine Hydroelectric Project Area– Data Collected September 24-27, 2019.

Site ID	Root Depth Score	Root Density Score	Surface Protection Score	Bank Angle Score	Total Score	Score Category
Bypass Area						
BA05V2[a]	1.45	4.95	4.95	2.95	14.30	Moderate
BA06V2[a]	1.45	4.95	4.95	2.95	14.3	Moderate
BA10V2	1.45	2.95	2.95	2.95	10.30	Low
BA11V2	1.45	2.95	1.45	2.95	8.80	Low
BA13	1.45	2.95	4.95	1.45	10.80	Low
BA14	1.45	2.95	2.95	2.95	10.30	Low
BA15	1.45	2.95	2.95	2.95	10.30	Low
BA16	10.00	8.50	10.00	4.95	33.45	NA

Reservoir Area						
SJR01V2 [b]	2.95	2.95	2.95	1.45	10.30	Low
SJR02V2 [b]	1.45	2.95	2.95	1.45	8.80	Low
SJR03V2 [b]	1.45	2.95	2.95	1.45	8.80	Low
SJR05V2[c]	4.95	4.95	4.95	4.95	19.80	Moderate
SJR06V2[c]	4.95	4.95	4.95	4.95	19.80	Moderate
SJR07V2[c]	4.95	4.95	4.95	4.95	19.80	Moderate
SJR08V2[c]	4.95	4.95	4.95	4.95	19.80	Moderate
SJR09V2[c]	4.95	4.95	4.95	4.95	19.80	Moderate
SJR10V2[c]	4.95	4.95	4.95	4.95	19.80	Moderate
SJR11V2[d]	1.45	4.95	6.95	4.95	18.30	Moderate
SJR12V2[d]	1.45	4.95	6.95	4.95	18.30	Moderate
SJR13V2[e]	2.95	2.95	2.95	2.95	11.80	Low
SJR14V2[e]	2.95	2.95	2.95	2.95	11.80	Low
SJR15V2[e]	2.95	2.95	2.95	2.95	11.80	Low
SJR16V2	1.45	2.95	2.95	1.45	8.80	Low
SJR19V2	2.95	4.95	2.95	2.95	13.80	Moderate
SJR20V2	2.95	4.95	2.95	2.95	13.80	Moderate
SJR24V2[f]	1.45	2.95	2.95	2.95	10.30	Low
SJR25V2[f]	1.45	2.95	2.95	2.95	10.30	Low
SJR46	1.45	2.95	2.95	2.95	10.30	Low
SJR47	1.45	1.45	1.45	2.95	7.30	Low
SJR48	2.95	2.95	2.95	2.95	11.80	Low
SJR49	2.95	2.95	2.95	4.95	13.80	Moderate
SJR50	2.95	2.95	2.95	2.95	11.80	Low
SJR51	2.95	2.95	2.95	2.95	11.80	Low
SJR52	1.45	2.95	2.95	2.95	10.30	Low
SJR53	1.45	2.95	2.95	4.95	12.30	Moderate
SJR54	1.45	2.95	2.95	2.95	10.30	Low
SJR55	1.45	2.95	2.95	2.95	10.30	Low
SJR56	1.45	2.95	2.95	2.95	10.30	Low
SJR57	1.45	2.95	2.95	2.95	10.30	Low

a, b, c, d, e, f – Combined as individual sites during the September Assessment

NA - Not applicable due to a high degree of armoring along bank within assessment site.

Table 4. Water surface elevations at the Constantine Project during the Shoreline Stability Assessment (June and September 2019).

Date	Forebay Elevation (ft)			Raceway Elevation (ft)			Tailwater Elevation (ft)		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
6/2/2019	783.3	783.3	783.3	783.3	783.3	783.3	772.2	772.2	772.3
6/3/2019	783.2	783.2	783.3	783.2	783.2	783.3	772.2	772.1	772.2
6/4/2019	783.2	783.2	783.2	783.2	783.2	783.3	772.1	772.1	772.2
9/24/2019	782.9	782.9	782.9	782.9	782.9	782.9	771.3	771.3	771.4
9/25/2019	782.9	782.9	782.9	782.9	782.9	782.9	771.3	771.2	771.4
9/26/2019	782.9	782.9	782.9	782.9	782.9	782.9	771.3	771.2	771.3
9/27/2019	782.9	782.9	783.0	782.9	782.9	782.9	771.3	771.2	771.5

9. References

Indiana Michigan Power Company (I&M). 2018. Constantine Hydroelectric Project (FERC No. 10661). Notice of Intent and Pre-Application Document. Federal Energy Regulatory Commission, Washington, D.C. June 4, 2018.

Rosgen, D.L. 2001. A Practical Method of Computing Streambank Erosion Rate. Proceedings of the Seventh Federal Interagency Sedimentation Conference, Vol. 2, pp. II - 9-15, March 25-29, 2001, Reno, NV.

Appendix A. Rosgen SOP

STANDARD OPERATING PROCEDURE

ASSESSING BANK EROSION POTENTIAL USING ROSGEN'S BANK EROSION HAZARD INDEX (BEHI)

1.0 Overview

While stream bank erosion is a natural process that occurs in every watershed, excessive erosion has serious adverse consequences for the physical and biological function of rivers. Eroding stream banks can be a major source of sediment to a stream (up to 80% of the annual load; Simon and Thorne, 1996), and human activities such as urbanization or dam construction can accelerate bank erosion rates by more than an order of magnitude. It is often difficult, however, to distinguish between stream banks that are eroding at a natural rate from those that are or have the potential to erode at unnaturally high rates due to altered watershed hydrology or sediment loads. The Bank Erosion Hazard Index (BEHI), created by Dave Rosgen of Wildland Hydrology, Inc. (Rosgen, 2001), is one of several procedures for assessing stream bank erosion condition and potential. It assigns point values to several aspects of bank condition and provides an overall score that can be used to inventory stream bank condition over large areas, prioritize eroding banks for remedial actions, etc. This standard operating procedure (SOP) describes two versions of the BEHI technique.

2.0 Procedure

Below are descriptions of two BEHI procedures. The first describes the complete BEHI procedure created by Rosgen, including identification of bankfull width. The second describes a modified BEHI procedure, which does not require identification of bankfull width. The modified BEHI procedure is intended for use by workers who lack experience in identifying bankfull indicators, including volunteer monitors. Correctly identifying appropriate bankfull indicators requires considerable experience, and is the most subjective step in the original BEHI procedure.

In truth, both procedures described below are 'modified', in that the step of calculating BEHI scores has been simplified such that there is only a single score for each metric, rather than the range of possible scores provided in Rosgen's original paper. This simplification is intended to remove some unnecessary subjectivity from the field observations, without overly reducing the utility of the procedure.

A. Complete BEHI Procedure

The complete BEHI procedure consists of five metrics; four observational and one requiring some measurements. They are:

1. Ratio of bank height to bankfull height
2. Ratio of root depth to bank height

3. Root density, in percent
4. Bank angle, in degrees
5. Surface protection, in percent

Brief descriptions of each metric are provided below.

Point values for these metrics (Table 1) should only be assigned after a sufficient length of the stream channel (the 'stream reach') has been examined (at least 100'; 2 to 3 meander lengths is preferable), so that representative conditions are identified. Conditions on both banks should be assessed, and scored separately if they are consistently different. See Section 4 for further advice on where to make – and not make – the observations.

Ratio of bank height to bankfull height. This is the most challenging of the BEHI metrics, as it requires accurate identification of bankfull indicators. A full discussion of different bankfull indicators is beyond the scope of this SOP, but it is thoroughly discussed in Williams (1978), and a useful free video is available from the U.S. Forest Service (2003). Common bankfull indicators in stable southern Michigan streams include top of bank, top of point bars, and other changes in channel slope. Vegetative indicators are seldom useful in southern Michigan streams. Bankfull indicators in unstable streams (i.e., incising or aggrading streams) can be more difficult to identify, but are usually less than top of bank.

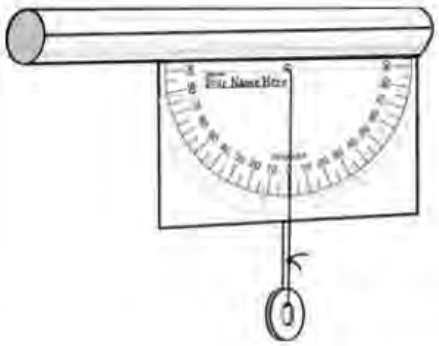
Ratio of root depth to bank height. Root depth is the ratio of the average plant root depth to the bank height, expressed as a percent (e.g., roots extending 2' into a 4' tall bank = 0.50.)

Root density. Root density, expressed as a percent, is the proportion of the stream bank surface covered (and protected) by plant roots (e.g., a bank whose slope is half covered with roots = 50%).

Surface protection. Surface protection is the percentage of the stream bank covered (and therefore protected) by plant roots, downed logs and branches, rocks, etc. In many streams in southern Michigan, surface protection and root density are synonymous.

Bank angle. Bank angle is the angle of the "lower bank" – the bank from the waterline at base flow to the top of the bank, as opposed to benches that are higher on the floodplain. Bank angles great than 90º occur on undercut banks. Bank angle can be measured with an inclinometer (Figure 1), though given the broad bank angle categories (Table 1), visual estimates are generally sufficient. Bank angle is perhaps the metric most often estimated incorrectly.

Figure 1. Simple and More Expensive (~ $100) Inclinometers



B. Modified BEHI Procedure

If the field staff lack experience with identifying bank full indicators, it is recommended that the bank height/bankfull height ratio metric be dropped from the BEHI calculation, leaving four metrics:

1. Ratio of root depth to bank height
2. Root density, in percent
3. Surface protection, in percent
4. Bank angle, in degrees

Observations for these metrics are made as described in Section 2A, and the overall BEHI score is calculated using Table 2.

3.0 Data Calculation and Interpretation

A draft field sheet for recording observations for the modified BEHI procedure is in Appendix 1. Overall scores for the Complete BEHI are calculated by summing the scores for each individual metric using the values in Table 1, and scores for the Modified BEHI are similarly calculated using the values in Table 2. The overall BEHI score corresponds to an erosion hazard category. It should be noted that the overall BEHI scores and categories were created by Rosgen's work in the Rocky Mountain states, and in the future these may be modified for conditions in Michigan. Illustrated examples from southern Michigan streams are in Appendix 2.

BEHI scores have several potential uses, including ranking multiple stations for further study or remedial actions (Figure 2).

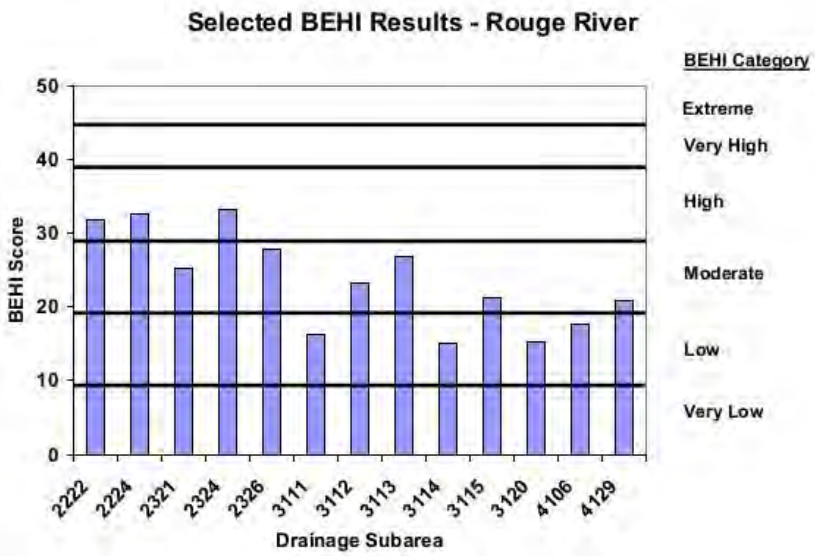
Table 1. Scores for the Complete BEHI.

BEHI Category	Bank Height/ Bankfull Height	BH/BFH Score	Root Depth (% of BFH)	Root Depth Score	Root Density (%)	Root Density Score	Surface Protection (Avg. %)	Surface Protection Score	Bank Angle (degrees)	Bank Angle Score	Total Score, by Category
Very low	1.0-1.1	1.45	90-100	1.45	80-100	1.45	80-100	1.45	0-20	1.45	≤ 7.25
Low	1.11-1.19	2.95	50-89	2.95	55-79	2.95	55-79	2.95	21-60	2.95	7.26 – 14.75
Moderate	1.2-1.5	4.95	30-49	4.95	30-54	4.95	30-54	4.95	61-80	4.95	14.76 – 24.75
High	1.6-2.0	6.95	15-29	6.95	15-29	6.95	15-29	6.95	81-90	6.95	24.76 – 34.75
Very high	2.1-2.8	8.5	5-14	8.5	5-14	8.5	10-14	8.5	91-119	8.5	34.76 – 42.50
Extreme	>2.8	10	< 5	10	< 5	10	< 10	10	> 119	10	42.51 - 50

Table 2. Scores for the Modified BEHI.

BEHI Category	Root Depth Values	Root Depth Scores	Root Density (%)	Root Density Scores	Surface Protection (Avg. %)	Surface Protection Scores	Bank Angle (degrees)	Bank Angle Scores	Total Score, by Category
Very low	90-100	1.45	80-100	1.45	80-100	1.45	0-20	1.45	≤ 5.8
Low	50-89	2.95	55-79	2.95	55-79	2.95	21-60	2.95	5.9 – 11.8
Moderate	30-49	4.95	30-54	4.95	30-54	4.95	61-80	4.95	11.9 – 19.8
High	15-29	6.95	15-29	6.95	15-29	6.95	81-90	6.95	19.9 – 27.8
Very high	5-14	8.5	5-14	8.5	10-14	8.5	91-119	8.5	27.9 – 34.0
Extreme	< 5	10	< 5	10	< 10	10	> 119	10	34.1 - 40

Figure 2. BEHI Score Example



4.0 Quality Control Issues

(1) Accuracy: Accuracy as traditionally defined is difficult to assess for this largely subjective, observational procedure. When performed by volunteers, however, the accuracy of their observations can be maximized by training from others more experienced in river morphology studies, and verified by spot-checks of their work by the trainers.

(2) Precision: Precision as traditionally defined is also difficult to assess for this largely subjective, observational procedure. Spot-checks within a few weeks of volunteer observations can be used to assess precision as well as accuracy.

(3) Reference reaches: In addition to the erosion hazard categories generated by this procedure, it can also be useful to make these observations at reference reaches – stream reaches in portions of the same watershed, or an adjacent watershed, that are believed to be (relatively) undisturbed by urban development, stream channelization, etc. A good document describing how to choose and document conditions at a reference site is the U.S. Forest Service report by Harrelson, et al. (1994). Alternatively, contact the author of this SOP for advice on selecting a representative reference reach. In general, reference reaches are best established in the same watershed as the stream reach of interest, in a stream of the same size (e.g., same stream order, or baseflow wetted width) and with similar soil type and channel slope.

(4) Stream reach selection (Representativeness): Selection of specific stream reaches for BEHI observations will depend on the objectives of the study, but a few general rules apply:

- Stream bank conditions are naturally variable even in stable streams, and to characterize a stream reach it is recommended that at least 200' of the stream reach be viewed before the BEHI observations are made.
- Stream banks adjacent to riffle areas tend to be the most stable section of a stream channel, while banks in meander bends tend to have the highest erosion rates – even in geomorphically stable streams.
- Stream banks in 'high traffic' areas (parks, livestock crossings, etc.) are not representative of average conditions and should be avoided – unless they are the specific focus of the study.

While volunteers can collect large amounts of useful BEHI data with adequate training and supervision, experience has shown that they are prone to overemphasizing small, atypical bank erosion "hot spots," even when asked to score more representative banks.

5.0 References

Harrelson C. C., Rawlins, C. L. and Potyondy J. P. 1994. Stream Channel Reference Sites: An Illustrated Guide to Field Technique, General Technical Report RM-245, USDA - Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, 61 pages. Available from: http://www.stream.fs.fed.us/publications/documentsStream.html

Rosgen, D.L. 2001. A Practical Method of Computing Streambank Erosion Rate. Proceedings of the Seventh Federal Interagency Sedimentation Conference, Vol. 2, pp. II - 9-15, March 25-29, 2001, Reno, NV. Available on the Wildland Hydrology website: http://www.wildlandhydrology.com/html/references_.html

Simon, A., and C. Thorne. 1996. Channel Adjustment of an Unstable Coarse-Grained Alluvial Stream: Opposing Trends of Boundary and Critical Shear Stress, and the Applicability of Extremal Hypothesis. Earth Surface Processes and Landforms 21:155-180.

U.S. Forest Service. 2003. Identifying Bankfull Stage in Forested Streams in the Eastern United States. Free from: http://www.stream.fs.fed.us/publications/videos.html

Williams, G.P. 1978. Bank-Full Discharge of Rivers. *Water Resources Research* 14(6):1141-1154.

SOP Prepared by:

Joe Rathbun
Michigan Department of Environmental Quality – Water Bureau – Nonpoint Source Unit
(517) 373-8868 rathbunj@michigan.gov

Modified Bank Erosion Hazard Index (BEHI) Field Form

Date:______________________ **Personnel:**____

Location:____

(Circle one in each column)

Root Depth (% of BH)	Root Density (%)	Surface Protection (Avg. %)	Bank Angle (degrees)
90-100	80-100	80-100	0-20
50-89	55-79	55-79	21-60
30-49	30-54	30-54	61-80
15-29	15-29	15-29	81-90
5-14	5-14	10-14	91-119
< 5	< 5	< 10	> 119

Comments:

Date:______________________ **Personnel:**____

Location:____

(Circle one in each column)

Root Depth (% of BH)	Root Density (%)	Surface Protection (Avg. %)	Bank Angle (degrees)
90-100	80-100	80-100	0-20
50-89	55-79	55-79	21-60
30-49	30-54	30-54	61-80
15-29	15-29	15-29	81-90
5-14	5-14	10-14	91-119
< 5	< 5	< 10	> 119

Comments:

Date:______________________ **Personnel:**____

Location:____

(Circle one in each column)

Root Depth (% of BH)	Root Density (%)	Surface Protection (Avg. %)	Bank Angle (degrees)
90-100	80-100	80-100	0-20
50-89	55-79	55-79	21-60
30-49	30-54	30-54	61-80
15-29	15-29	15-29	81-90
5-14	5-14	10-14	91-119
< 5	< 5	< 10	> 119

Comments:____

Appendix 2. Examples of Different Bank Conditions in Southern Michigan Streams

Figure A. Tributary, Kalamazoo River watershed

Bank Height/Bankfull Height ≈ 1.0-1.1

Root Depth/Bank Height ≈ 0.9-1.0

Root Density ≈ 80-100%

Bank Angle ≈ 0-20° ?

Surface Protection ≈ 80-100%

BEHI Score = 7.25 (Very low)

Figure B. Kalamazoo River

Bank Height/Bankfull Height ≈ 1.0-1.1

Root Depth/Bank Height ≈ 0.9-1.0

Root Density ≈ 30-54%, not counting sod slump

Bank Angle ≈ 81-90°

Surface Protection ≈ 30-54%

BEHI Score = 19.75 (Moderate)

Note sod slumping into channel – a sure indication of an unstable bank, presumably because streamside vegetation = mowed grass, not woody vegetation. Otherwise the channel is in pretty good shape.

Figure C. Rouge River

Bank Height/Bankfull Height ≈ 1.0-1.1 (assuming top of bank = bankfull)

Root Depth/Bank Height ≈ 0.9-1.0

Root Density ≈ 5-14%

Bank Angle ≈ 81-90°

Surface Protection ≈ 10-14%

BEHI Score = 26.85 (High)

Interesting site – roots extend to waterline, but are so few that they provide minimal bank protection. Also, this site is downstream from a dam, where erosion is usually atypically high due to "hungry water" created by the impoundment.

Figure D. Hagar Creek , Ottawa County

Bank Height/Bankfull Height ≈ > 2.8

Root Depth/Bank Height ≈ 0.3-0.49 at best

Root Density ≈ 5-14%

Bank Angle ≈ 81-90°

Surface Protection ≈ 10-14%

BEHI Score = 38.9 (Very high)

Appendix B. Field Form

Modified Bank Erosion Hazard Index (BEHI) Field Form

Date:____________________ **Personnel:**____

Location:____

(Circle one in each column)

Root Depth (% of BH)	Root Density (%)	Surface Protection (Avg. %)	Bank Angle (degrees)
90-100	80-100	80-100	0-20
50-89	55-79	55-79	21-60
30-49	30-54	30-54	61-80
15-29	15-29	15-29	81-90
5-14	5-14	10-14	91-119
< 5	< 5	< 10	> 119

Comments:

Date:____________________ **Personnel:**____

Location:____

(Circle one in each column)

Root Depth (% of BH)	Root Density (%)	Surface Protection (Avg. %)	Bank Angle (degrees)
90-100	80-100	80-100	0-20
50-89	55-79	55-79	21-60
30-49	30-54	30-54	61-80
15-29	15-29	15-29	81-90
5-14	5-14	10-14	91-119
< 5	< 5	< 10	> 119

Comments:

Date:____________________ **Personnel:**____

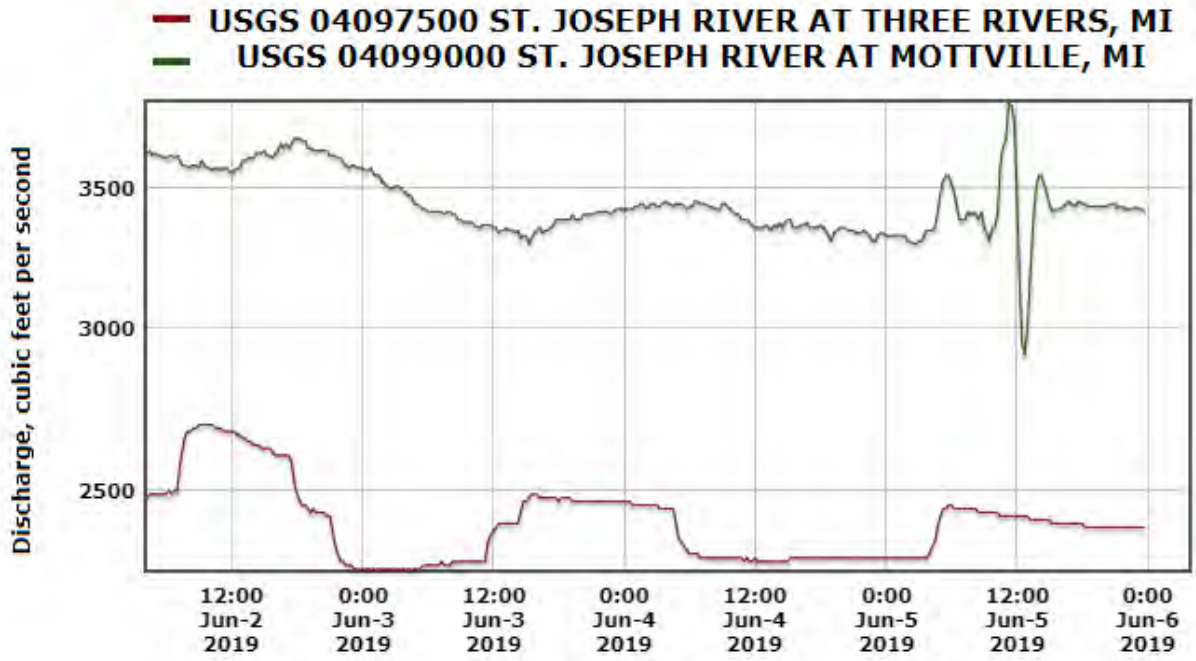
Location:____

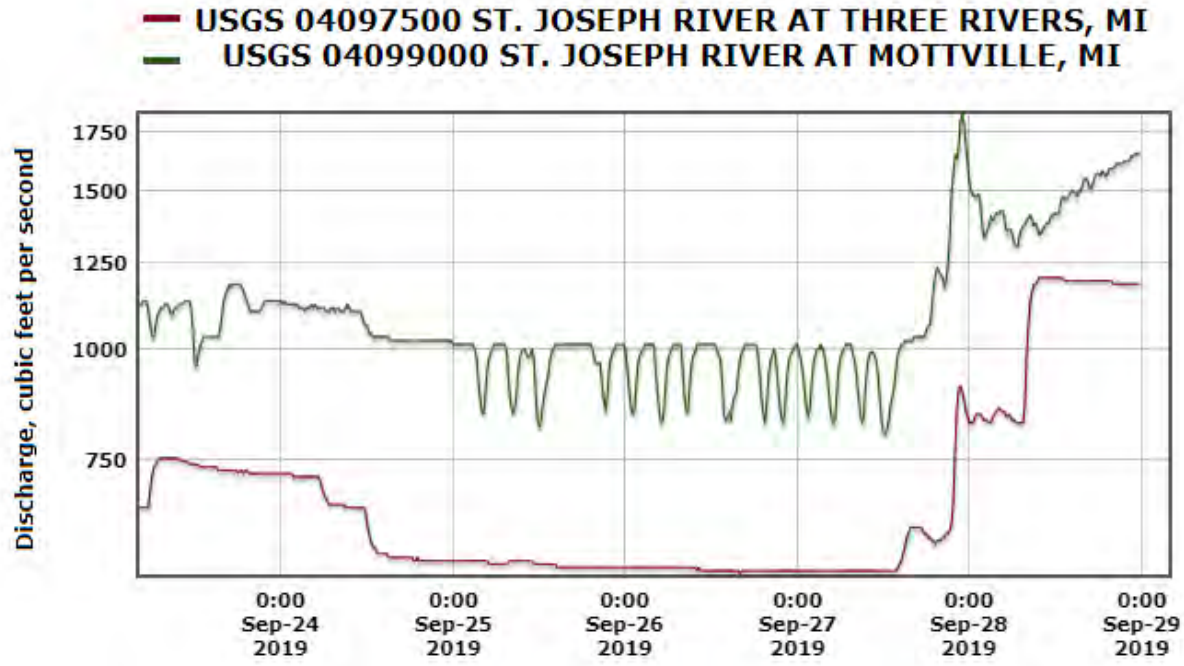
(Circle one in each column)

Root Depth (% of BH)	Root Density (%)	Surface Protection (Avg. %)	Bank Angle (degrees)
90-100	80-100	80-100	0-20
50-89	55-79	55-79	21-60
30-49	30-54	30-54	61-80
15-29	15-29	15-29	81-90
5-14	5-14	10-14	91-119
< 5	< 5	< 10	> 119

Comments:____

Appendix C. Flow Graphs


USGS 04097500 ST. JOSEPH RIVER AT THREE RIVERS, MI
USGS 04099000 ST. JOSEPH RIVER AT MOTTVILLE, MI
Discharge, cubic feet per second
3500
3000
2500
12:00 Jun-2 2019
0:00 Jun-3 2019
12:00 Jun-3 2019
0:00 Jun-4 2019
12:00 Jun-4 2019
0:00 Jun-5 2019
12:00 Jun-5 2019
0:00 Jun-6 2019


USGS 04097500 ST. JOSEPH RIVER AT THREE RIVERS, MI
USGS 04099000 ST. JOSEPH RIVER AT MOTTVILLE, MI
Discharge, cubic feet per second
1750
1500
1250
1000
750
0:00 Sep-24 2019
0:00 Sep-25 2019
0:00 Sep-26 2019
0:00 Sep-27 2019
0:00 Sep-28 2019
0:00 Sep-29 2019

Appendix D. Water Quality Study

Water Quality Study Report

Constantine Project (FERC No. 10661)
March 31, 2020

Contents

Tables

Figures

Appendices

1. Project Introduction and Background

Indiana Michigan Power Company (I&M), a unit of American Electric Power (AEP), is the Licensee, owner, and operator of the run-of-river, 1.2 megawatt(MW) Constantine Hydroelectric Project (Project) (FERC Project No. 10661).The Project is located along the St. Joseph River in the Village of Constantine in St. Joseph County, Michigan.

I&M operates and maintains the Project under a license from the Federal Energy Regulatory Commission (FERC or Commission). The Project's existing license expires on September 30, 2023. I&M is pursuing a subsequent license for the Project using the Commission's Integrated Licensing Process (ILP) as defined in 18 Code of Federal Regulations (CFR) Part 5.

In accordance with 18 CFR § 5.15, I&M has conducted studies as provided in the March 15, 2019 Revised Study Plan (RSP) and schedule approved in the Commission's April 9, 2019 Study Plan Determination (SPD) for the Project. This report describes the methods and results of the Water Quality Study conducted in support of preparing an application for a subsequent license for the Project.

Existing relevant and reasonably available information regarding water quality in the Project area was presented in Section 5.3 of the Pre-Application Document (PAD) (I&M 2018). The PAD included historical water quality data collected in support of the existing license. Historical data show that the Project waters meet the state standards regarding water temperature and dissolved oxygen (DO), and that Project operations appear to have little to no effect on water quality in the St. Joseph River.

1.1. Applicable Water Quality Standards

Water quality standards for Project waters are regulated by the Michigan Department of Environment, Great Lakes, and Energy (EGLE) under delegated authority from the U.S. Environmental Protection Agency (USEPA). The water quality standards applicable to the St. Joseph River are provided in the State of Michigan's Part 4 Rules, Water Quality Standards (of Part 3, Water Resources Protection, of Act 451 of 1994). Michigan's Part 4 Water Quality Standards require that all designated uses of the receiving water be protected (Michigan Department of Environmental Quality (MDEQ, 2016). Designated uses are defined in R 323.1100 and include at a minimum: agriculture, navigation, industrial water supply, warmwater fishery, other indigenous aquatic life and wildlife, fish consumption, and partial body contact recreation. Additional designated uses may be applied to specific waters. The St. Joseph River has no additional designation (i.e., trout stream or public water supply). Table 1 summarizes the numeric and qualitative water quality standards for pH, DO, and water temperature in the St. Joseph River.

Table 1: Water Quality Standards for the St. Joseph River, Michigan.

<table>
<tr><th>Michigan Rule</th><th>Parameter</th><th>Warmwater Standards</th></tr>
<tr><td>Rule 53</td><td>pH</td><td>The hydrogen ion concentration expressed as pH shall be maintained within the range of 6.5 to 9.0 S.U. in all surface waters of the state, except for those waters where the background pH lies outside the range of 6.5 to 9.0 S.U.</td></tr>
<tr><td>Rule 64</td><td>Dissolved Oxygen</td><td>…the dissolved oxygen shall not be lowered below a minimum of 4 milligrams per liter, or below 5 milligrams per liter as a daily average, at the design flow during the warm weather season…</td></tr>
<tr><td>Rule 75</td><td>Temperature</td><td>Rivers, streams, and impoundments naturally capable of supporting warmwater fish shall not receive a heat load which would warm the receiving water at the edge of the mixing zone to temperatures greater than the following monthly maximum temperatures:
<table>
<tr><td>Month</td><td>J</td><td>F</td><td>M</td><td>A</td><td>M</td><td>J</td><td>J</td><td>A</td><td>S</td><td>O</td><td>N</td><td>D</td></tr>
<tr><td>°F</td><td>50</td><td>50</td><td>55</td><td>65</td><td>75</td><td>85</td><td>85</td><td>85</td><td>85</td><td>70</td><td>60</td><td>50</td></tr>
<tr><td>°C</td><td>10.0</td><td>10.0</td><td>12.8</td><td>18.3</td><td>23.9</td><td>29.4</td><td>29.4</td><td>29.4</td><td>29.4</td><td>21.1</td><td>15.6</td><td>10.0</td></tr>
</table></td></tr>
</table>

Source: MDEQ 2016.

2. Study Goals and Objectives

In accordance with I&M's RSP and the Commission's SPD for the Project, the goal of the Water Quality Study was to determine the effects of continued Project operation on water quality, including DO concentrations and water temperature in the Project reservoir and in the St. Joseph River downstream from the Project (i.e., Project bypass reach and tailrace). The goals and objectives of this study were as follows:

- Gather existing and relevant baseline water quality data to determine compliance with state water quality standards.
- Analyze sediment in the Project reservoir to determine the concentration of select contaminants potentially present in sediment.

Methodologies for the collection and analysis of water quality and sediment data are detailed in this report. Results presented in this report characterize water quality and conditions within the reservoir, the power canal, the bypass reach, and the tailrace in three categories: 1) Continuous DO and temperature monitoring, 2) Discrete multi-parameter water quality sampling, and 3) Sediment contaminant sampling and analysis from the Project reservoir.

3. Study Area

The study area for the Water Quality Study is the FERC Project boundary, the bypass reach, and the river reach downstream to the US 131 Business Route Bridge (Figure 1). In total, five water quality monitoring stations (reservoir, power canal, tailrace, bypass reach upstream of the Fawn River, and bypass reach downstream of the Fawn River) were established and monitored for approximately six months in 2019. Sediment sampling was conducted along three transects in the reservoir (lower, middle, and upper reservoir) on September 25, 2019.

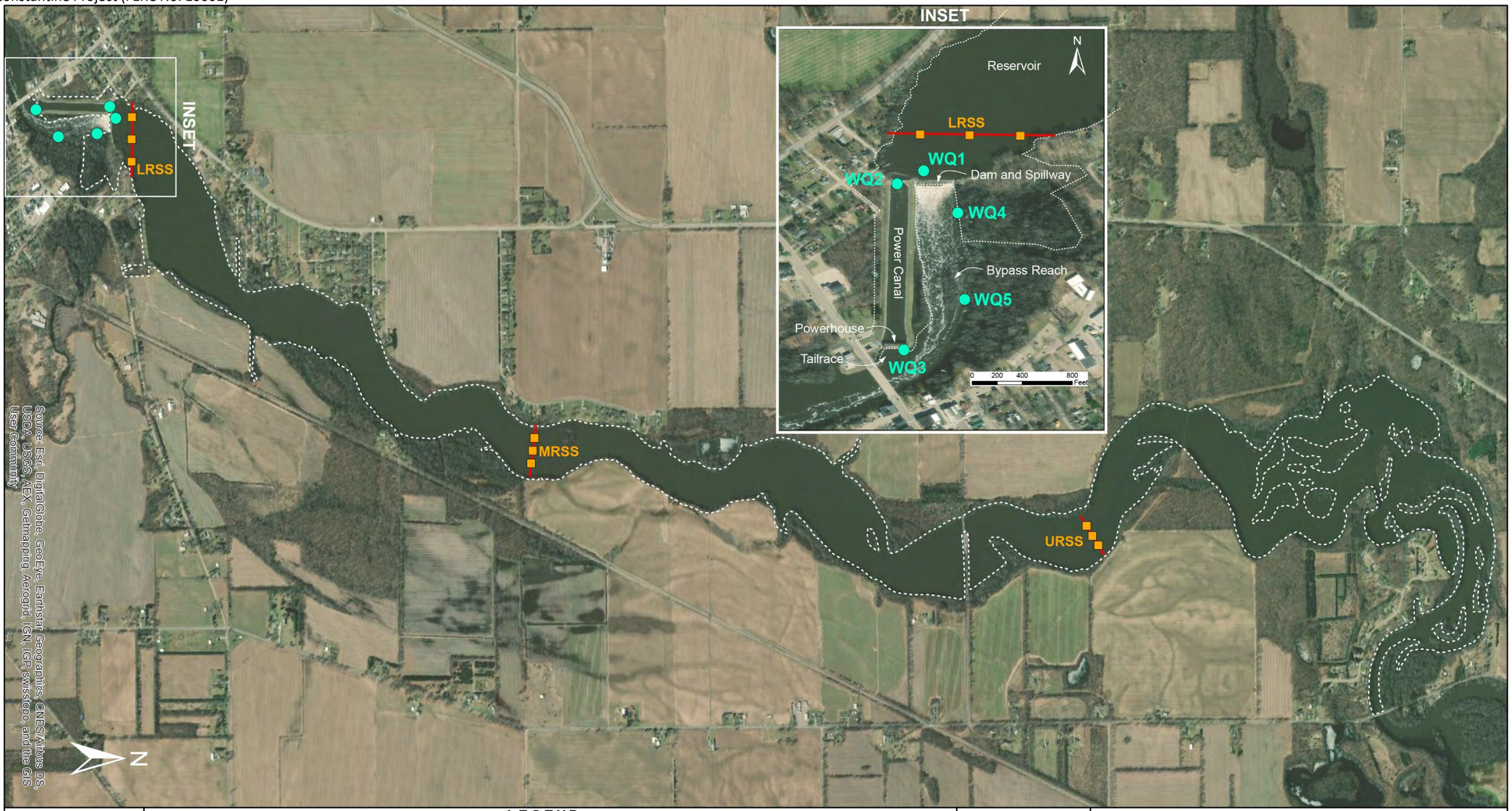


Figure 1: Water Quality Monitoring and Sediment Sampling Stations at the Constantine Hydroelectric Project, 2019.

4. Methodology

The Water Quality Study was conducted pursuant to the Commission's SPD at predetermined locations in the Project reservoir and in the St. Joseph River downstream from the Project. All water quality monitoring stations were geo-referenced using a Global Positioning System (GPS). Great Lakes Environmental Center (GLEC) collected discrete and continuous seasonal water quality data of the physical and chemical state of surface water in the study area as described in greater detail below.

4.1. Continuous Temperature and DO Monitoring and Discrete Multi-parameter Water Quality Measurements

The three components of the field data collection were conducted in accordance with the methods provided in the approved RSP. Duplicate combined water temperature and DO data loggers were set to record water temperature and DO at 1-hour intervals from May 1 through October 31, 2019. Calibrated Onset® HOBO U26 DO/Temperature Loggers were deployed at the five water quality monitoring stations for continuous *in situ* measurements (Figure 1). At all locations, a primary data logger and a secondary data logger were installed. The loggers were suspended in the water column approximately one meter below the surface on a steel cable attached to various stationary objects above the water's surface (trees, fencing, etc.). Both data loggers at station WQ4 in the bypass reach upstream of the Fawn River were discovered to be missing on August 1, 2019. Consequently, the data loggers were lost sometime between June 27 and August 1, 2019.Therefore no data was collected for that location during that time period. GLEC took corrective action, and replaced the loggers with a new primary logger. Additional discussion of other periods of low DO measurements and equipment malfunction is presented in Section 5.

Field staff downloaded data from loggers at each monitoring station directly onto a laptop computer. During each visit, all equipment was checked for operation, calibration, battery life, and any necessary adjustments to the instrument were made based on manufacturer's specifications. Each logger was also cleaned and the cable, housing, and other installation materials were visually inspected for damage and repaired or replaced as necessary.

Discrete multi-parameter water quality measurements of temperature, DO concentration, pH, and specific conductance were also collected at the monitoring stations using a calibrated YSI ProDSS® multi-parameter probe. These data collections occurred monthly and concurrent with deployment and downloads of the continuous data loggers, starting May 1 and ending October 31, 2019, in accordance with the schedule listed in Table 2.

Table 2: 2019 Water Quality Sampling and Data Download Schedule

Data Type	4/29	5/1	5/13	5/30	6/27	8/1	8/29	9/30	10/31
Continuous DO/Temperature	NA	Deploy[1]	x	x	x	x	x	x	X Retrieve
Discrete Multi-parameter	x	NA	x	x	x	x	x	x	x

Note:
NA = Not applicable, no data collected.
[1] = Continuous data collection began on May 1, 2019.
X = Data collection and/or data download.

4.2. Sediment Contaminant Sampling

Three transects were established in the reservoir: Lower Reservoir (LRSS), Middle Reservoir (MRSS), and Upper Reservoir (URSS). Along each transect, three sediment samples were collected on September 25, 2019 and composited for shipment and analysis. The Lower Reservoir transect was sampled in duplicate. Sediment sampling transects and locations are shown in Figure 1above. The composited sediment samples were analyzed for the following parameters:

- Total PCBs
- Mercury
- Percent Moisture
- Oil and Grease
- Total Phosphorus
- Total Organic Carbon
- Metals: Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, and Zinc

Sediment samples were collected and processed following the methodologies outlined in *EPA-823-B-01-002 – Methods for Collection, Storage, and Manipulation of Sediments for Chemical and Toxicological Analyses*. Samples were shipped to Pace Analytical Laboratory for analysis.

4.3. Data Analysis and Processing

Upon completion of the field data collection effort, all data was checked for errors and omissions. For monitoring stations utilizing primary and secondary data loggers, data were preferentially reported and analyzed from the primary data logger at each station with a few exceptions. In those instances when anomalies were identified with the data, data from the second data logger was reviewed to address the anomaly. Instream flow data (e.g., U.S. Geological Survey gauging stations) and Constantine Project operational data (i.e., MW production converted to discharge) were also reviewed to understand the data. Verified data is presented as tables and/or plots to illustrate the information. Descriptive statistics (e.g., minimum, maximum, mean, median) were calculated to further characterize the data.

4.4. Equipment Calibration and Quality Assurance

The field measurement equipment used during this study included the following:

- Onset HOBO Model U26 DO/Temperature Loggers were used to monitor continuous temperature and DO. The water temperature sensor is accurate to ± 0.2 degrees Celsius (°C). Prior to deployment, each data logger was fitted with a new RDO Basic Sensor and anti-fouling cap. The DO sensor has a seven month use life and is accurate to ± 0.2 mg/L.
- A YSI ProDSS multi-parameter water quality meter was outfitted with temperature, specific conductance, pH, and DO sensors. It was used to collect discrete multi-parameter water quality data. The unit was also used to collect water quality parameters prior to deployment of data loggers. The accuracy of the YSI's sensor array as specified by the manufacturer is presented in Table 3.

Table 3: YSI ProDSS Sensor Specifications

Sensor	Accuracy
Temperature	± 0.2°C
DO	0 to 20 mg/L: ± 0.1 mg/L or 1% of reading, whichever is greater
Specific conductance	0 to 100 mS/cm: ±0.5% of reading or 0.001 mS/cm, whichever is greater
pH	± 0.2 pH units

Prior to the first deployment, units were calibrated in the GLEC laboratory and then field calibrated on-site per the manufacturer instructions. Data loggers were also field calibrated according to manufacturer instructions prior to each subsequent deployment. Prior to each day's instantaneous sample collection, the YSI ProDSS was checked against a suite of standards, and adjustments were made to the calibration according to manufacturer instructions.

A Quality Assurance Project Plan (QAPP) was developed by GLEC. Throughout the study, the designated Quality Assurance Officer was responsible for monitoring and verifying implementation of the quality assurance and quality control procedures. Additionally, the Quality Assurance Officer reviewed the study's intermediate and final products and worked with the Project Leader to ensure consistency and adherence to the plan.

5. Study Results

Water quality characteristics and conditions in the reservoir, power canal, tailrace, and bypass reach during the 2019 study period are detailed in this section. Several water quality plots are presented in the appendices to this report. Appendix A presents time series plots for the continuous temperature and DO at all monitoring stations on a monthly basis to illustrate temperature and DO along the longitudinal profile of the study reach. Monthly time periods were selected to better illustrate diurnal patterns and magnitudes of change at each monitoring station under varying flow conditions.

The continuous data logger plots provided in Appendix B present DO and temperature data collected at individual monitoring stations during the 6-month study period on a monthly basis. Monthly time periods were selected to better illustrate diurnal patterns and magnitudes of change at each monitoring station under varying flow conditions.

Discrete multi-parameter data provided in Appendix C includes time series plots for each water quality parameter and allows for comparison of water quality conditions across monitoring stations.

5.1. Continuous Dissolved Oxygen and Temperature Monitoring

The range, mean, and median of temperature and DO readings collected during continuous monitoring in the study area is presented in Table 4 below, and monthly plots are provided in Appendix B for each station. Water temperatures between stations had consistent daily and seasonal patterns, and ranged from a minimum of 8.78°C at the bypass reach downstream of the Fawn River on October 31, 2019 to a maximum of 29.20°Cin the power canal on July 20, 2019.The bypass reach upstream and downstream of the Fawn River generally had lower water temperatures than the reservoir, power canal, and tailrace.

With the exception of the bypass reach downstream of the Fawn River, water temperatures recorded at all monitoring stations were below the month-by-month state regulatory thresholds outlined in Section 1.1. Beginning on October 1 and ending on October 2, 2019, temperatures above 21.1°C were recorded in the bypass reach downstream of the Fawn River for 26 consecutive hours. The temperature readings during this time ranged from 21.12°C to 21.48°C. Fourteen of the 26 readings were within 0.2°C (temperature probe accuracy is ±0.2°C) of the state threshold.

DO ranged from a minimum of 1.06 mg/L at the bypass reach upstream of the Fawn River on August 21, 2019 to a maximum of 15.48 mg/L on September 23, 2019 also at the bypass reach upstream of the Fawn River. This lowest fluctuation in DO corresponds to the dates when it was suspected that water was not flowing over the water control structure upstream of the bypass reach. The highest fluctuation in DO (15.48 mg/L) is an anomaly and likely due to an equipment malfunction since the value is much greater than the saturation value for DO at those temperatures.

The tailrace and bypass reach upstream and downstream of the Fawn River experienced instantaneous DO concentrations below the state threshold of 4.0 mg/L. On July 16, 2019, DO in the tailrace fell below 4.0 mg/L for multiple hours between 07:00 and 13:00. The bypass reach upstream of the Fawn River experienced a total of eight days in August and ten days in September where instantaneous DO readings were below 4.0 mg/L. The bypass reach downstream of the Fawn River experienced three days in August where the instantaneous DO concentration dropped below the state threshold.

DO concentrations dropped below the daily average threshold of 5.0 mg/L at three locations. The daily average DO in the tailrace dropped below 5.0 mg/L on July 16, 2019 with an average reading of 4.61 mg/L. The bypass reach downstream of the Fawn River experienced two days where DO was below the daily average threshold: July 21, 2019(average DO was 4.87 mg/L) and August 19, 2019 (average DO was 4.99 mg/L). The bypass reach upstream of the Fawn River had

10 days on which the DO fell below the daily average threshold: August 20, 21, 27, 28, and 29, with average DO values of 3.79, 2.28, 3.16, 2.44, and 4.26 mg/L, respectively and September 16, 17, 18, 19, and 20, with average DO values of 4.23, 3.86, 4.03, 4.18, and 4.91 mg/L, respectively.

Table 4: Range of Continuous Temperature and DO Readings from May 1 to October 31, 2019

Monitoring Station	Temperature (°C)				DO (mg/L)			
	Max	Min	Mean	Median	Max	Min	Mean	Median
WQ1 - Reservoir	28.66	9.00	20.52	21.36	11.43	4.43	8.09	7.99
WQ2 - Power Canal	29.20	9.20	20.72	21.52	13.30	5.11	8.56	8.54
WQ3 - Tailrace	28.82	9.20	20.61	21.47	11.84	2.73	8.50	8.49
WQ4 - Bypass Reach Upstream of the Fawn River	26.60	9.14	18.52	19.20	15.48	1.06	8.25	8.40
WQ5 - Bypass Reach Downstream of the Fawn River	29.06	8.78	20.29	21.21	10.45	2.34	7.14	6.98

During the course of the study, several anomalies were noted with the instrumentation. Below is a list of those anomalies and how they affected data collection. These instances are also listed below the corresponding plots in Appendices A and B.

1. On or around May 21, 2019, it is suspected that both loggers in the tailrace were pushed up onto the concrete ledge due to upwelling. The primary logger was damaged during this action and quit recording on May 21 while the secondary logger continued to record data from what could have been a position above the water. Because of the damage to the primary logger, data from the secondary logger was used for the month of May. The primary logger was replaced on May 30, 2019.
2. Tailrace logger data had two instances where the DO readings were suspect. These instances were from June 12-21, 2019 and from July 14-19, 2019. These were possibly due to turbulence or shock from upwelling at this location. No secondary logger data was available for comparison due to a malfunction with the secondary logger.
3. The secondary logger in the bypass reach upstream of the Fawn River did not record data from May 30 through June 27, 2019. Data from the primary logger was used for May 30 through June 27, 2019.
4. Both loggers located in the bypass reach upstream of the Fawn River were discovered to be missing on August 1, 2019. No data exists for that location for June 27 through August 1, 2019.
5. During the visit on August 29, 2019, nearly all of the water from the reservoir was being routed through the power canal. There was little to no flow through the bypass reach during that visit. The exact date that this process began is unknown, but it is believed that it began somewhere between August 14 and 20, 2019. The data from both locations in the bypass reach show large drops in DO in mid- to late August. During the visit on September 30, 2019, water was once again flowing through the bypass reach.
6. The secondary logger in the tailrace was not working from September 30 through October 31, 2019. Data from the primary logger was used for that month.

7. The secondary logger data was used for the bypass reach downstream of the Fawn River from August 29 to September 30, 2019. The plot for the primary logger data showed an odd section of low DO data during that time.
8. For the month of August, data from the primary logger at the bypass reach downstream of the Fawn River was used with the exception of August 17 at 11:00 through August 22, 2019 at 11:00. Data from the secondary logger was used for that time period due to oddly low DO readings observed with the primary data.
9. From August 1 to August 29, 2019, data from the secondary logger was used for the power canal.

5.2. Discrete Multi-parameter Water Quality Sampling

Water temperature, DO concentration, specific conductance, and pH were collected at the monitoring stations during eight sampling events, as summarized in Table 5 below and detailed in Appendix C. Water quality sampling was conducted approximately 1.0 meter below the water's surface at each monitoring station. Water temperature, pH values, and DO concentrations recorded during *in situ*, discrete sampling events all fell below the state thresholds for temperature, pH, and DO.

On average, water temperatures were lowest in the bypass reach downstream of the Fawn River (17.3°C). The lowest recorded *in situ* water temperature was 8.7°C at the bypass reach downstream of the Fawn River on October 31, 2019. The highest temperature (24.3°C) was also recorded at the bypass reach downstream of the Fawn River on June 27, 2019.

With the exception of the October 31, 2019 *in situ* measurement, the bypass reach downstream of the Fawn River consistently had the lowest measured DO concentration among monitoring sites as well as the lowest average DO concentration (8.01 mg/L). The average DO concentration was highest in the bypass reach upstream of the Fawn River (8.89 mg/L). The highest measured *in situ* DO concentration (10.81 mg/L) occurred in the power canal on April 29, 2019.

Specific conductance was, on average, highest in the bypass reach downstream of the Fawn River (529 µS/cm). Average specific conductance values for the other four monitoring sites ranged from 508 to 509 µS/cm. The highest discrete specific conductance value was recorded on August 1, 2019 in the bypass reach downstream of the Fawn River and was 555 µS/cm. The lowest discrete value was recorded on September 30, 2019 in the bypass reach upstream of the Fawn River (475 µS/cm).

Average pH was lowest in the bypass reach downstream of the Fawn River (7.74) and highest in the bypass reach upstream of the Fawn River (8.01). The lowest *in situ* pH was recorded in the bypass reach downstream of the Fawn River on May 30, 2019 (7.42) and the highest *in situ* pH (8.29) was recorded in both the power canal and the bypass reach upstream of the Fawn River on April 29, 2019.

Table 5: 2019 Discrete Multi-parameter Water Quality Results

Temperature (°C)									
Monitoring Station	**4/29**	**5/13**	**5/30**	**6/27**	**8/1**	**8/29**	**9/30**	**10/31**	**Mean**
WQ1 -Reservoir	12.4	12.6	21.2	23.9	23.7	21.6	17.7	9.2	**17.8**
WQ2 - Power Canal	12.3	12.5	21.0	24.0	23.8	21.5	17.7	9.2	**17.8**
WQ3 - Tailrace	12.0	12.5	21.0	24.1	24.1	21.5	17.8	9.2	**17.8**
WQ4 - Bypass Reach Upstream of the Fawn River	12.4	12.5	21.0	24.1	23.8	20.2	17.8	9.2	**17.6**
WQ5 - Bypass Reach Downstream of the Fawn River	11.4	12.3	21.0	24.3	23.1	19.9	17.5	8.7	**17.3**
Dissolved Oxygen (mg/L)									
Monitoring Station	**4/29**	**5/13**	**5/30**	**6/27**	**8/1**	**8/29**	**9/30**	**10/31**	**Mean**
WQ1 - Reservoir	10.46	9.51	7.79	7.06	8.23	8.58	7.15	9.70	**8.56**
WQ2 - Power Canal	10.81	9.62	7.53	7.20	8.15	8.57	7.23	9.72	**8.60**
WQ3 - Tailrace	10.46	9.55	7.68	7.40	8.47	8.54	7.61	10.20	**8.74**
WQ4 - Bypass Reach Upstream of the Fawn River	10.61	10.01	8.19	7.85	8.47	7.77	8.68	9.50	**8.89**
WQ5 - Bypass Reach Downstream of the Fawn River	10.11	8.67	6.82	6.75	7.13	7.07	7.05	10.50	**8.01**
Specific Conductance(µS/cm)									
Monitoring Station	**4/29**	**5/13**	**5/30**	**6/27**	**8/1**	**8/29**	**9/30**	**10/31**	**Mean**
WQ1 - Reservoir	530	494	509	501	536	498	476	522	**508**
WQ2 - Power Canal	528	496	509	501	536	498	476	524	**509**
WQ3 - Tailrace	529	495	508	501	535	498	477	523	**508**
WQ4 - Bypass Reach Upstream of the Fawn River	528	494	507	500	535	513	475	523	**509**
WQ5 - Bypass Reach Downstream of the Fawn River	518	521	524	527	555	546	523	521	**529**
pH Value									
Monitoring Station	**4/29**	**5/13**	**5/30**	**6/27**	**8/1**	**8/29**	**9/30**	**10/31**	**Mean**
WQ1 - Reservoir	8.26	7.95	7.47	7.73	8.07	7.86	8.03	7.92	**7.91**
WQ2 - Power Canal	8.29	7.86	7.65	7.67	7.79	7.94	7.88	7.86	**7.87**
WQ3 - Tailrace	8.26	7.94	7.69	7.82	8.10	7.94	8.03	8.04	**7.98**
WQ4 - Bypass Reach Upstream of the Fawn River	8.29	7.98	7.79	7.97	8.10	7.87	7.94	8.11	**8.01**
WQ5 - Bypass Reach Downstream of the Fawn River	8.07	7.68	7.42	7.56	7.79	7.70	7.76	7.95	**7.74**

5.3. Sediment Sampling

Pace Analytical Laboratory conducted the analysis on the Constantine reservoir sediment samples collected on September 25, 2019. A summary of the results is listed in Table 6 below and the full report from Pace Analytical is presented in Appendix D. The results are reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Table 6: Summary of Sediment Results for the Constantine Reservoir, Collected September 25, 2019

Analyte (Method)	Units	LRSS: Lower Reservoir Sediment Sample (MDL)	LRSSD: Lower Reservoir Sediment Sample Duplicate (MDL)	MRSS: Middle Reservoir Sediment Sample (MDL)	URSS: Upper Reservoir Sediment Sample (MDL)
PCB, Total (EPA 8082)	ug/kg	<110 (110)	<111 (111)	<94.0 (94.0)	<155 (155)
Mercury (EPA 7471)	mg/kg	**0.16** (0.043)	**0.19** (0.044)	**0.13** (0.035)	0.12[1] (0.060)
Percent Moisture (ASTM 02974-87)	%	**77.2** (0.10)	**77.6** (0.10)	**73.4** (0.10)	**83.8** (0.10)
Oil and Grease (EPA 9071)	mg/kg	**1,900**[1] (1,810)	<1,720 (1,720)	2,120[1] (1,540)	2,800[1] (2,480)
Total Phosphorus EPA 365.4)	mg/kg	**830** (77.0)	**828** (63.2)	**808** (59.7)	**1,190** (109)
Mean Total Organic Carbon (EPA 9060)	mg/kg	**98,200** (7,560)	**103,000** (9,030)	**82,100** (9920)	**131,000** (15,700)
Total Metals (EPA 6010)					
Arsenic	mg/kg	28.8 (6.2)	23.9 (6.1)	18.7 (5.1)	**30.2** (8.6)
Cadmium	mg/kg	0.78[1](0.57)	0.93[1] (0.56)	<0.47 (0.47)	**<0.78** (0.78)
Chromium	mg/kg	**16.4** (1.2)	**17.0** (1.2)	**13.4** (0.98)	**20.3** (1.6)
Copper	mg/kg	**24.2** (1.2)	**26.4** (1.2)	**22.6** (0.97)	**24.5** (1.6)
Lead	mg/kg	**30** (2.5)	**35.0** (2.5)	**24.4** (2.1)	**29.4** (3.5)
Nickel	mg/kg	**11.2** (1.1)	**12.3** (1.1)	**9.3** (0.93)	**14.8** (1.6)
Selenium	mg/kg	<5.6 (5.6)	<5.5 (5.5)	<4.6 (4.6)	<7.7 (7.7)
Silver	mg/kg	<1.3 (1.3)	<1.3 (1.3)	<1.1 (1.1)	<1.8 (1.8)
Zinc	mg/kg	**93.2** (5.1)	**104** (5.0)	**84.2** (4.2)	**87.8** (7.0)

MDL = Adjusted Method Detection Limit.
[1]Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

6. Summary and Discussion

In general, the DO and water temperature plots demonstrate a typical diurnal fluctuation that is reflective of day and night respiration (dissolved oxygen) and the relatively rapid change in water temperature due to changes in air temperature. However, there were several instances when this pattern was interrupted possibly due to meter malfunctioning, meter desiccation (temporarily out of the water) or vandalism. Specifically;

- the mid-June and mid-July DO data for the tailrace,
- rapidly declining DO and temperature data in late August for the bypass reach upstream of the Fawn River,
- the rapid decline and then increase in water temperature mid- to late September in the tailrace, and
- spikes in DO to levels greater than saturation in late September in the bypass reach upstream of the Fawn River.

In each instance the anomalies were investigated by reviewing the field conditions, maintenance and calibration logs and the data from the secondary data logger (if available) to determine the problem.

Primary observations from the Water Quality Study include:

- DO readings fell within state threshold limits for the entire duration of the study in both the reservoir and power canal. Water temperature readings were below the monthly maximum threshold limits in the reservoir, power canal, tailrace, and the bypass reach upstream of the Fawn River.

- The monthly water temperature threshold was exceeded on October 1 and 2, 2019 in the bypass reach downstream of the Fawn River for 26 consecutive instantaneous measurements. However, 14 of the 26 measurements were above the threshold by only 0.2°C, which is within the accuracy range of the temperature probe. It's possible that water temperature at this location may be heavily influenced by warm water coming from the Fawn River rather than exceedances only attributable to influences in the St. Joseph River.

- In the tailrace, instantaneous DO readings as well as the daily average DO were below state thresholds on July 16, 2019. Due to probe damage and malfunction as listed in Section 5.1, only one logger was recording in the tailrace in July and so there was not a second set of data to verify these low readings. DO values recorded at all other water quality monitoring stations were above the thresholds on this day.

- Instantaneous DO readings below the state threshold were recorded on August 7, 18, and 19, 2019 in the bypass reach downstream of the Fawn River. The daily average DO fell below the threshold on July 21, 2019 and August 19, 2019 for this location.

In the bypass reach upstream of the Fawn River, instantaneous DO values below the threshold were recorded on eight days in August and ten days in September. For five of those days in August and five in September, the daily average DO also fell below the state threshold. During the data download event on August 29, 2019, the field crew observed that no significant river flow was present in the bypass reach due to the fact that the water surface elevation at that time was below the top surface of the control structure. The DO data suggests that this diversion of water to the power canal began somewhere between August 14 and August 20, 2019. On August 20, 2019, both the instantaneous DO threshold of 4.0 mg/L and the daily average threshold of 5.0 mg/L were exceeded in the bypass reach upstream of the Fawn River. These exceedances persisted on and off through September 25, 2019. During the fish collection event on September 26-28, 2019, conducted as part of the Fisheries Survey for the Project relicensing, the field crew noted that the water surface elevation at that time was again below the top surface of the control structure. Heavy rain was observed during the fish collection event and the DO data shows that concentrations rose shortly after that. The majority of the DO exceedances observed during the Water Quality Study correspond to water diversion out of the bypass reach and into the power canal.

Sediment Chemistry

Sediment analysis results were compared to published sediment quality guidelines (SQG) (MacDonald et al. 2000, Ingersoll et al. 2002, GeoEngineer 2015, and WDNR 2003) to determine the relative risk to aquatic life and human health. Relative risk to aquatic life was determined by comparing the sediment analysis to Probable Effect Levels (PEL), Threshold Effect Levels (TEL), Effect Range Median (ERM) and Effect Range Low (ERL). Sediment concentrations of various contaminants that exceed the SQG may adversely affect aquatic life. Total PCB and mercury were also assessed, but those chemicals are likely to have a greater effect on human health than aquatic life and are also discussed in the fish tissue results section of the Fisheries Survey study report.

With the exception of mercury, lead and arsenic, each analyte concentration in the Constantine reservoir sediments were measured at concentrations less than the most restrictive SQG (TEL).

Mercury

The sediment mercury concentration in the LRSS duplicate sample slightly exceeded the TEL (0.17 mg/kg) at 0.19 mg/kg in the duplicate sample. Mercury was measured at 0.16 mg/kg in the other sample. These concentrations were less than the other three SQG values. Mercury concentrations at or below the TEL are unlikely to cause adverse effects to aquatic life.

Lead

Lead concentrations in the LRSS duplicate sample were equal to the TEL and ERL SQG at 35 mg/kg. Lead concentrations in the other LRSS sample and in the other two reservoir locations (middle reservoir and upper reservoir) were all less than any of the SQGs used. Lead concentrations at or below the TEL and ERL are unlikely to cause adverse effects to aquatic life.

Arsenic

Arsenic concentrations in the LRSS samples exceeded the PEL (17 mg/kg). The LRSS lead concentration was measured at 28.8 mg/kg. Arsenic levels at this concentration would likely cause adverse effects to aquatic life.

With the above noted exceptions, the contaminants measured in the Constantine reservoir are not likely to have an adverse effect on aquatic life or human health. Mercury and lead concentrations were measured at or near the TEL and ERL which would indicate a very low risk to aquatic life. Arsenic concentrations in the LRSS were measured at concentrations that may adversely affect aquatic life, but were at concentrations less than the median effects level (85 mg/kg). Site specific conditions (e.g., total organic carbon, pH, biotic ligands) will affect the bioavailability and are likely to lessen the effect of arsenic at these concentrations. Consequently, this concentration of arsenic in sediment is likely not a great concern to aquatic life in the sediment.

6.1. Variances from FERC-Approved Study Plan

The Water Quality Study was conducted in full conformance with the RSP, with the exception of the following variances:

- On or around May 21, 2019, it is suspected that both loggers in the tailrace were pushed up onto the concrete ledge due to upwelling. The primary logger was damaged during this action and quit recording on May 21 while the secondary logger continued to record data from what could have been a position above the water. Because of the damage to the primary logger, data from the secondary logger was used for the month of May. The primary logger was replaced on May 30, 2019.
- Both the primary and secondary continuous temperature and DO loggers were discovered to be missing from the bypass reach upstream of the Fawn River during the monthly download on August 1, 2019. No data exists for that location for June 27 to August 1, 2019.A new primary logger was placed at the site on August 1, 2019. A secondary logger was added the following month. The data collected during this time period from the other water quality monitoring stations suggests that no major adverse events occurred between June 27 and August 1, 2019.
- The Commission's SPD recommended that I&M modify the Water Quality Study to remove the sediment contaminant sampling component. However, based on I&M's experience at other projects on the St. Joseph River, I&M decided to proceed with the data collection and analysis.

7. References

GeoEngineer. 2015. Sediment Quality Guidelines (SQGs): A Review and Their Use in Practice. https://www.geoengineer.org/education/web-class-projects/cee-549-geoenvironmental-engineering-fall-2015/assignments/sediment-quality-guidelines-sqgs-a-review-and-their-use-in-practice

Indiana Michigan Power (I&M). 2018. Constantine Hydroelectric Project (FERC No. 10661). Notice of Intent and Pre-Application Document. Federal Energy Regulatory Commission, Washington, D.C. June 4, 2018.

Indiana Michigan Power (I&M). 2019. Constantine Hydroelectric Project (FERC No. 10661). Filing of Revised Study Plan for Relicensing Studies. Federal Energy Regulatory Commission, Washington, D.C. March 15, 2019

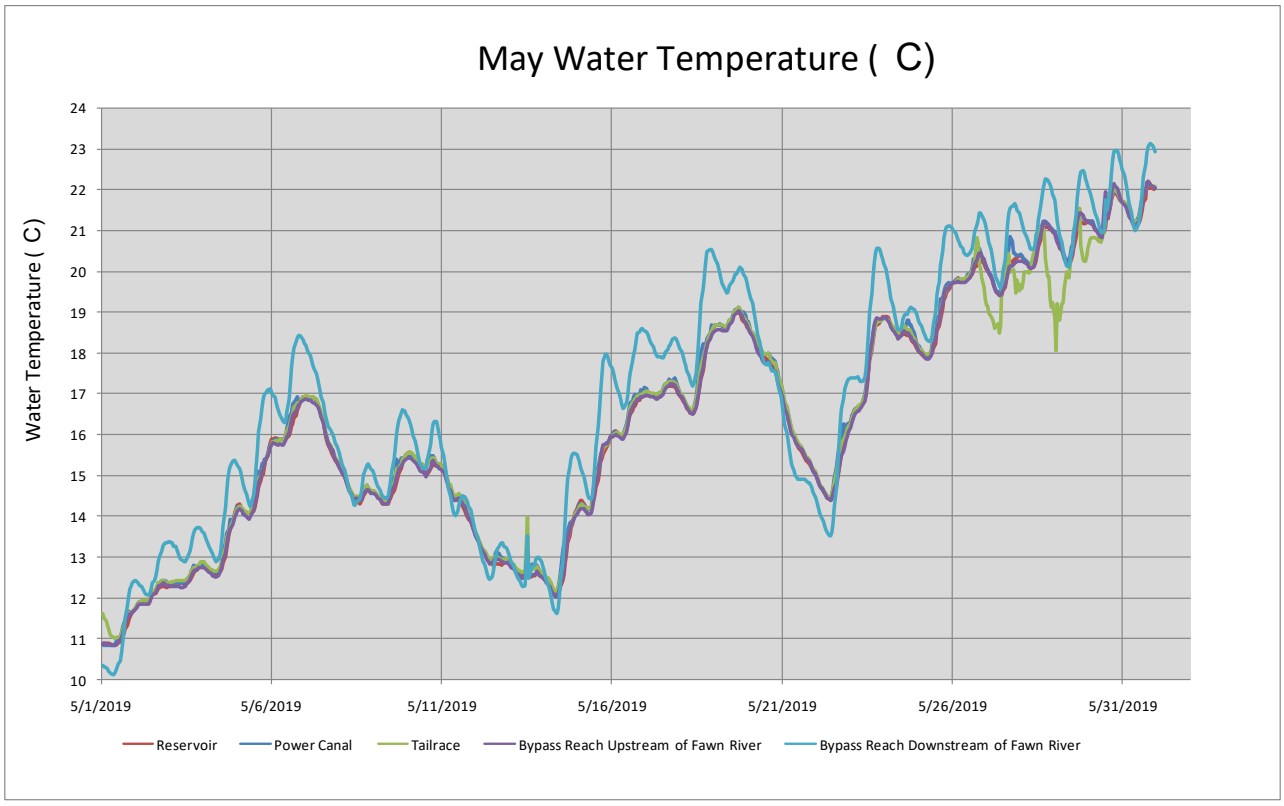
Ingersoll, Christopher G., Wenning, Richard J. 2002. "Use of Sediment Quality Guidelines and Related Tools for the Assessment of Contaminated Sediments: Executive Summary of a SETAC Pellston Workshop". Society of Environmental Toxicology and Chemistry.

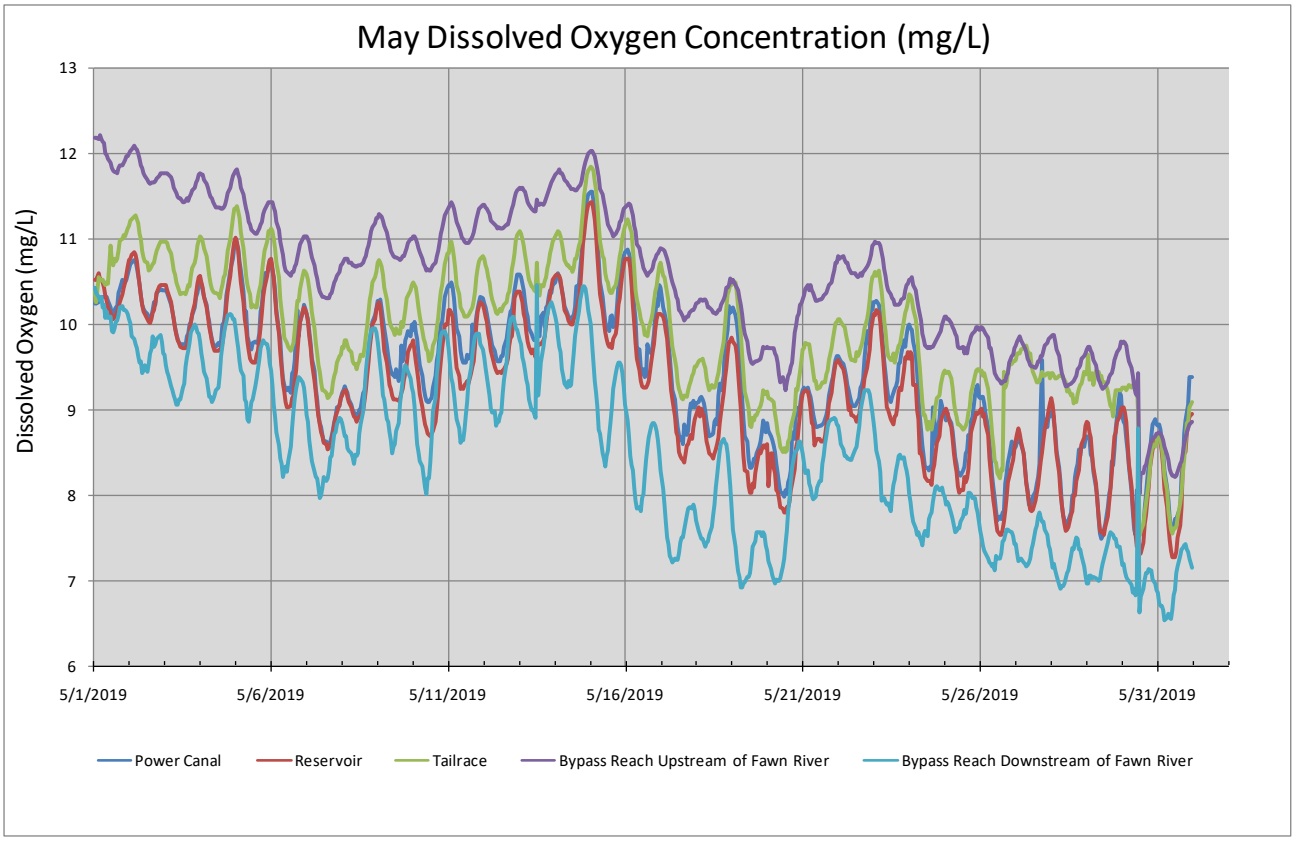
MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. Arch. Environ. Contam. Toxicol. 39:20- 31.

Michigan Department of Environmental Quality (MDEQ). 2016. Water Bureau. Water Resources Protection. January 13, 2006. Part 4 Water Quality Standards. www.michigan.gov/documents/deq/wrd-rules-part4_521508_7.pdf

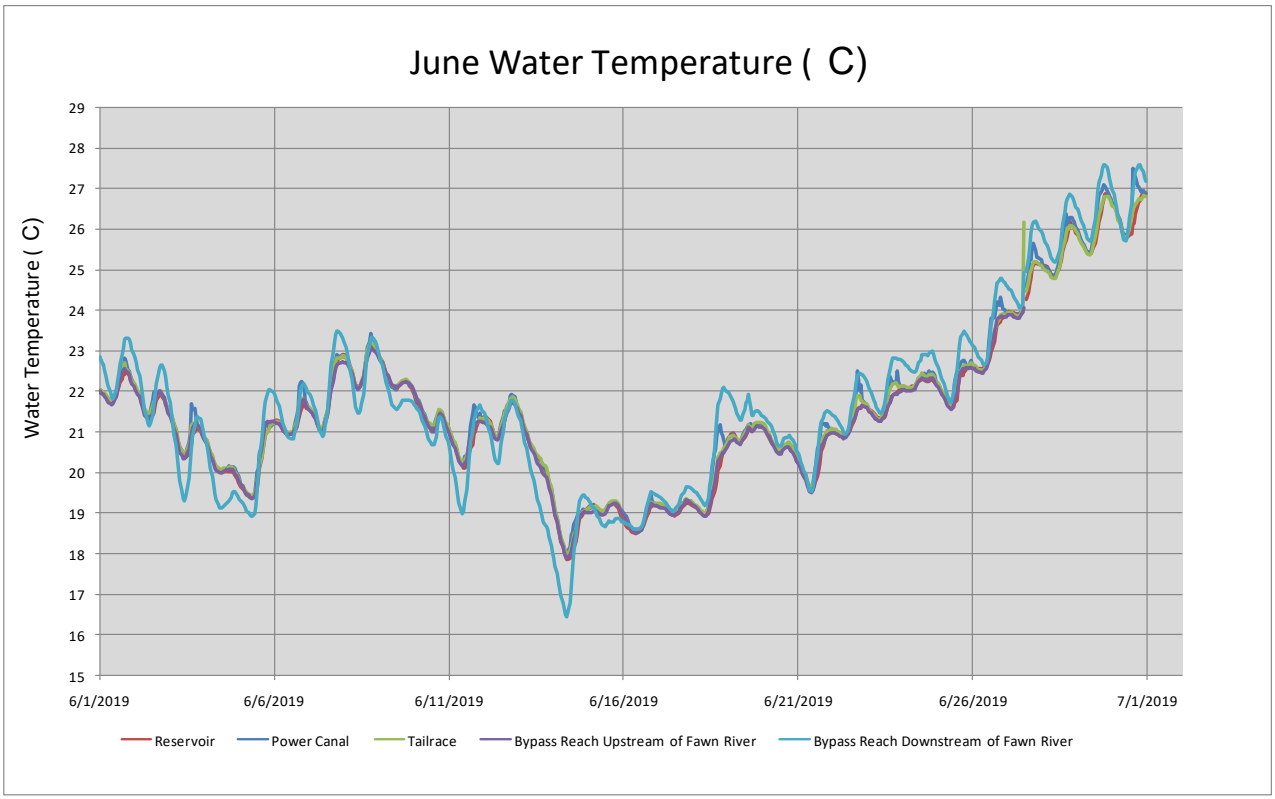
Wisconsin Department of Natural Resources (WDNR). 2003. "Consensus-Based Sediment Quality Guidelines: Recommendations for Use & Application." Contaminated Sediment Standing Team.

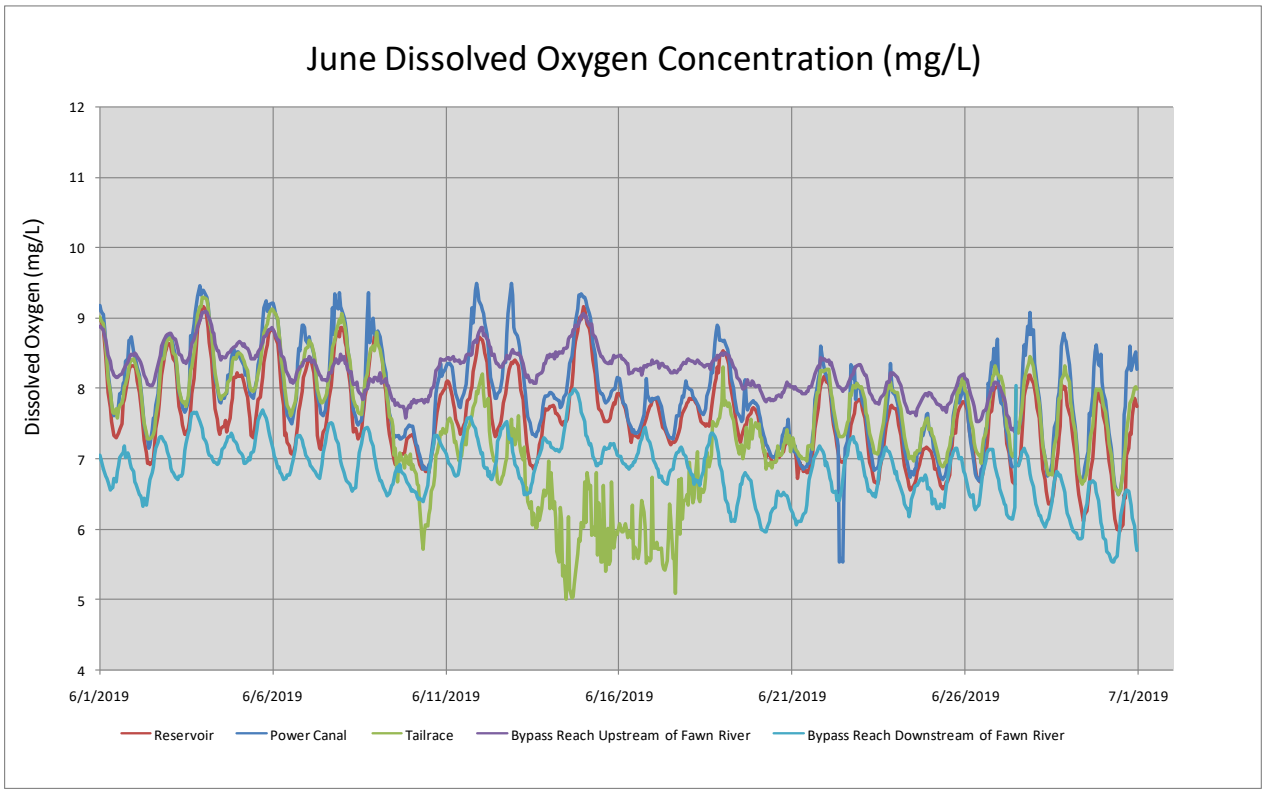
Appendix A
Combined Continuous Water Temperature and Dissolved Oxygen Plots



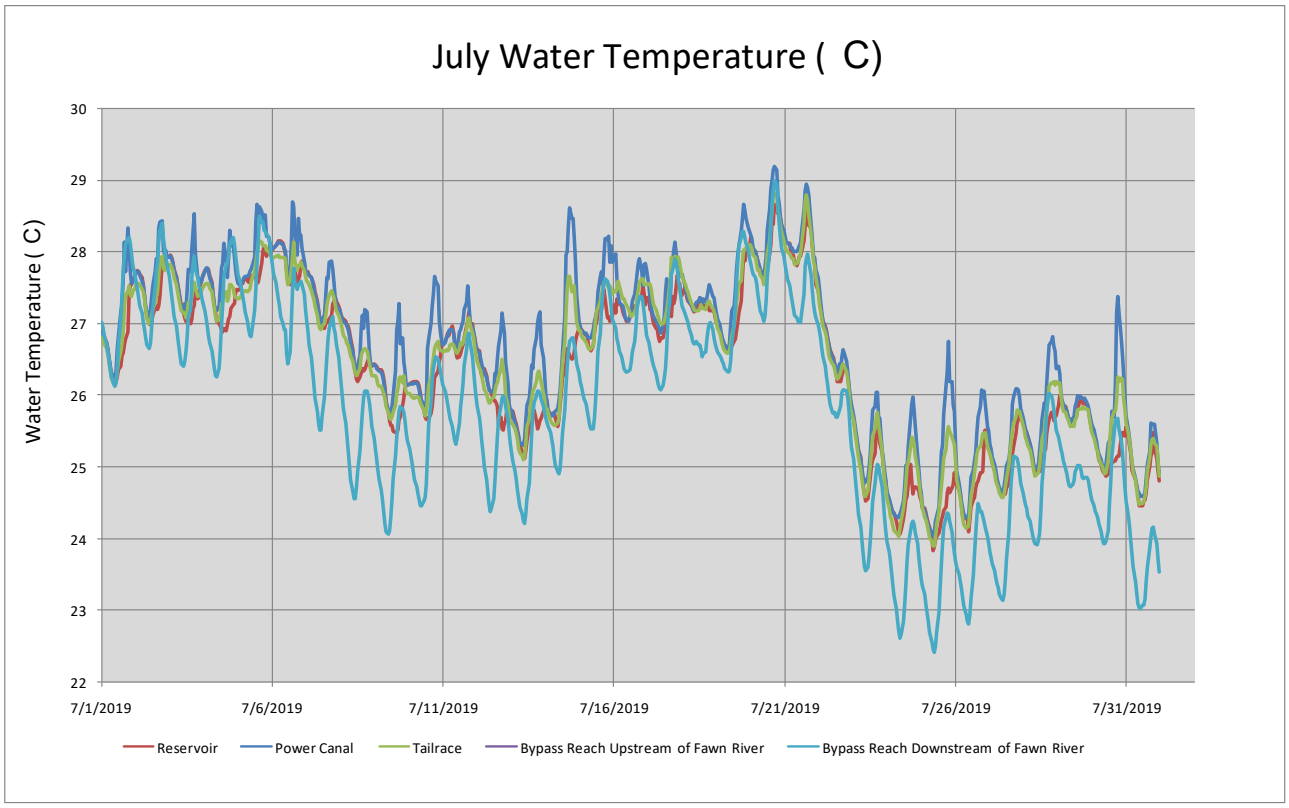


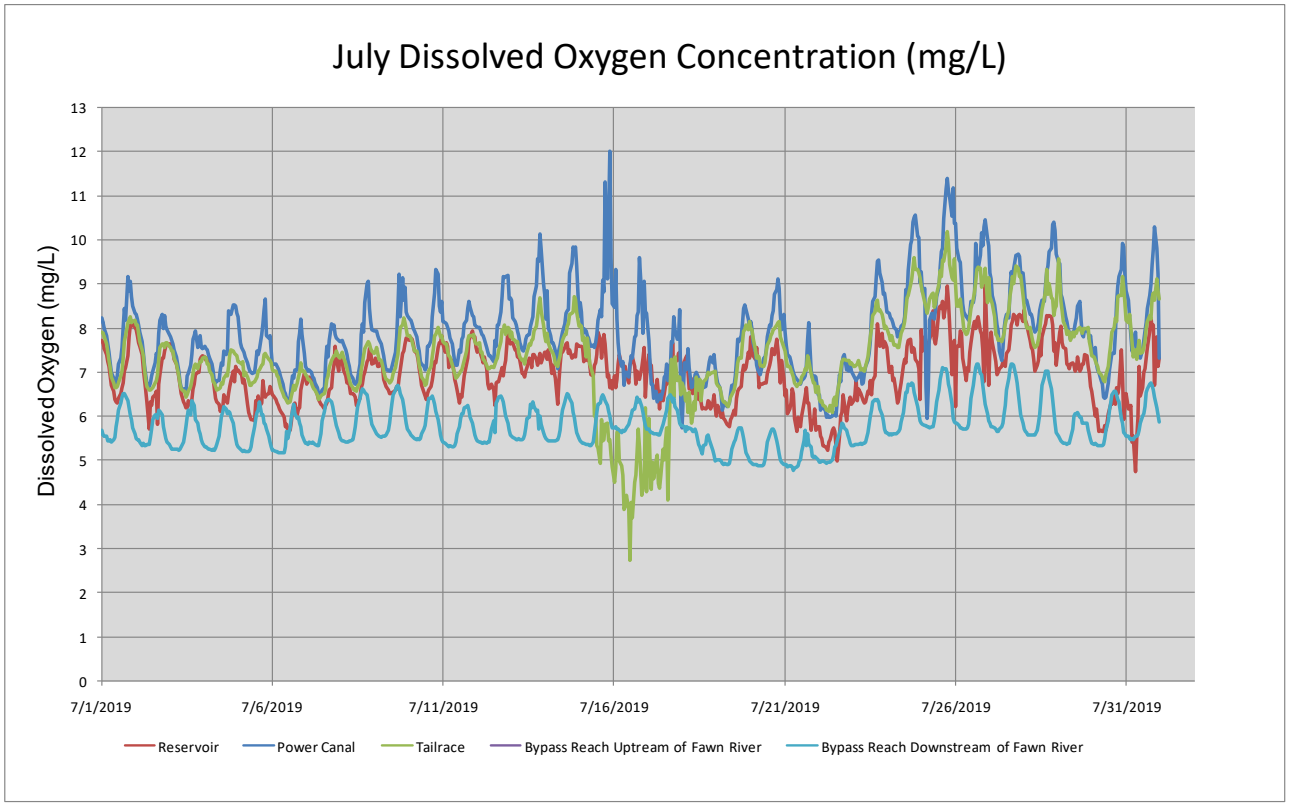
*On or around May 21, 2019, both loggers in the tailrace were pushed up onto the concrete ledge due to upwelling. The primary logger was damaged during this action and quit recording on May 21 while the secondary logger continued to record data from above the water. Because of the damage to the primary logger, data from the secondary logger was used for May 1 to May 21, 2019. The primary logger was replaced on May 30, 2019.





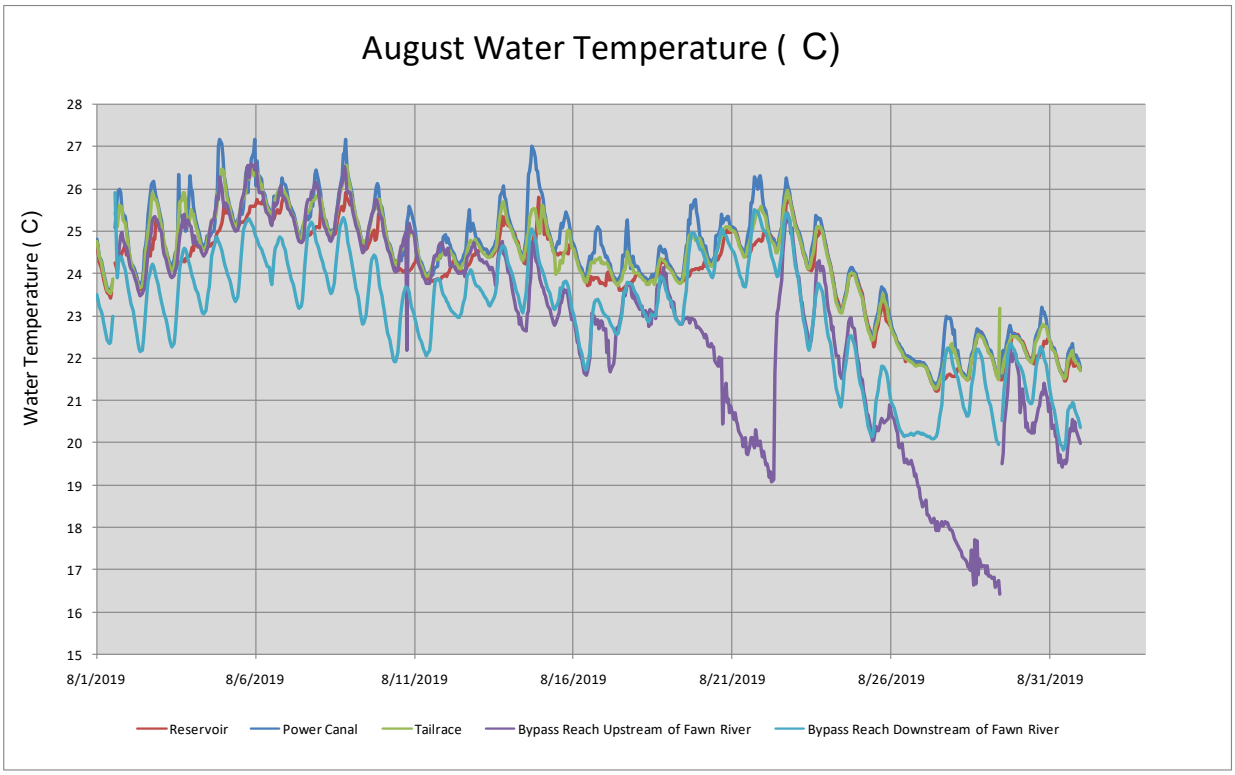
*Tailrace logger data had two instances where the DO readings were suspect. These instances were from June 12-21, 2019 and from July 14-19, 2019. These were possibly due to turbulence or shock from upwelling at this location. No secondary logger data was available for comparison due to a malfunction with the secondary logger.
*The secondary logger in the bypass reach upstream of the Fawn River did not record data from May 30 through June 27, 2019. Data from the primary logger was used for May 30 through June 27, 2019.
*Both loggers located in the bypass reach upstream of the Fawn River were discovered to be missing on August 1, 2019. No data exists for that location for June 27 through August 1, 2019.

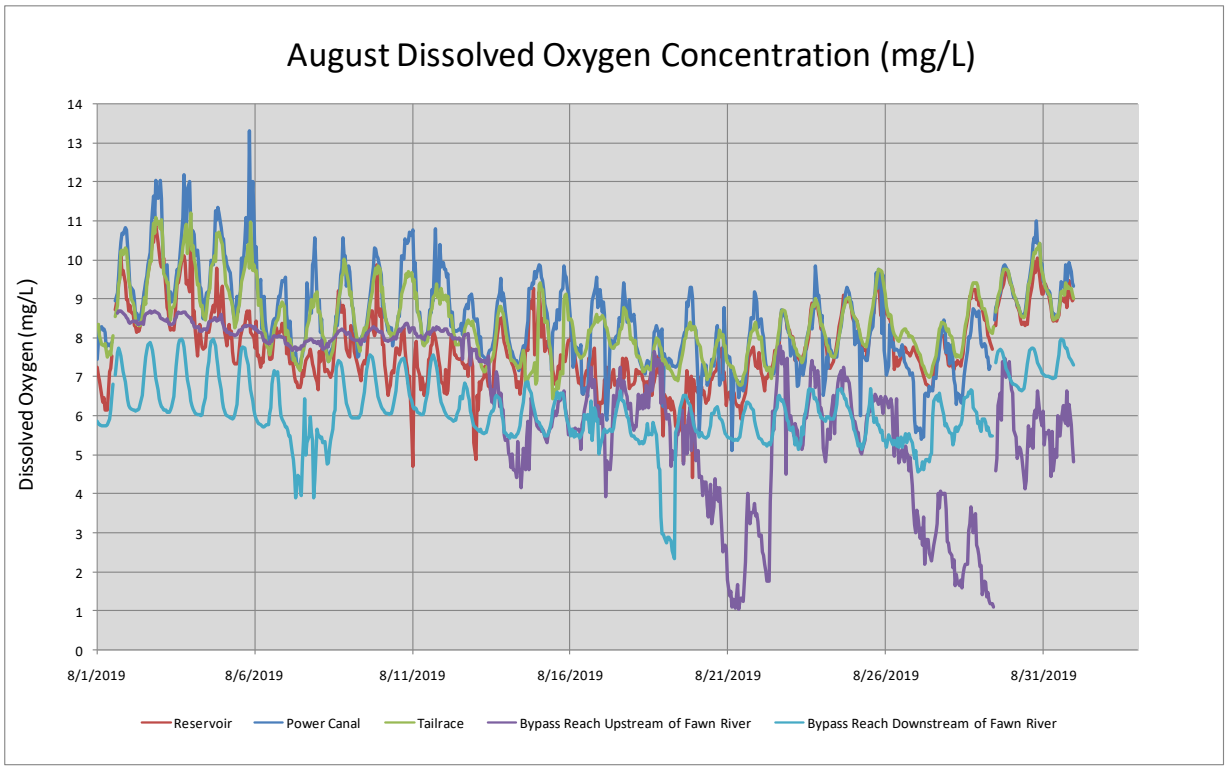




*Both loggers located in the bypass reach upstream of the Fawn River were discovered to be missing on August 1, 2019. No data exists for that location for June 27 through August 1, 2019.

*Tailrace logger data had two instances where the DO readings were suspect. These instances were from June 12-21, 2019 and from July 14-19, 2019. These were possibly due to turbulence or shock from upwelling at this location. No secondary logger data was available for comparison due to a malfunction with the secondary logger.

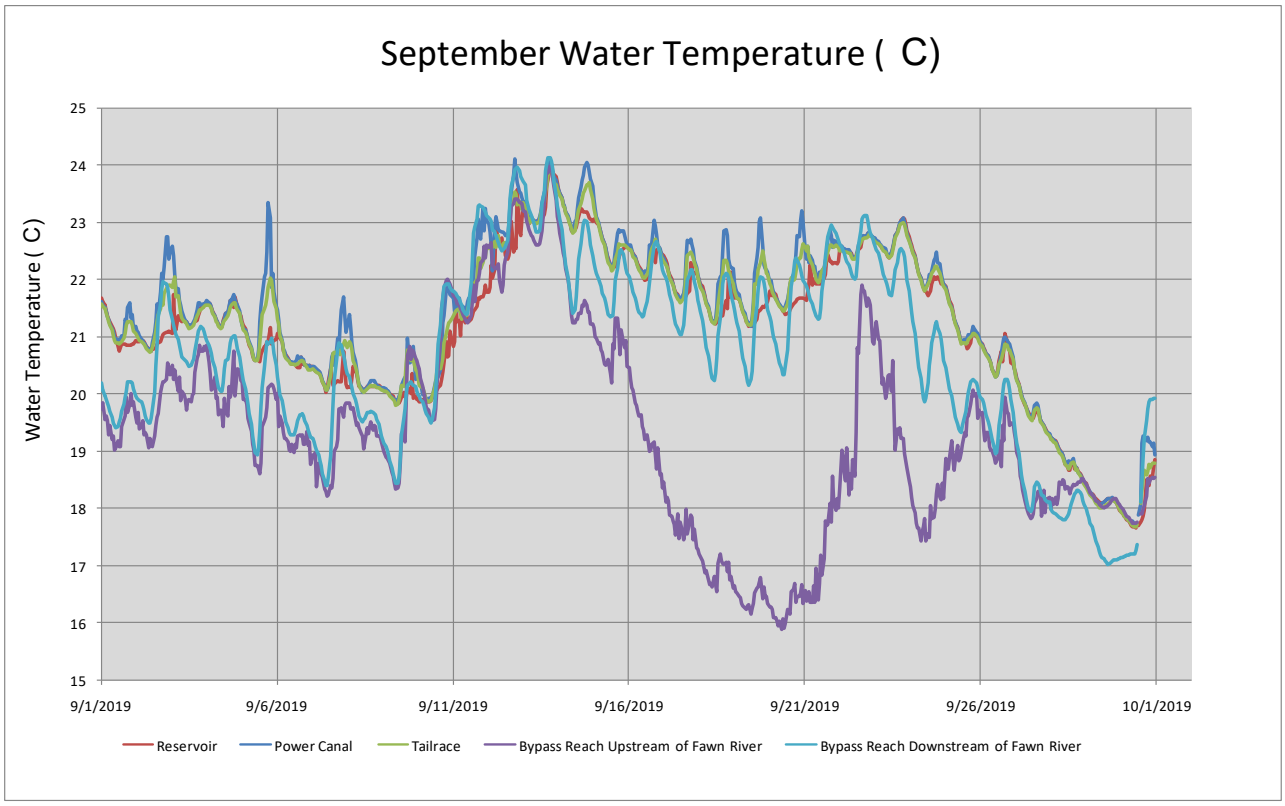


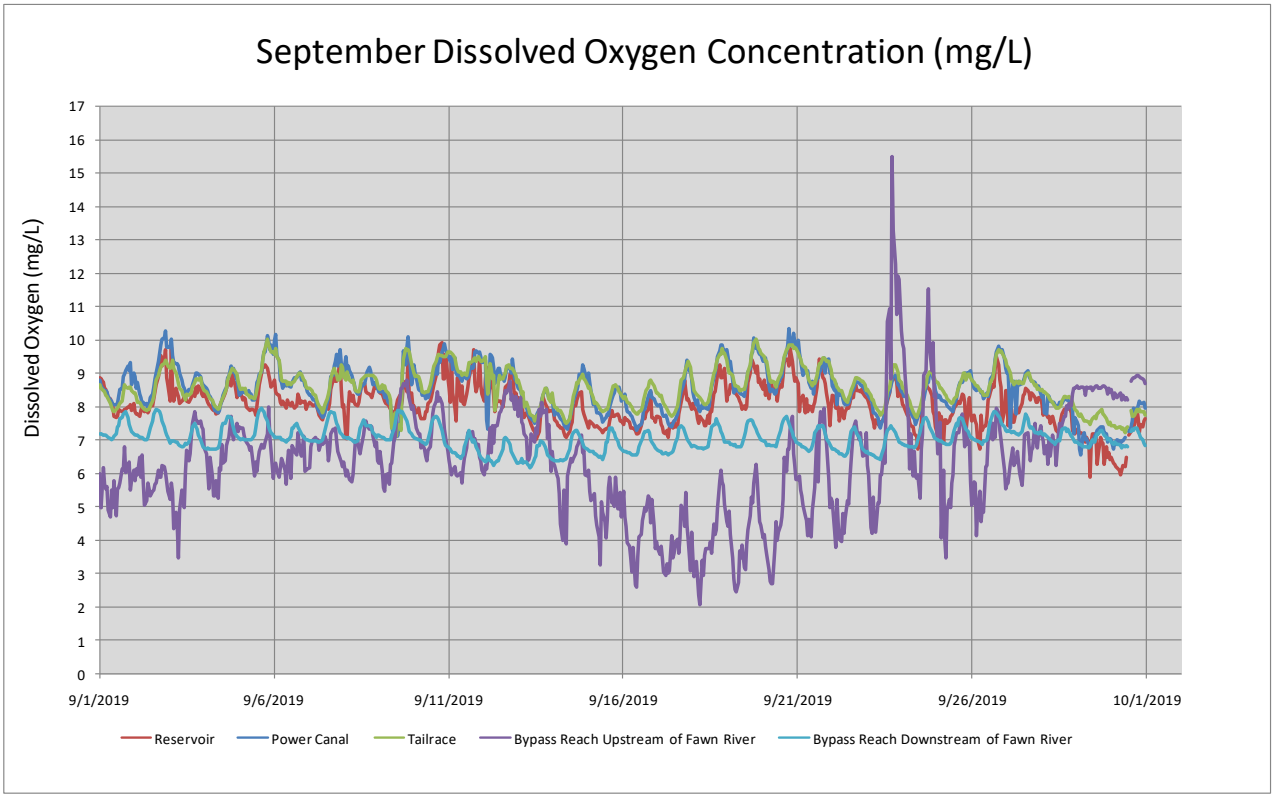


*During the visit on August 29, 2019, nearly all of the water from the reservoir was being routed through the power canal. There was little to no flow through the bypass reach during that visit. The exact date that this process began is unknown, but it is believed that it began somewhere between August 14 and 20, 2019. The data from both locations in the bypass reach show large drops in DO in mid- to late August. During the visit on September 30, 2019, water was once again flowing through the bypass reach.

*For the month of August, data from the primary logger in the bypass reach downstream of the Fawn River was used with the exception of August 17 at 11:00 through August 22, 2019 at 11:00. Data from the secondary logger was used for that time period due to oddly low DO readings observed with the primary data.

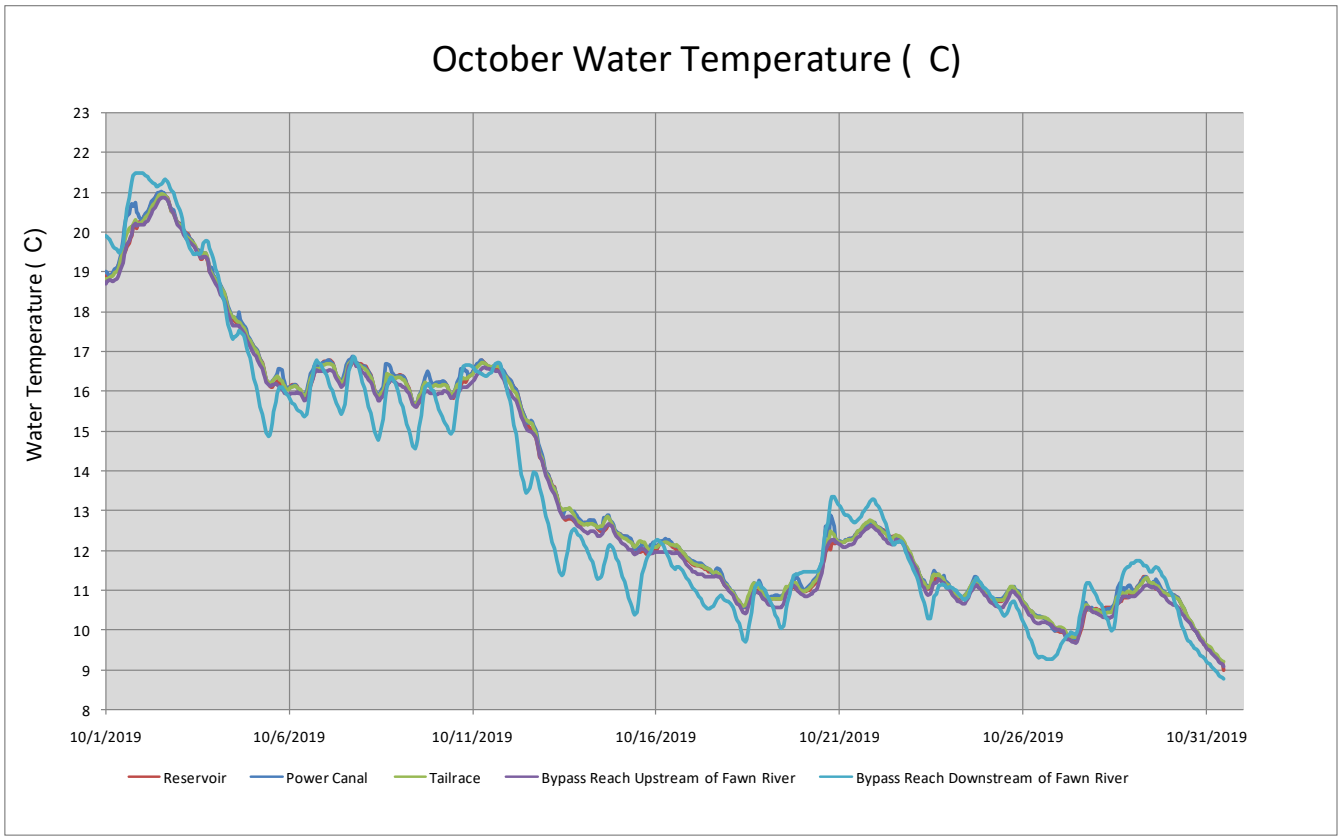
*From August 1 to August 29, 2019, data from the secondary logger was used for the power canal.

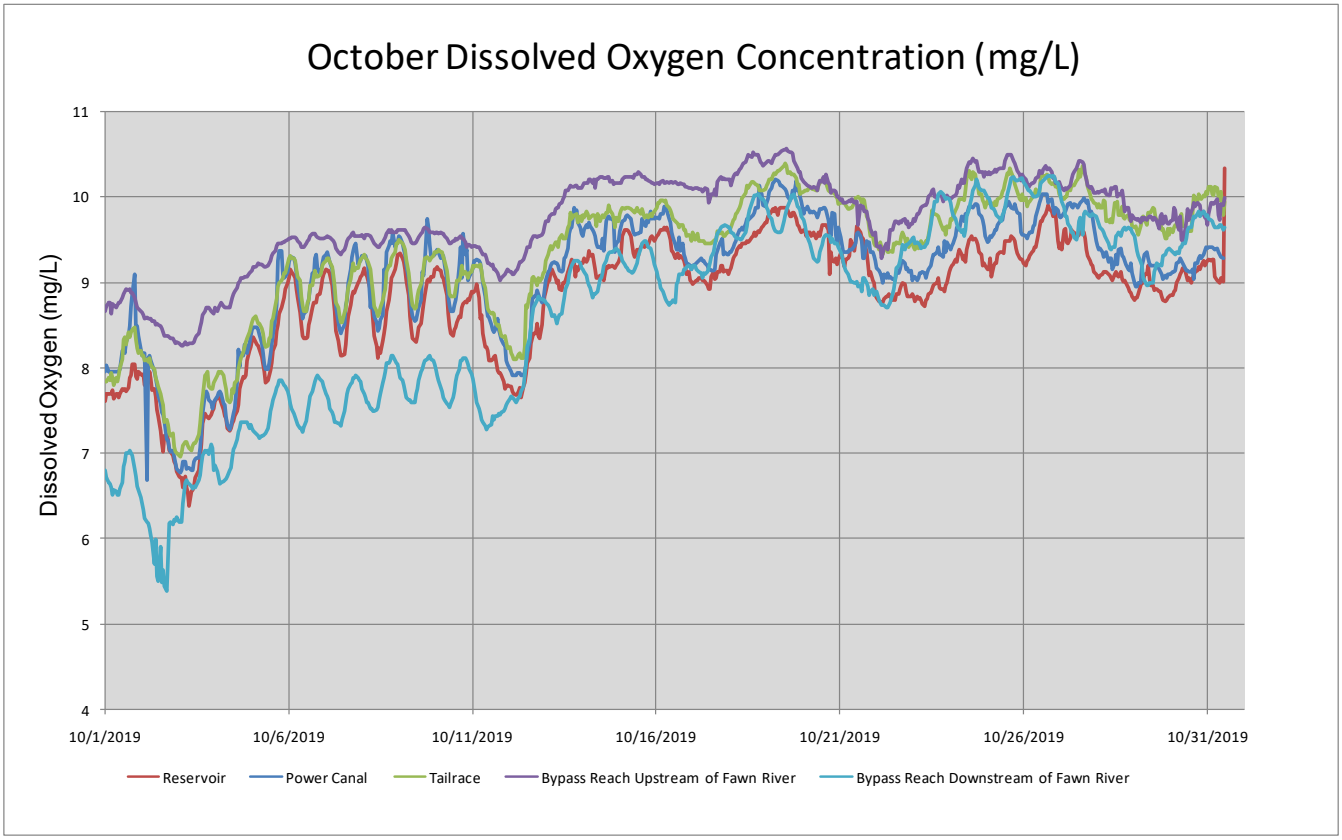




*During the visit on August 29, 2019, nearly all of the water from the reservoir was being routed through the power canal. There was little to no flow through the bypass reach during that visit. The exact date that this process began is unknown, but it is believed that it began somewhere between August 14 and 20, 2019. The data from both locations in the bypass reach show large drops in DO in mid- to late August. During the visit on September 30, 2019, water was once again flowing through the bypass reach.

*The secondary logger data was used for the bypass reach downstream of the Fawn River from August 29 to September 30, 2019. The plot for the primary logger data showed an odd section of low DO during that time.





*The secondary logger in the tailrace was not working from September 30 through October 31, 2019. Data from the primary logger was used for that month.

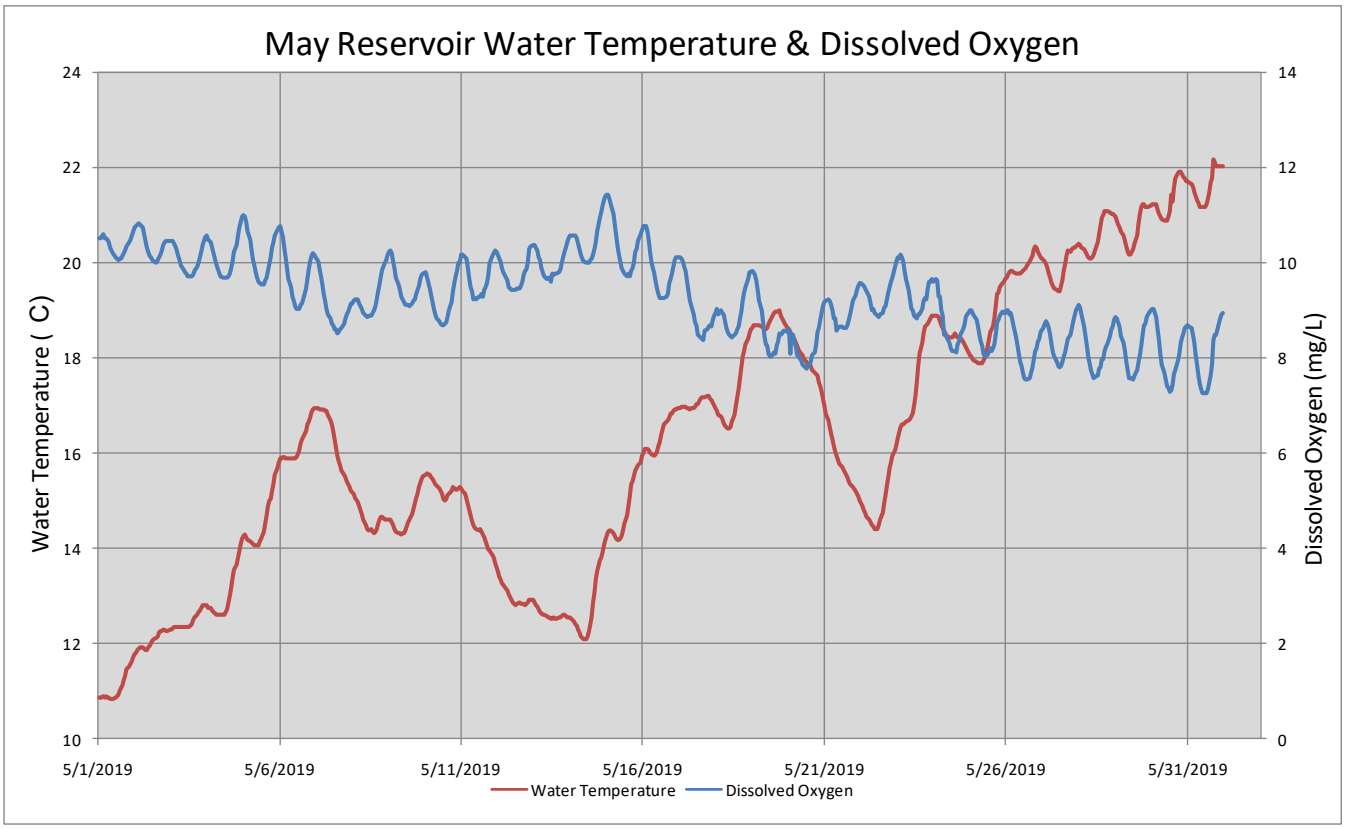
Appendix B

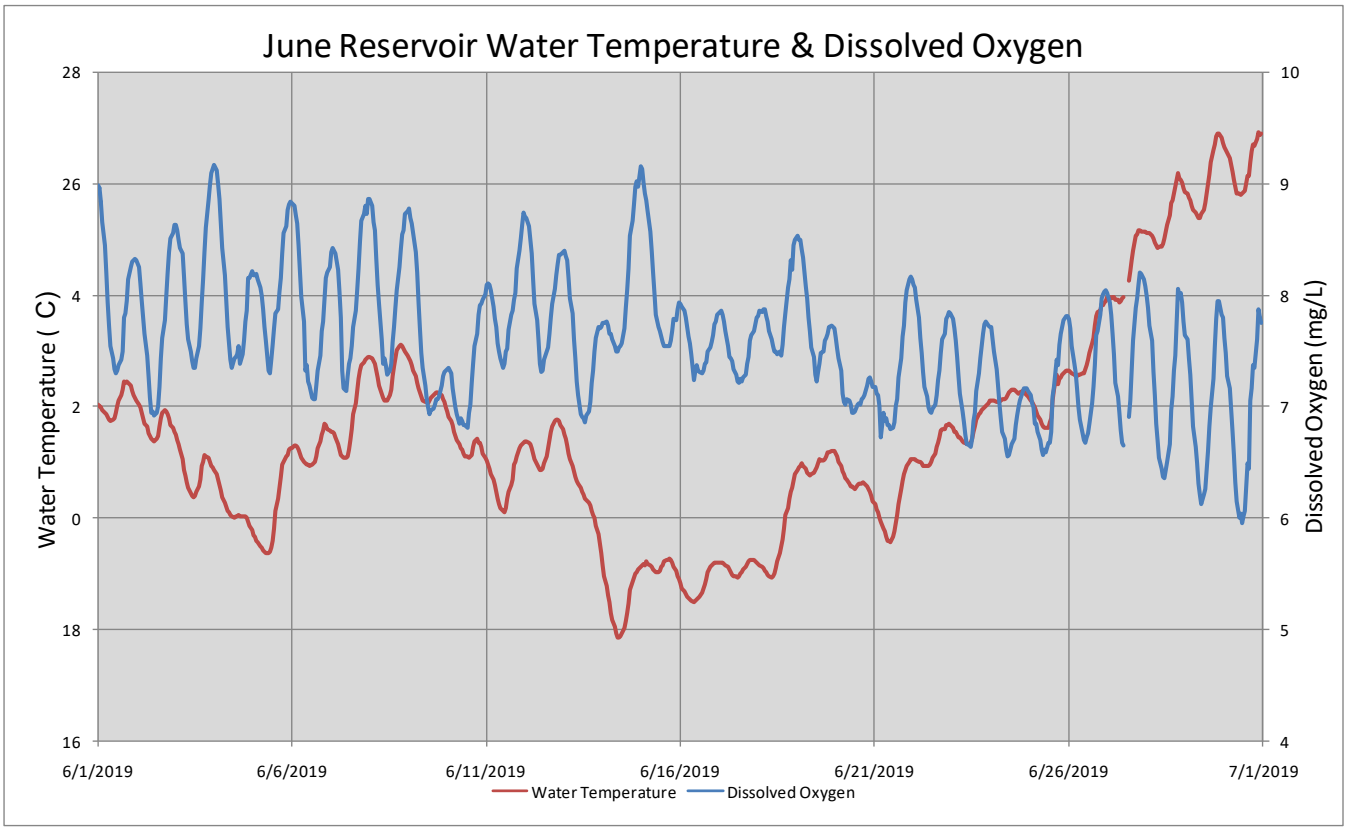
Continuous Water Temperature and Dissolved Oxygen Plots by Monitoring Stations:

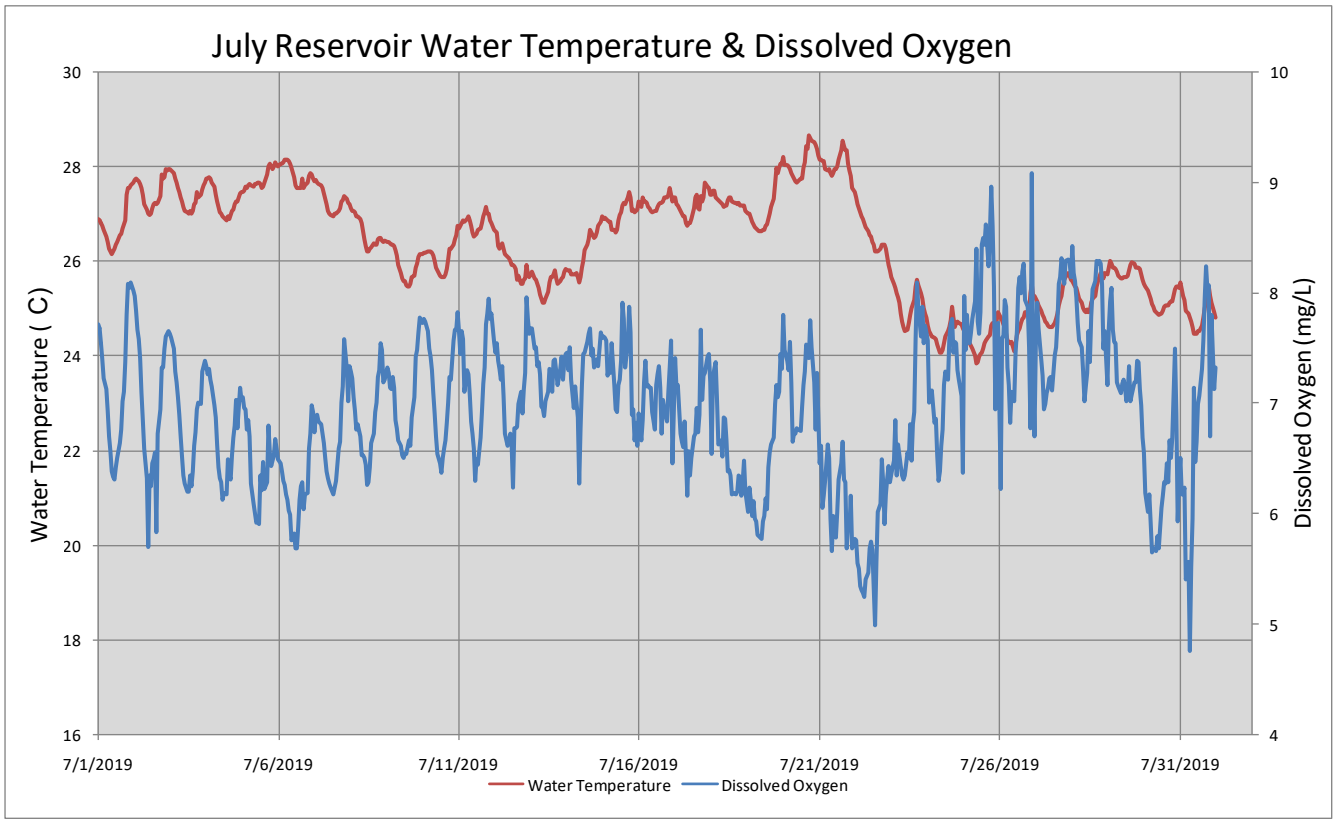
- Reservoir
- Power Canal
- Tailrace
- Bypass Reach Upstream of the Fawn River
- Bypass Reach Downstream of the Fawn River

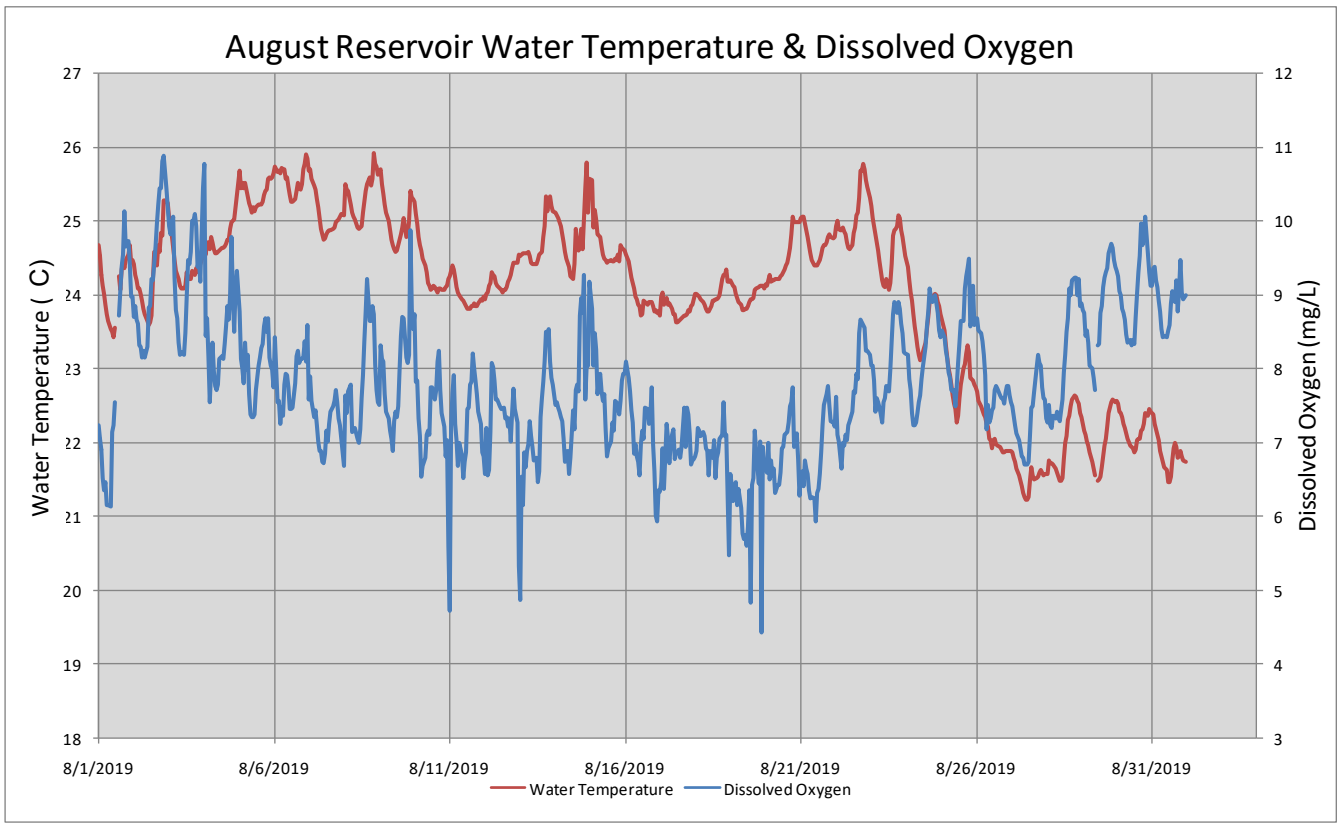
Continuous Water Temperature and Dissolved Oxygen Plots

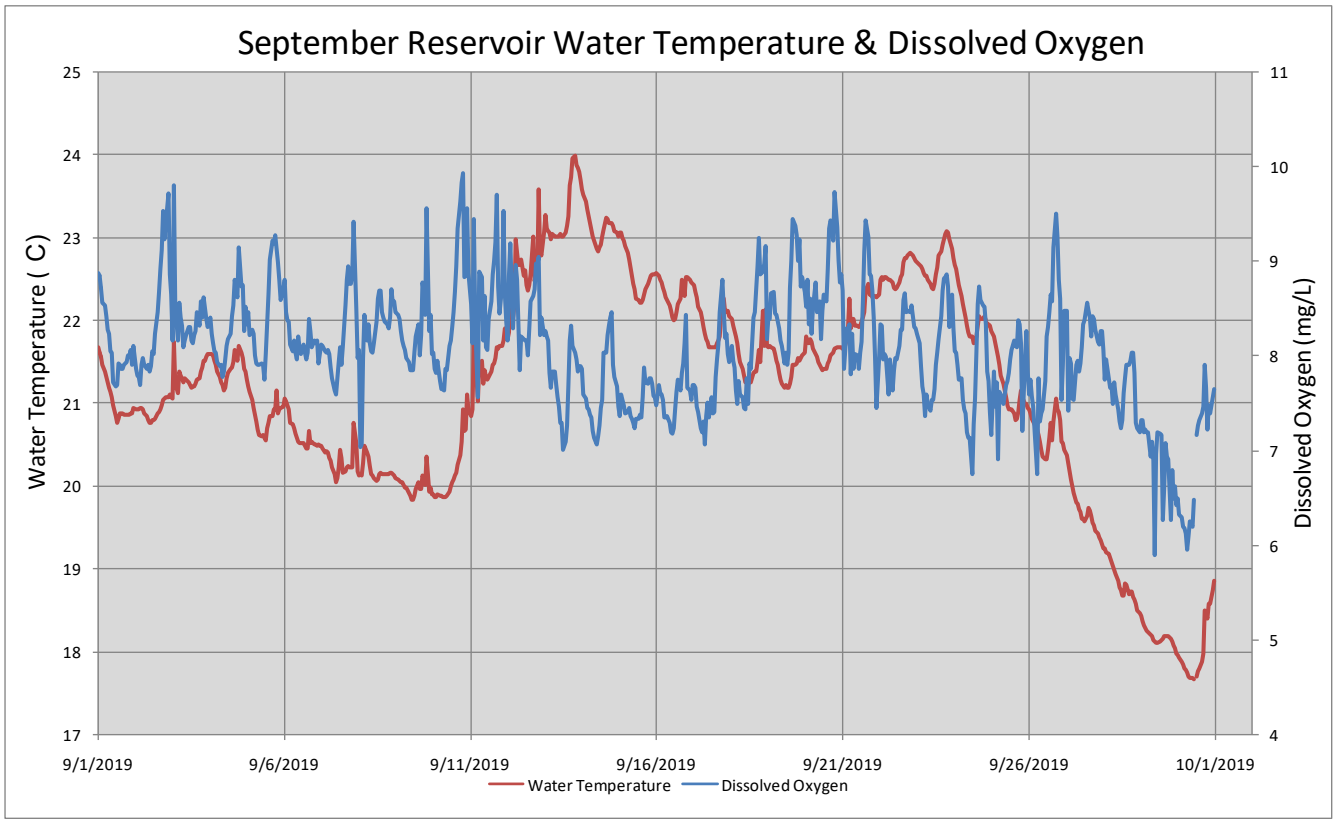
- Reservoir

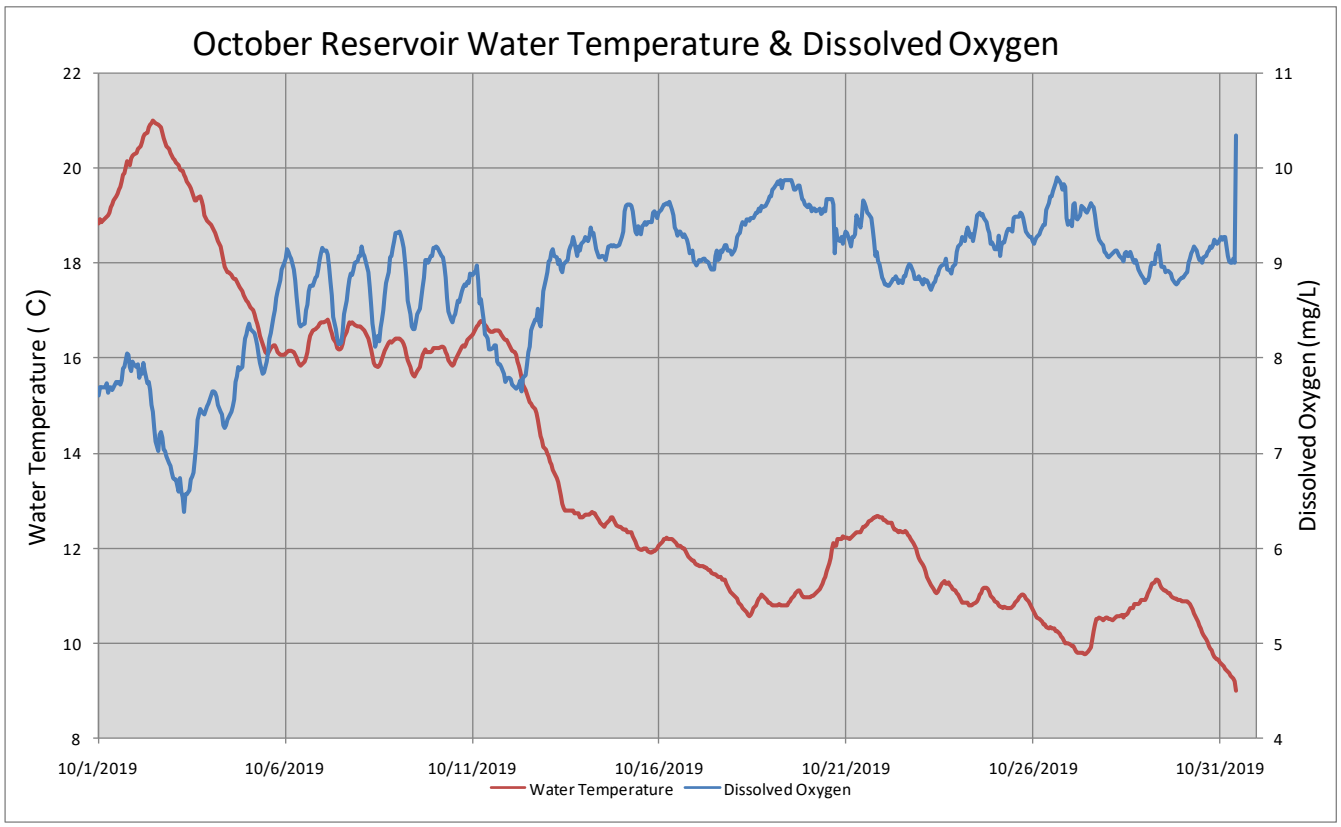

May Reservoir Water Temperature & Dissolved Oxygen
Water Temperature (C)
Dissolved Oxygen (mg/L)
24
22
20
18
16
14
12
10
14
12
10
8
6
4
2
0
5/1/2019
5/6/2019
5/11/2019
5/16/2019
5/21/2019
5/26/2019
5/31/2019
Water Temperature
Dissolved Oxygen


June Reservoir Water Temperature & Dissolved Oxygen
Water Temperature (C)
Dissolved Oxygen (mg/L)
28
26
4
2
0
18
16
10
9
8
7
6
5
4
6/1/2019
6/6/2019
6/11/2019
6/16/2019
6/21/2019
6/26/2019
7/1/2019
Water Temperature
Dissolved Oxygen


July Reservoir Water Temperature & Dissolved Oxygen
Water Temperature (C)
Dissolved Oxygen (mg/L)
30
28
26
24
22
20
18
16
10
9
8
7
6
5
4
7/1/2019
7/6/2019
7/11/2019
7/16/2019
7/21/2019
7/26/2019
7/31/2019
Water Temperature
Dissolved Oxygen

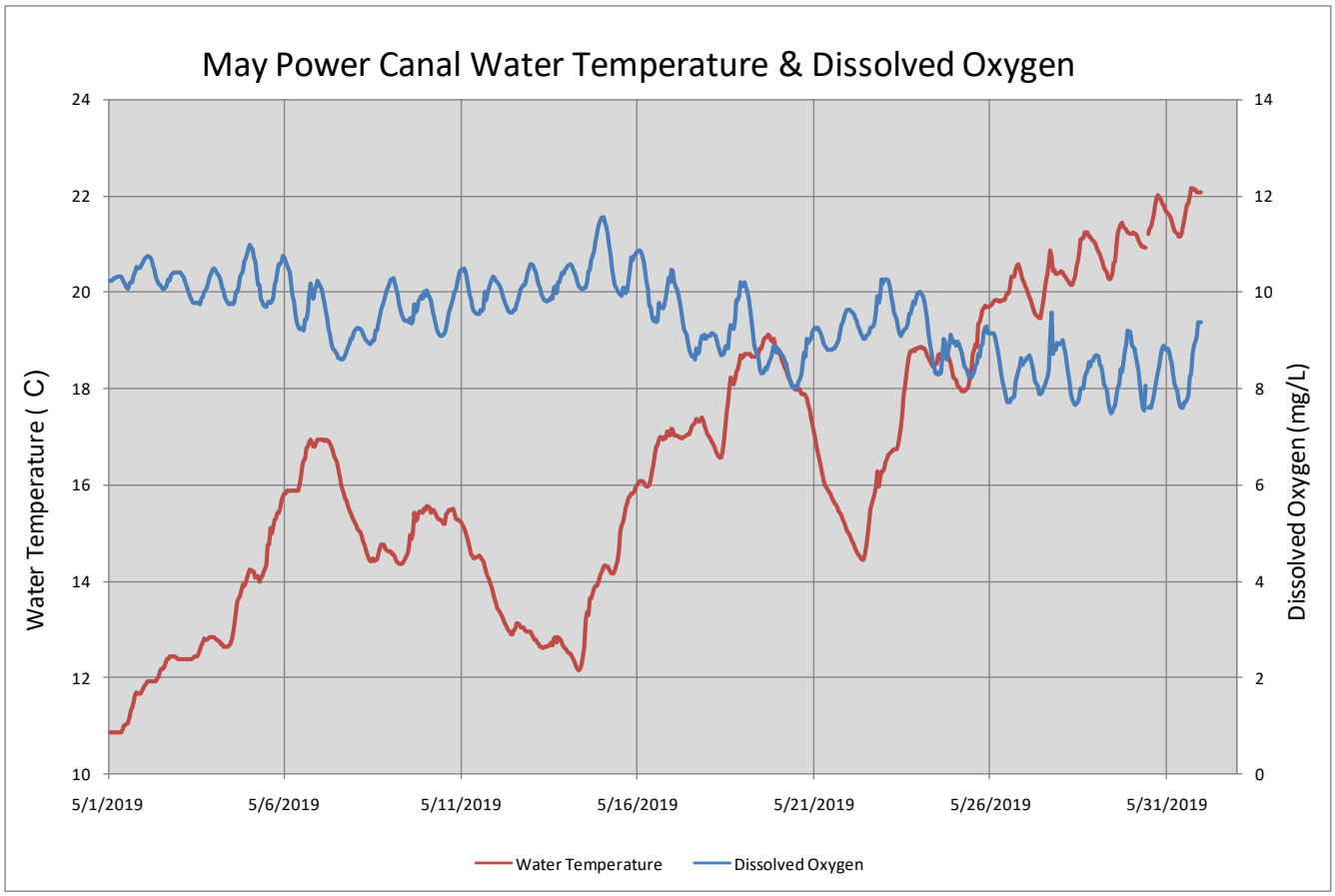

August Reservoir Water Temperature & Dissolved Oxygen
Water Temperature (C)
Dissolved Oxygen (mg/L)
27
26
25
24
23
22
21
20
19
18
12
11
10
9
8
7
6
5
4
3
8/1/2019
8/6/2019
8/11/2019
8/16/2019
8/21/2019
8/26/2019
8/31/2019
Water Temperature
Dissolved Oxygen

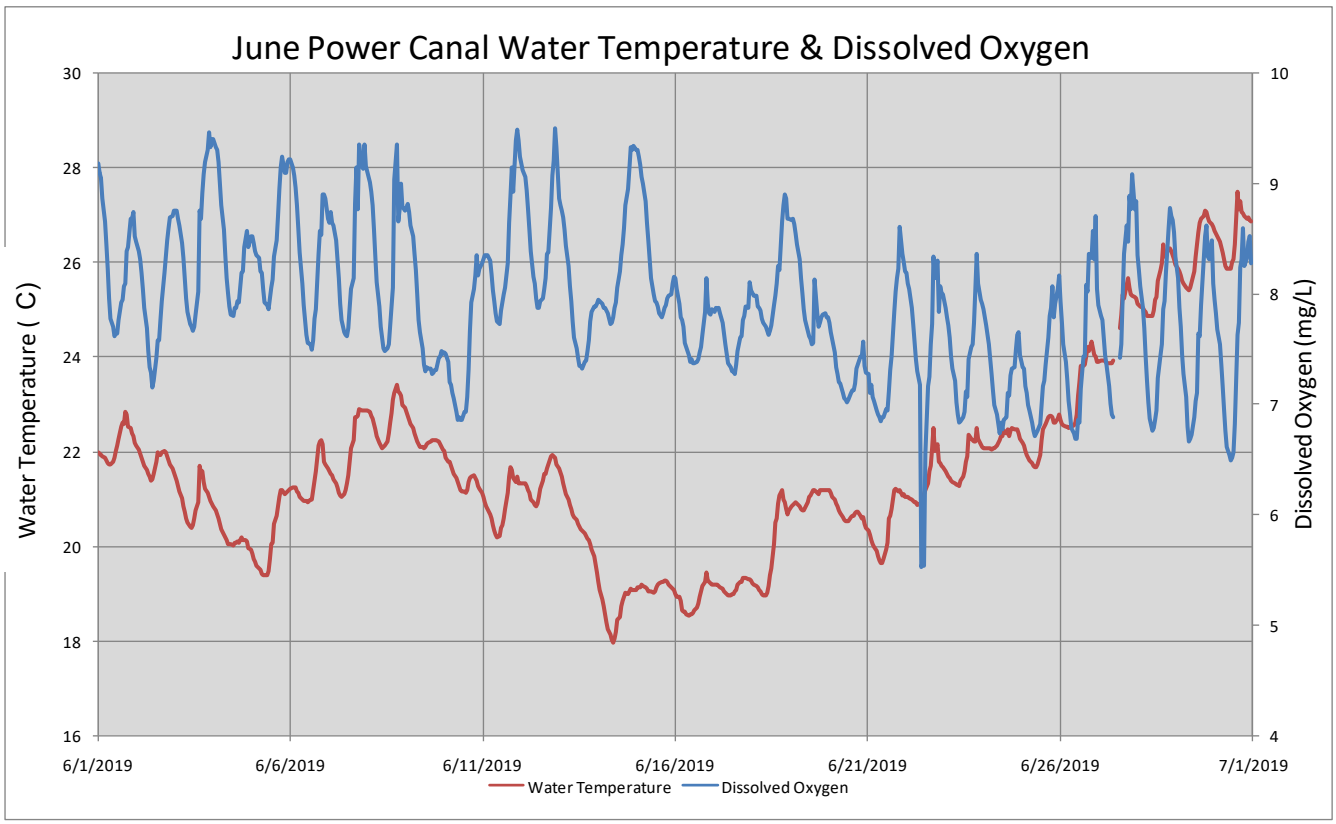

September Reservoir Water Temperature & Dissolved Oxygen
Water Temperature (C)
Dissolved Oxygen (mg/L)
25
24
23
22
21
20
19
18
17
11
10
9
8
7
6
5
4
9/1/2019
9/6/2019
9/11/2019
9/16/2019
9/21/2019
9/26/2019
10/1/2019
Water Temperature
Dissolved Oxygen

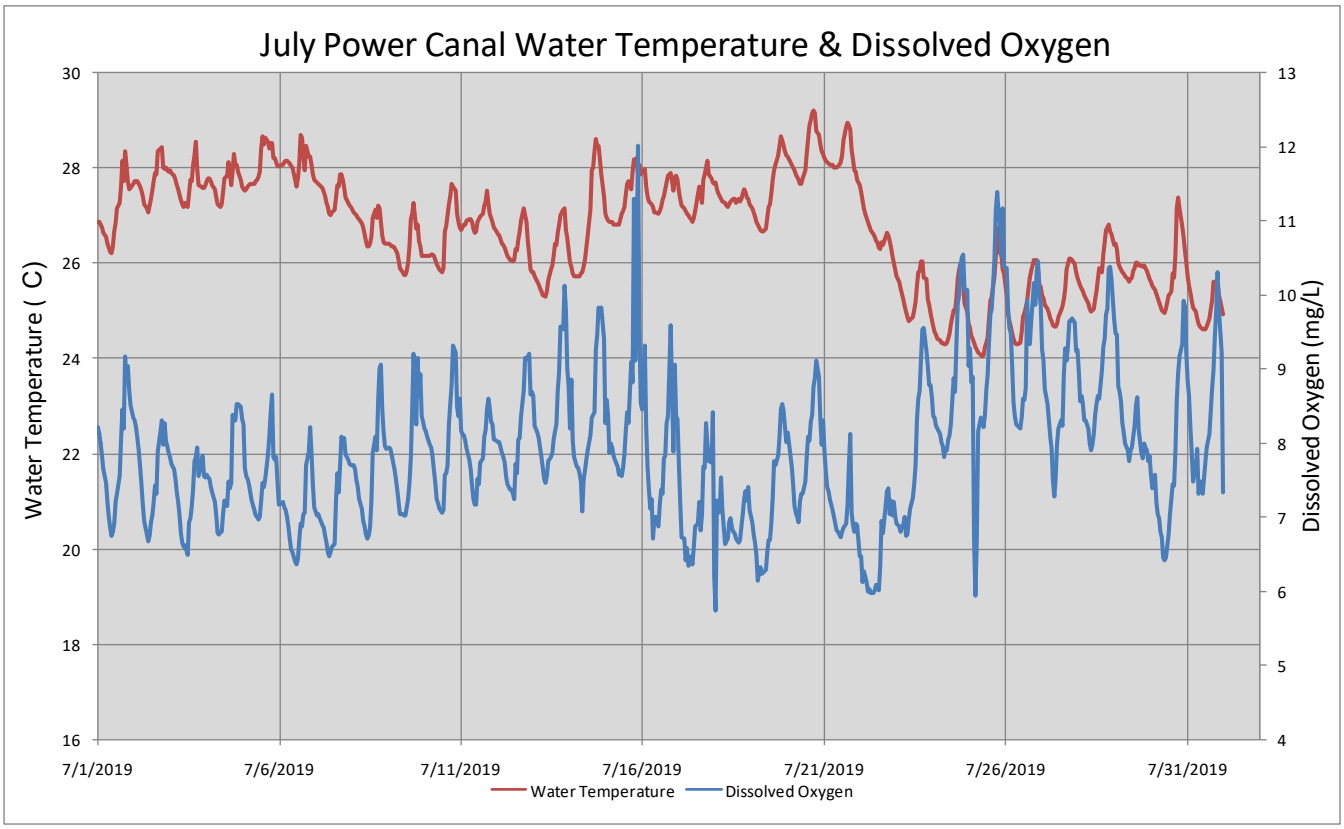

October Reservoir Water Temperature & Dissolved Oxygen
Water Temperature (C)
Dissolved Oxygen (mg/L)
22
20
18
16
14
12
10
8
11
10
9
8
7
6
5
4
10/1/2019
10/6/2019
10/11/2019
10/16/2019
10/21/2019
10/26/2019
10/31/2019
Water Temperature
Dissolved Oxygen

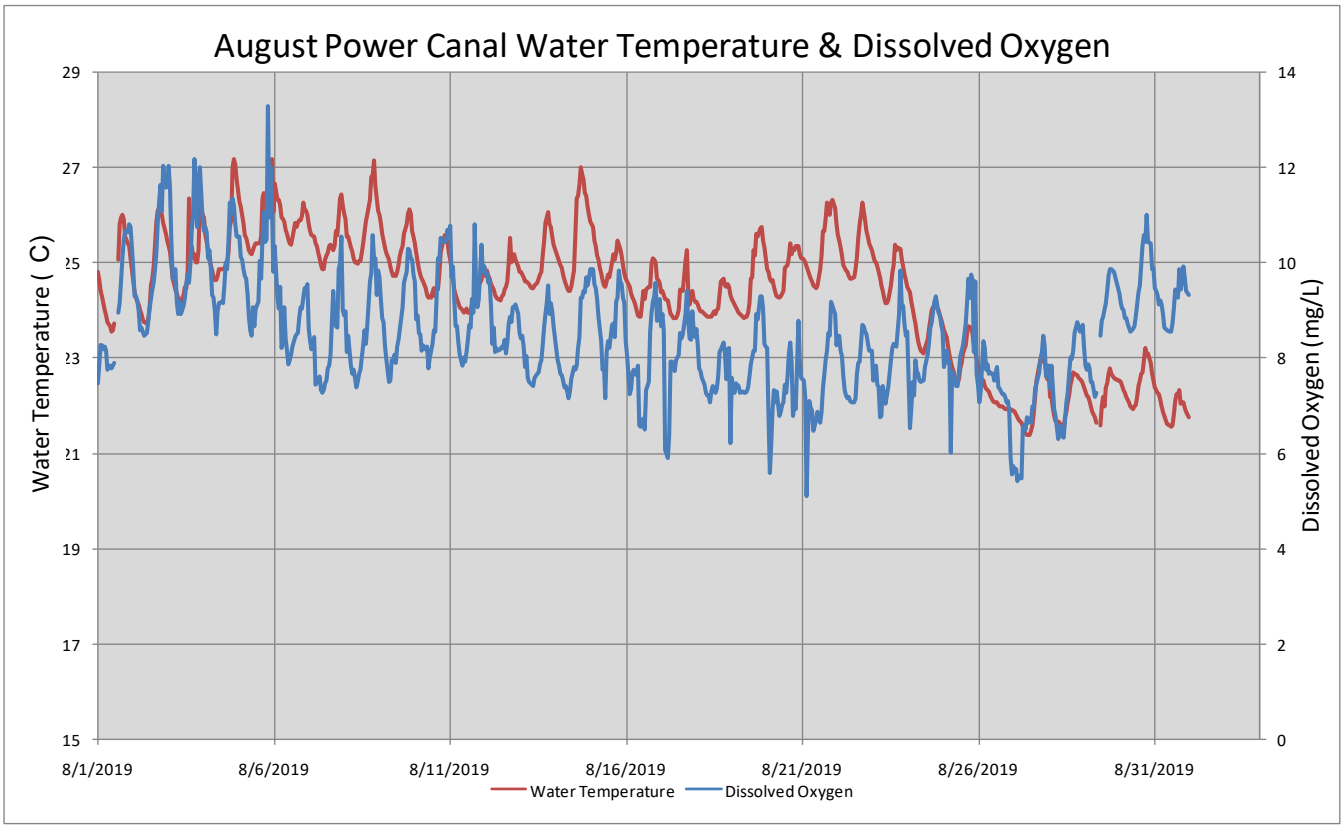
Continuous Water Temperature and Dissolved Oxygen Plots

- Power Canal

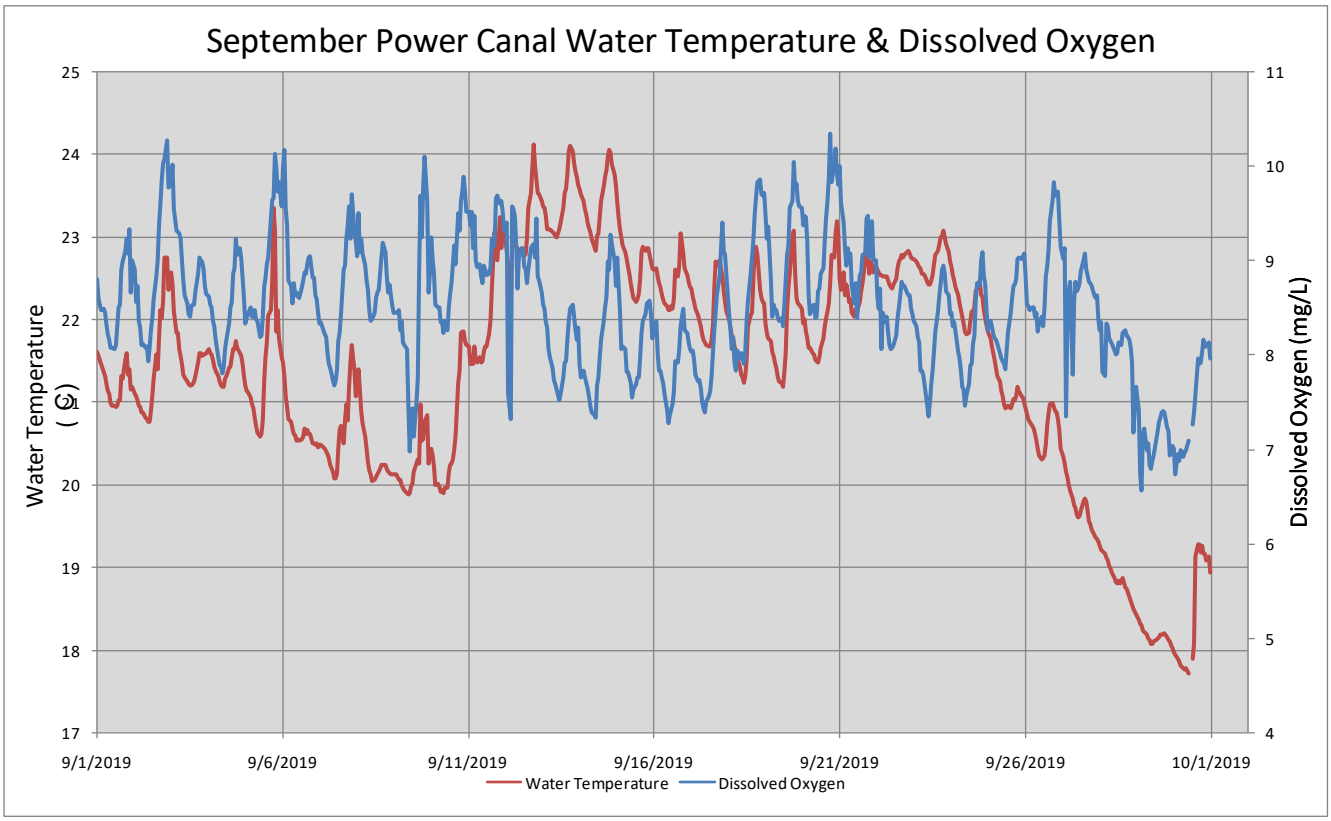

May Power Canal Water Temperature & Dissolved Oxygen
Water Temperature (C)
Dissolved Oxygen (mg/L)
24
22
20
18
16
14
12
10
14
12
10
8
6
4
2
0
5/1/2019
5/6/2019
5/11/2019
5/16/2019
5/21/2019
5/26/2019
5/31/2019
Water Temperature
Dissolved Oxygen

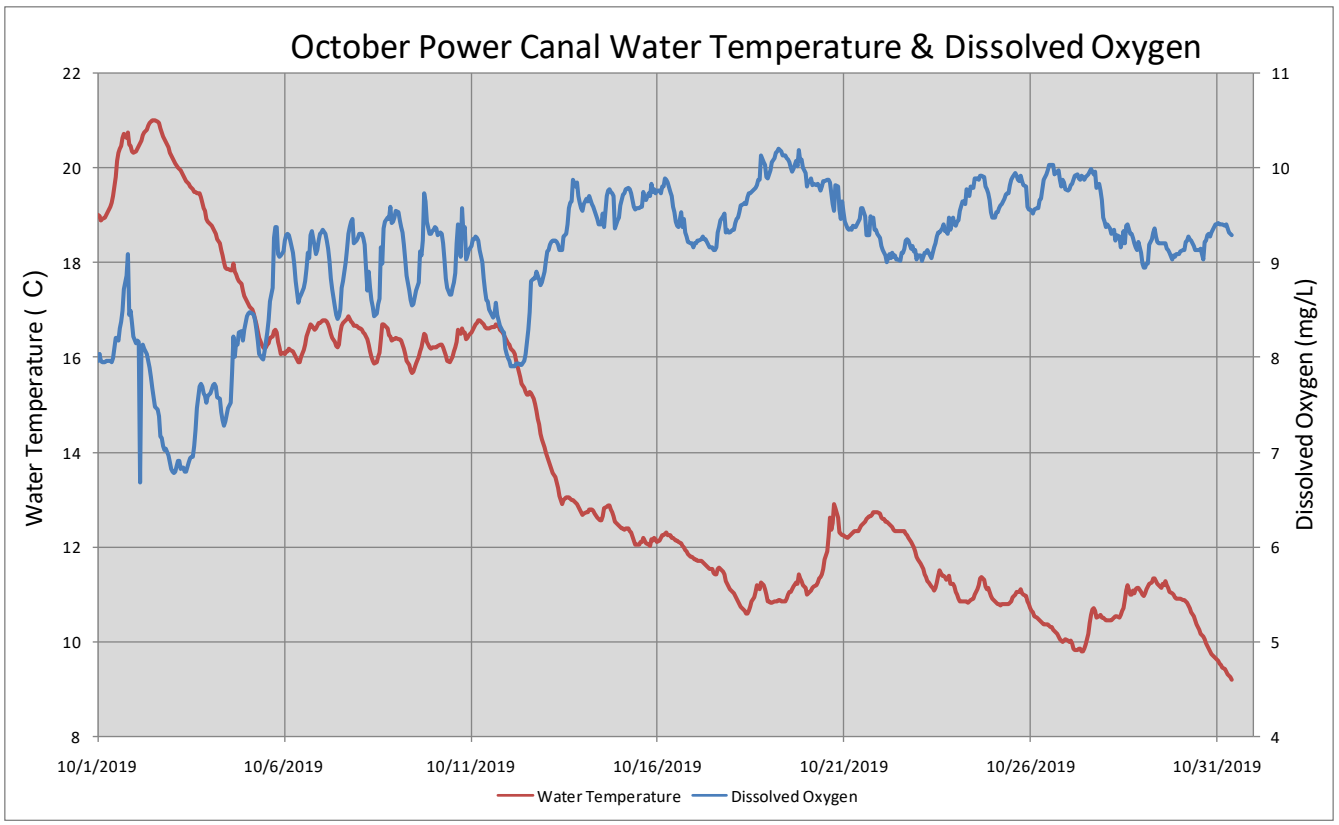

June Power Canal Water Temperature & Dissolved Oxygen
Water Temperature (C)
Dissolved Oxygen (mg/L)
30
28
26
24
22
20
18
16
10
9
8
7
6
5
4
6/1/2019
6/6/2019
6/11/2019
6/16/2019
6/21/2019
6/26/2019
7/1/2019
Water Temperature
Dissolved Oxygen





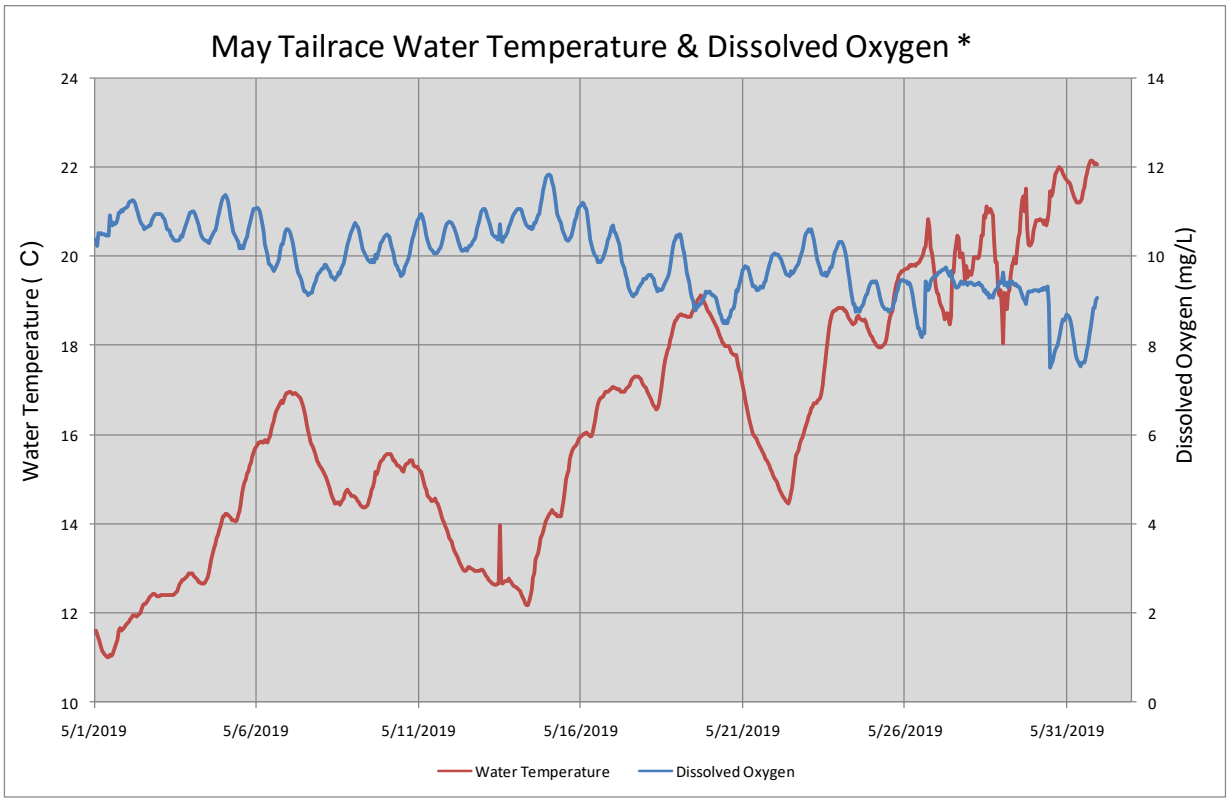
*From August 1 to August 29, 2019, data from the secondary logger was used for the power canal.


September Power Canal Water Temperature & Dissolved Oxygen
Water Temperature (C)
Dissolved Oxygen (mg/L)
25
24
23
22
21
20
19
18
17
11
10
9
8
7
6
5
4
9/1/2019
9/6/2019
9/11/2019
9/16/2019
9/21/2019
9/26/2019
10/1/2019
Water Temperature
Dissolved Oxygen

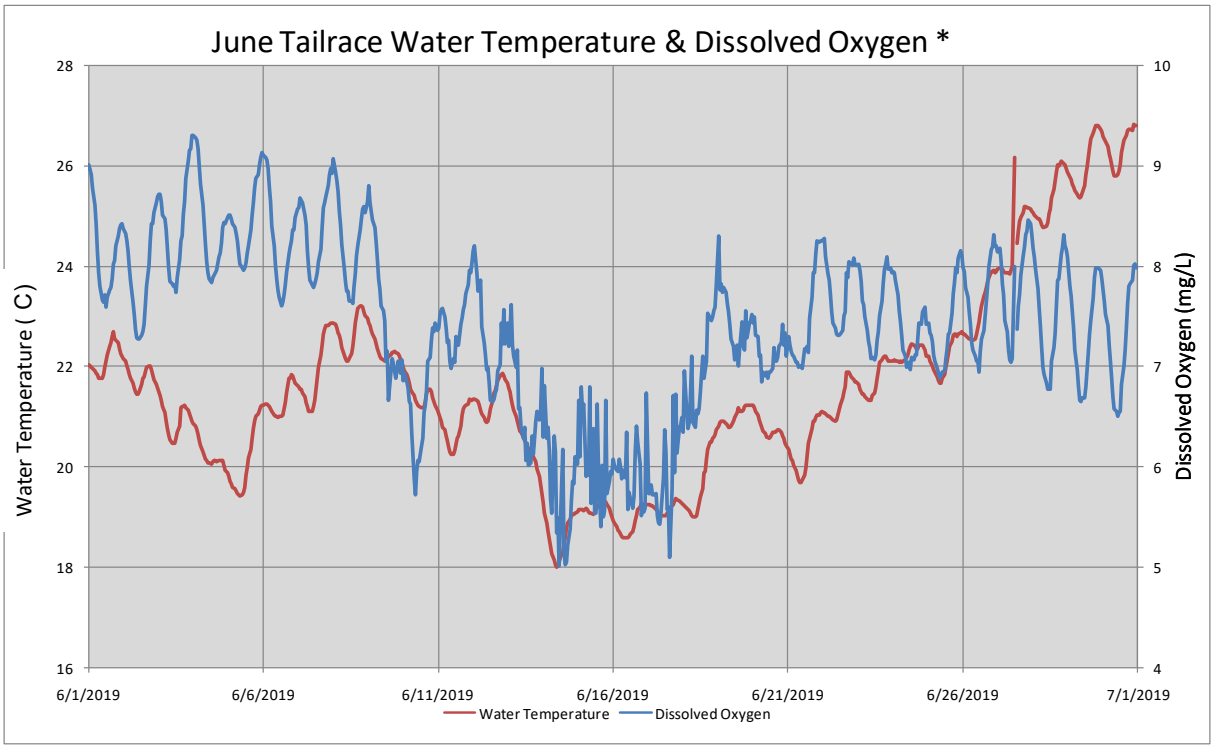

October Power Canal Water Temperature & Dissolved Oxygen
Water Temperature (C)
Dissolved Oxygen (mg/L)
22
20
18
16
14
12
10
8
11
10
9
8
7
6
5
4
10/1/2019
10/6/2019
10/11/2019
10/16/2019
10/21/2019
10/26/2019
10/31/2019
Water Temperature
Dissolved Oxygen

Continuous Water Temperature and Dissolved Oxygen Plots

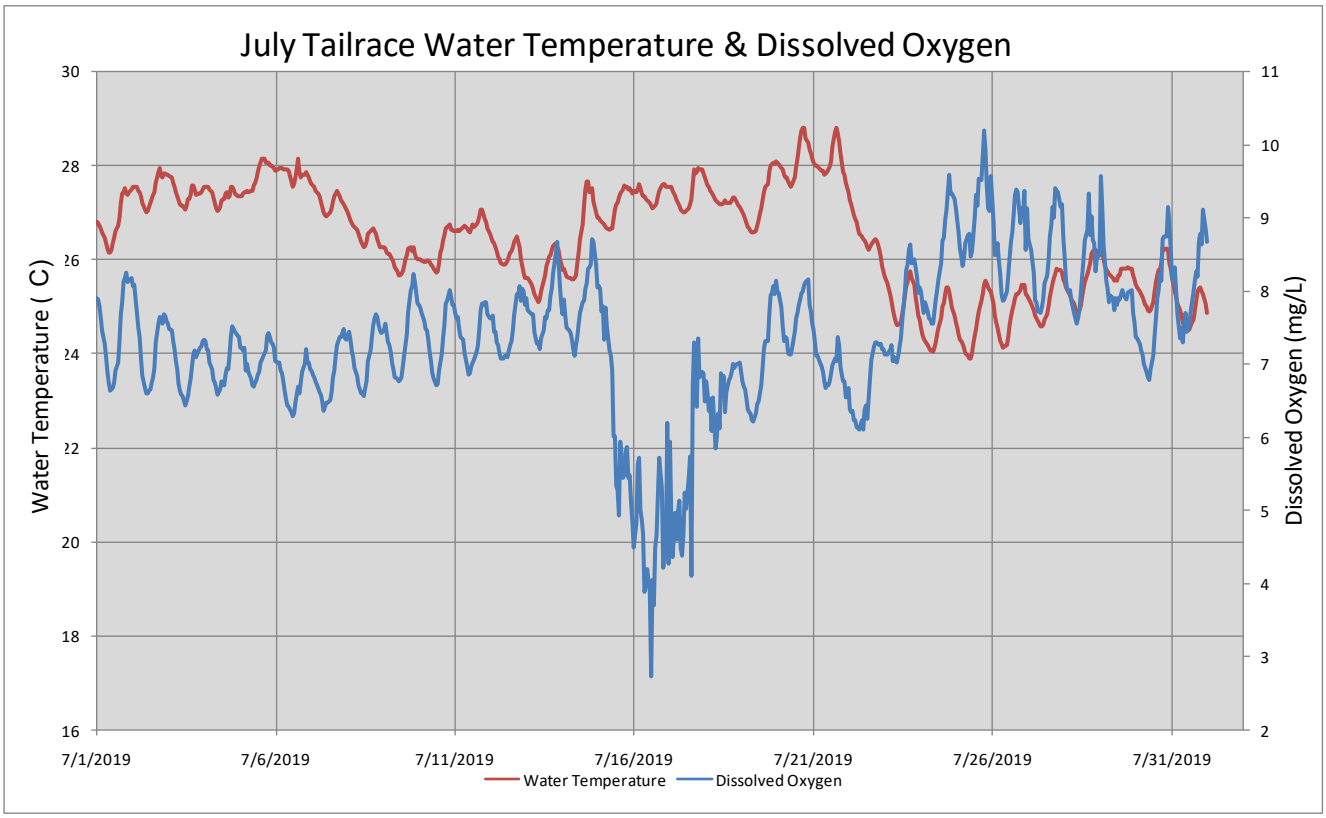
- Tailrace



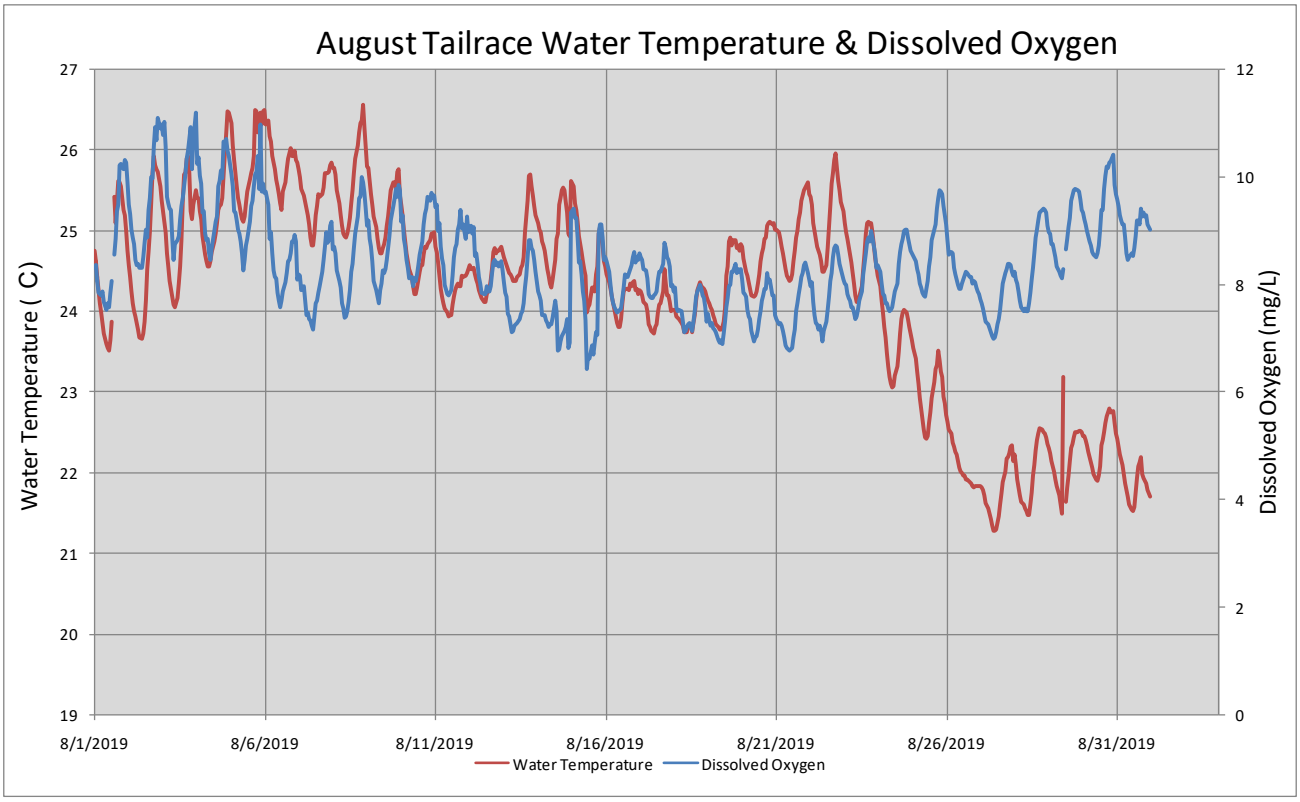
*On or around May 21, 2019, it is suspected that both loggers in the tailrace were pushed up onto the concrete ledge due to upwelling. The primary logger was damaged during this action and quit recording on May 21 while the secondary logger continued to record data from what could have been a position above the water. Because of the damage to the primary logger, data from the secondary logger was used for the month of May. The primary logger was replaced on May 30, 2019.

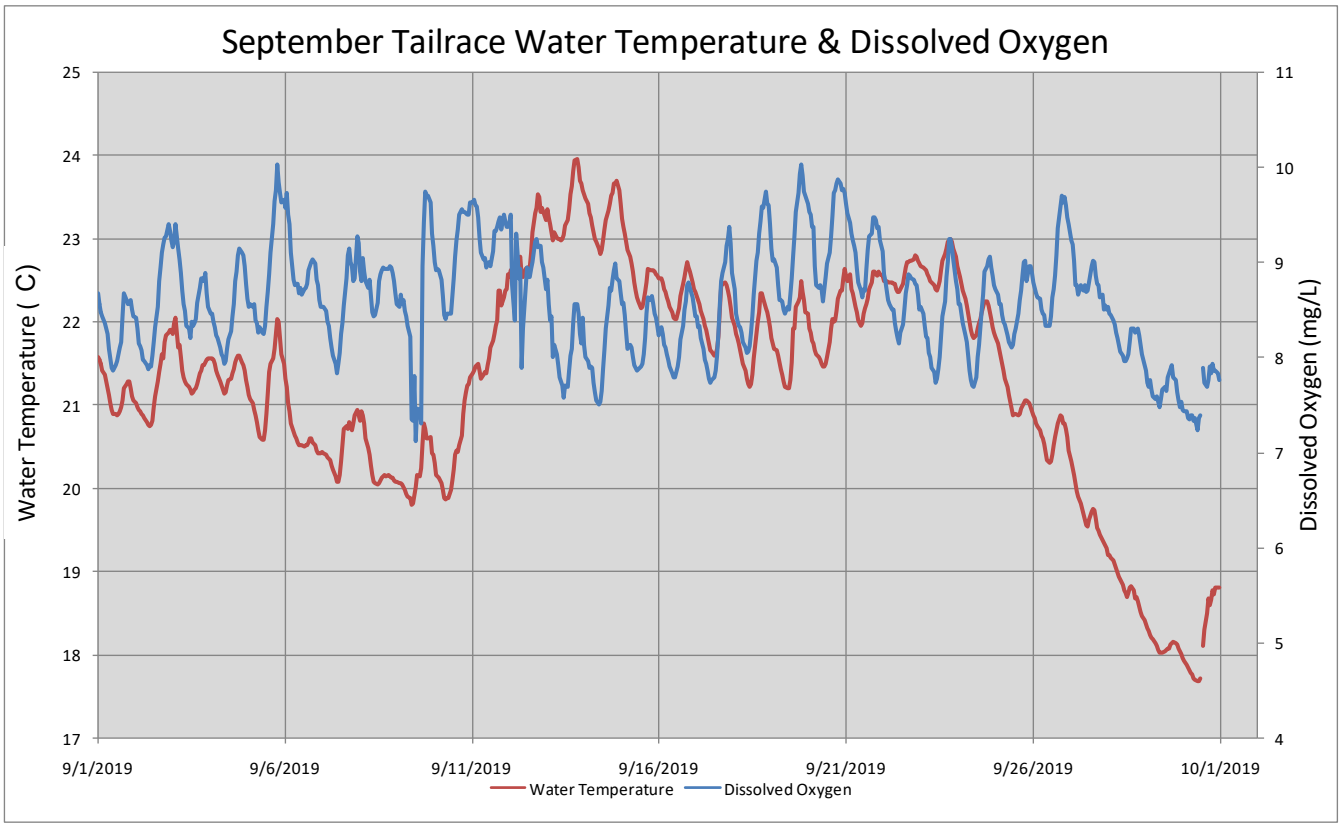


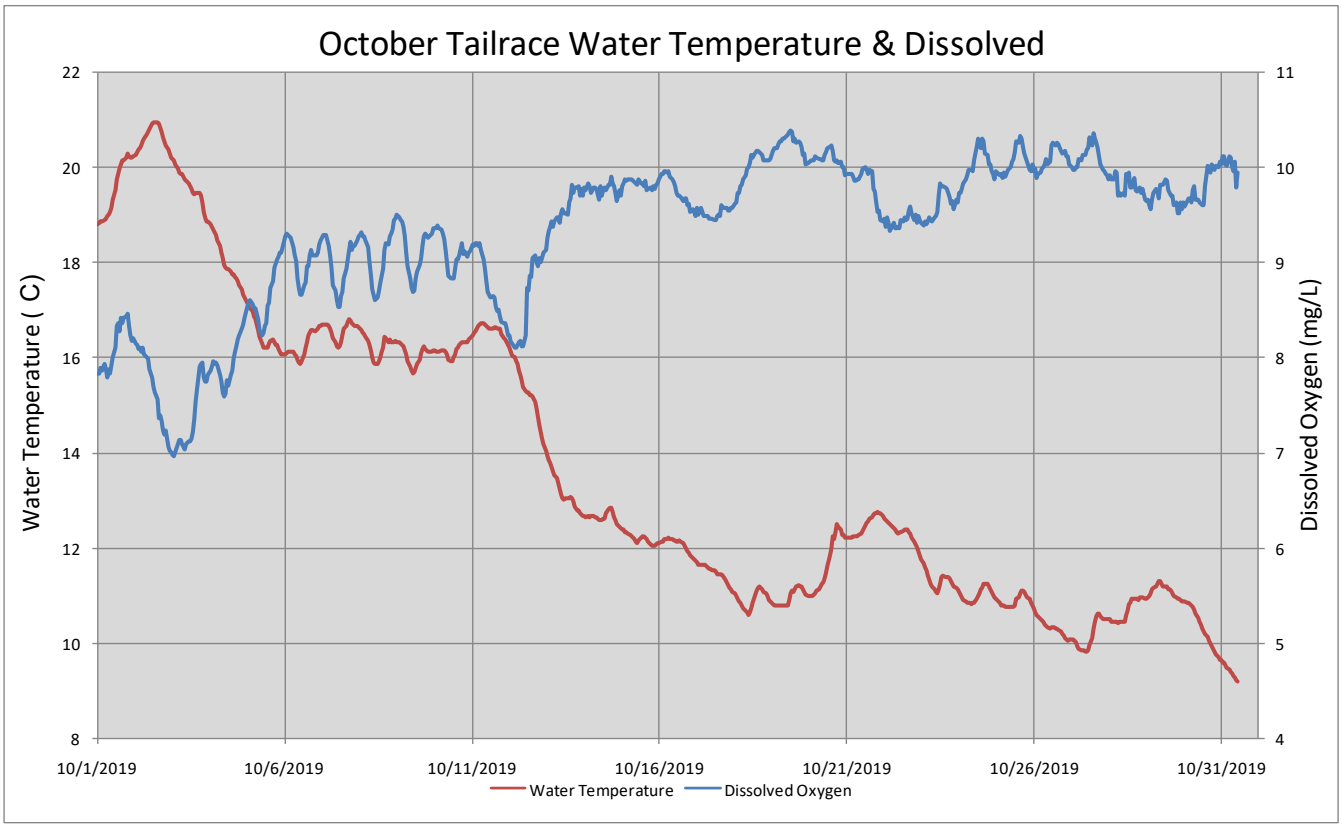
*Tailrace logger data had two instances where the DO readings were suspect. These instances were from June 12-21, 2019 and from July 14-19, 2019. These were possibly due to turbulence or shock from upwelling at this location. No secondary logger data was available for comparison due to a malfunction with the secondary logger.



*Tailrace logger data had two instances where the DO readings were suspect. These instances were from June 12-21, 2019 and from July 14-19, 2019. These were possibly due to turbulence or shock from upwelling at this location. No secondary logger data was available for comparison due to a malfunction with the secondary logger.



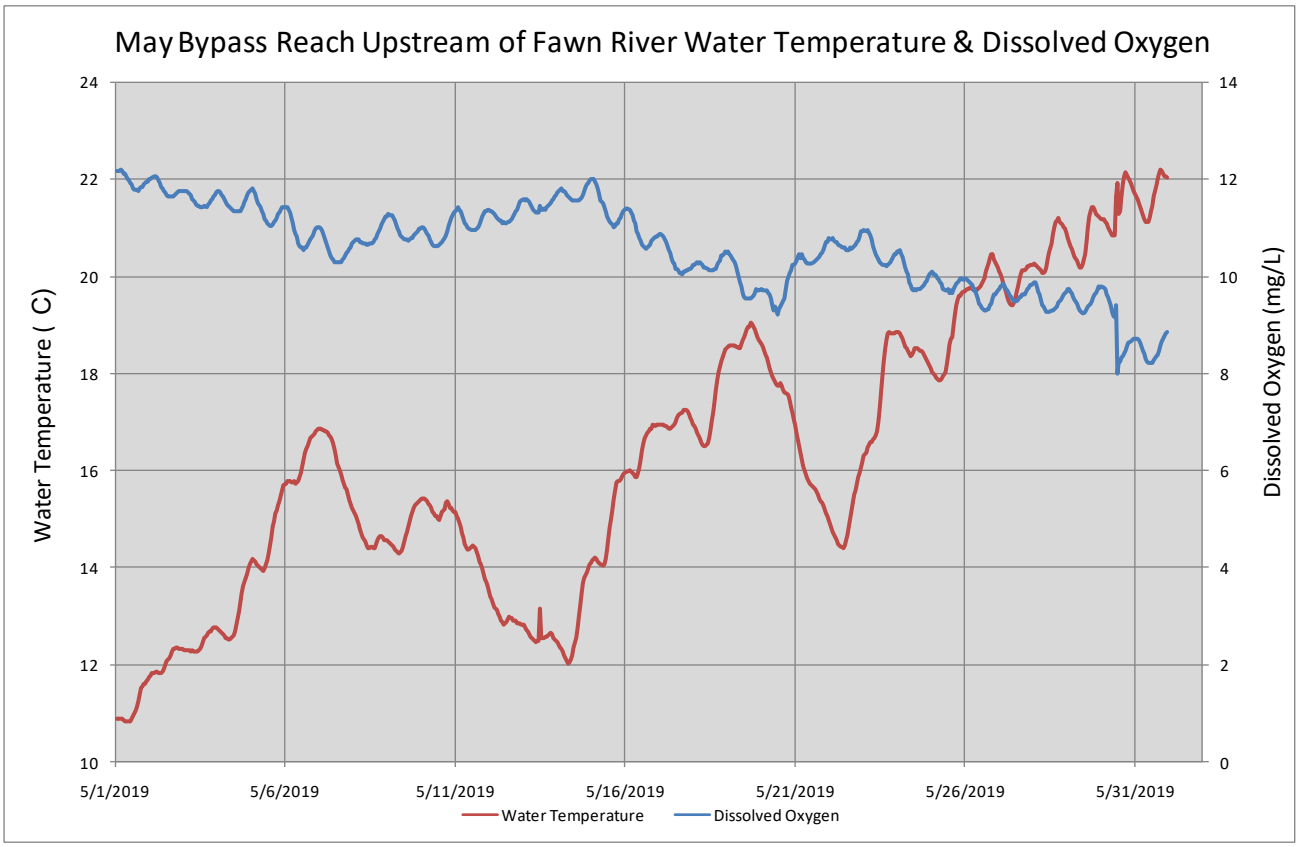


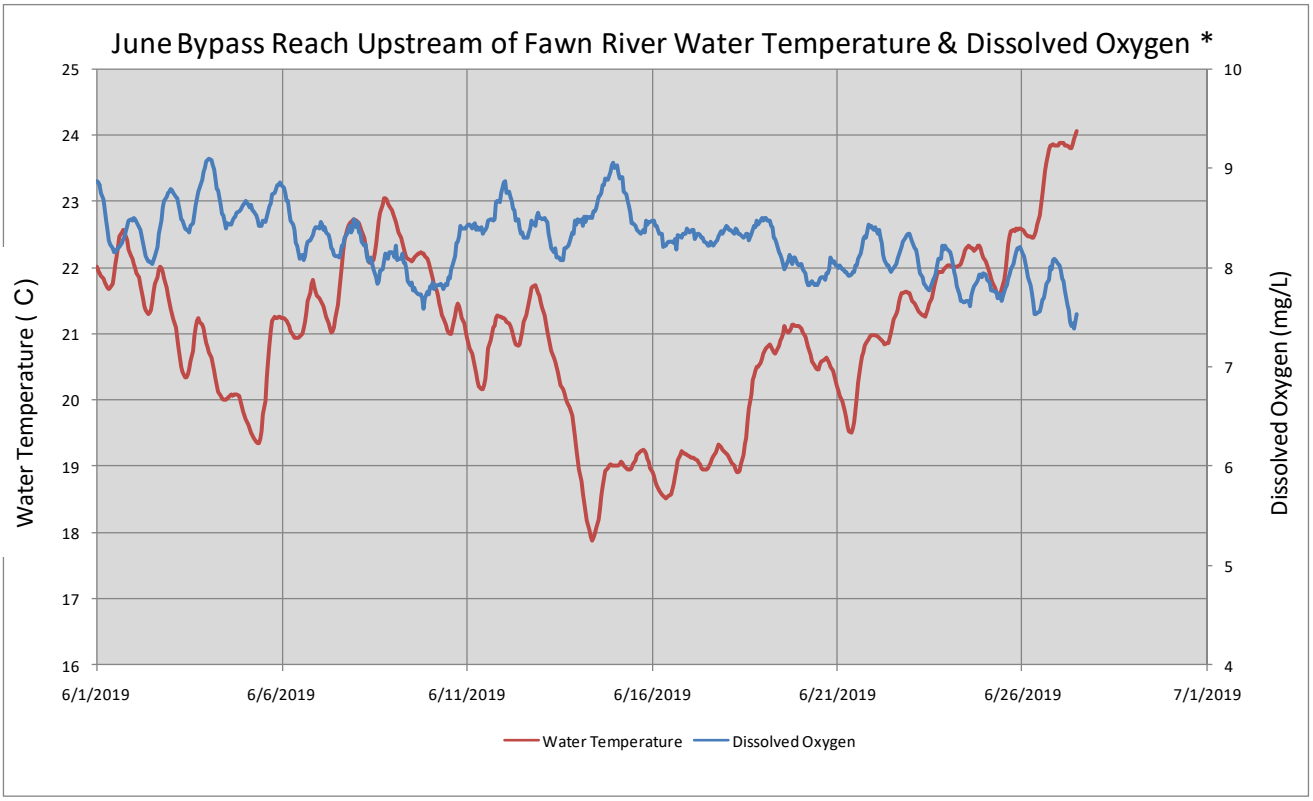


*The secondary logger in the tailrace was not working from September 30 through October 31, 2019. Data from the primary logger was used for that month.

Continuous Water Temperature and Dissolved Oxygen Plots

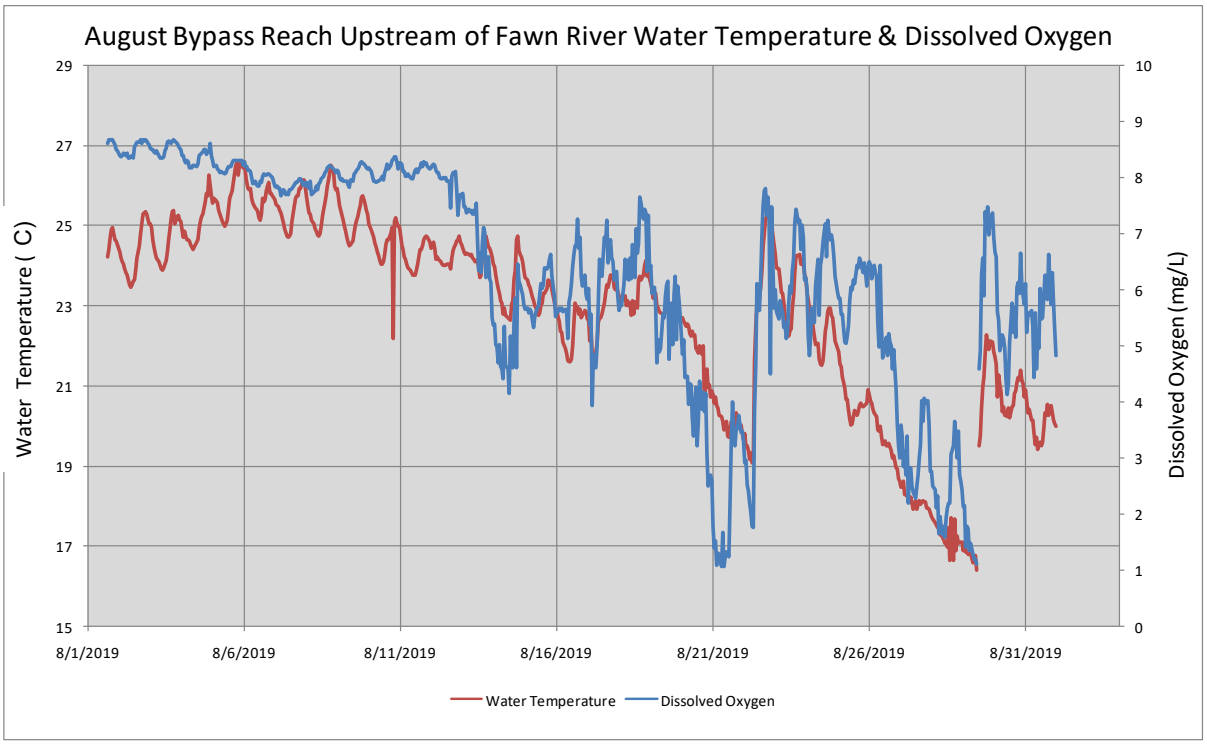
- Bypass Reach Upstream of the Fawn River



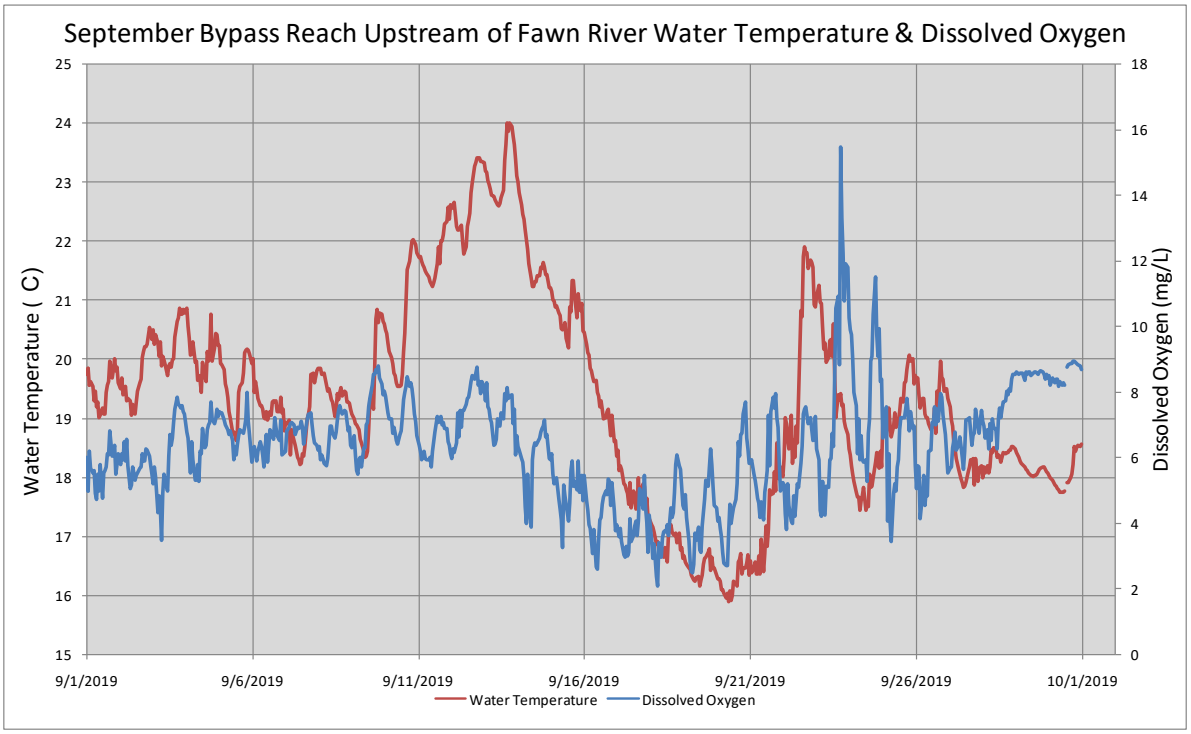


*The secondary logger in the bypass reach upstream of the Fawn River did not record data from May 30 through June 27, 2019. Data from the primary logger was used for May 30 through June 27, 2019.

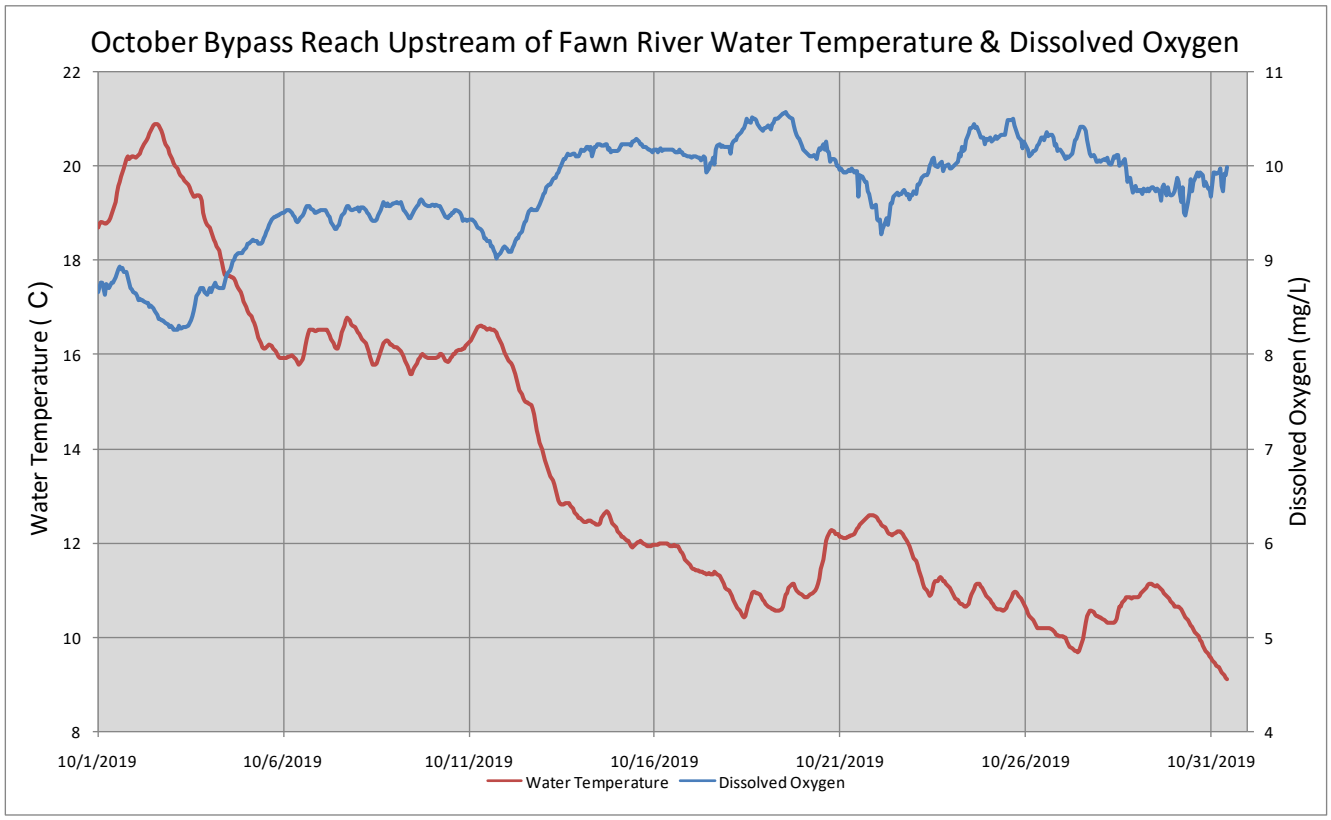
*Both loggers located in the bypass reach upstream of the Fawn River were discovered to be missing on August 1, 2019. No data exists for that location for June 27 through August 1, 2019.



*During the visit on August 29, 2019, nearly all of the water from the reservoir was being routed through the power canal. There was little to no flow through the bypass reach during that visit. The exact date that this process began is unknown, but it is believed that it began somewhere between August 14 and 20, 2019. The data from both locations in the bypass reach show large drops in DO in mid- to late August. During the visit on September 30, 2019, water was once again flowing through the bypass reach.

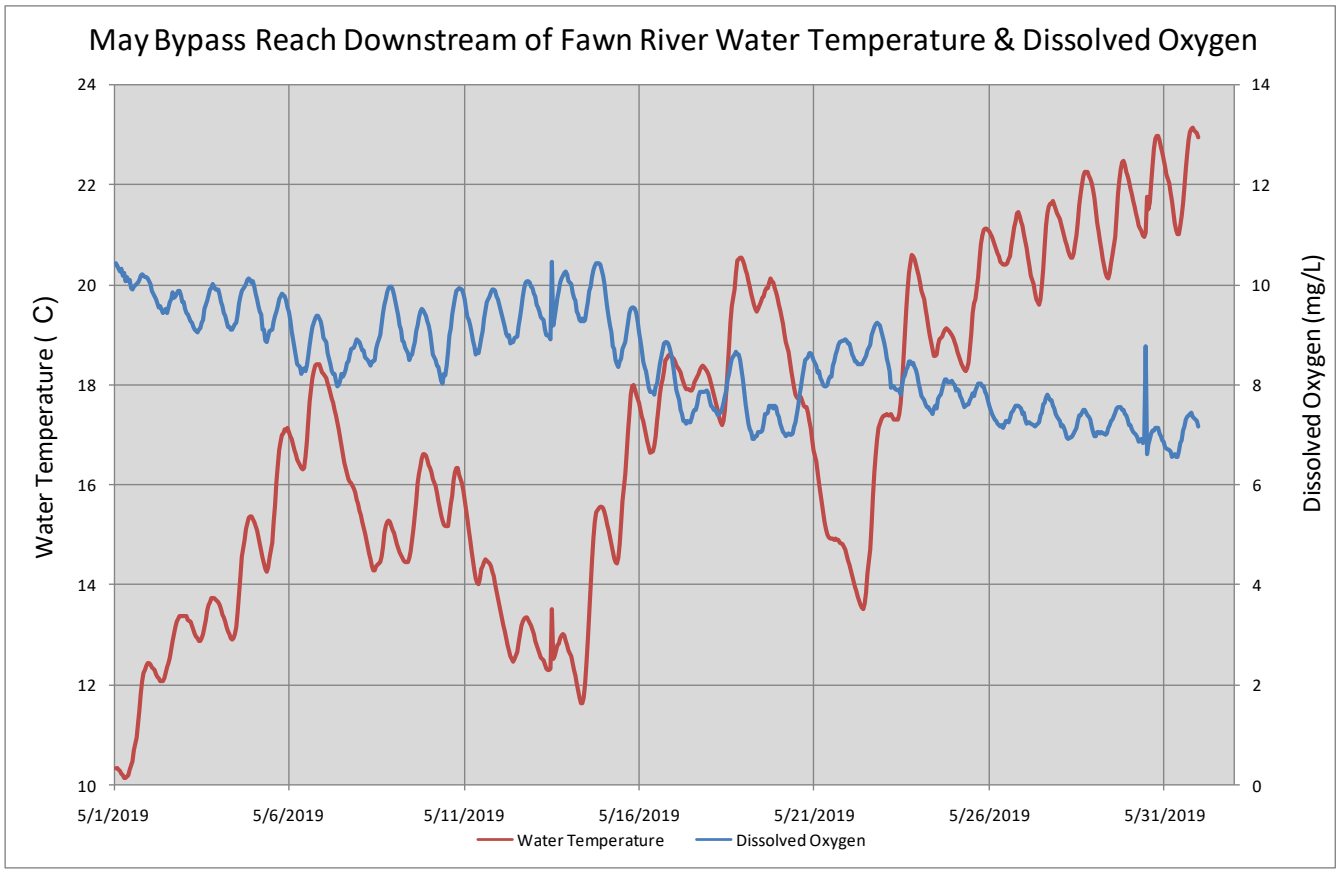


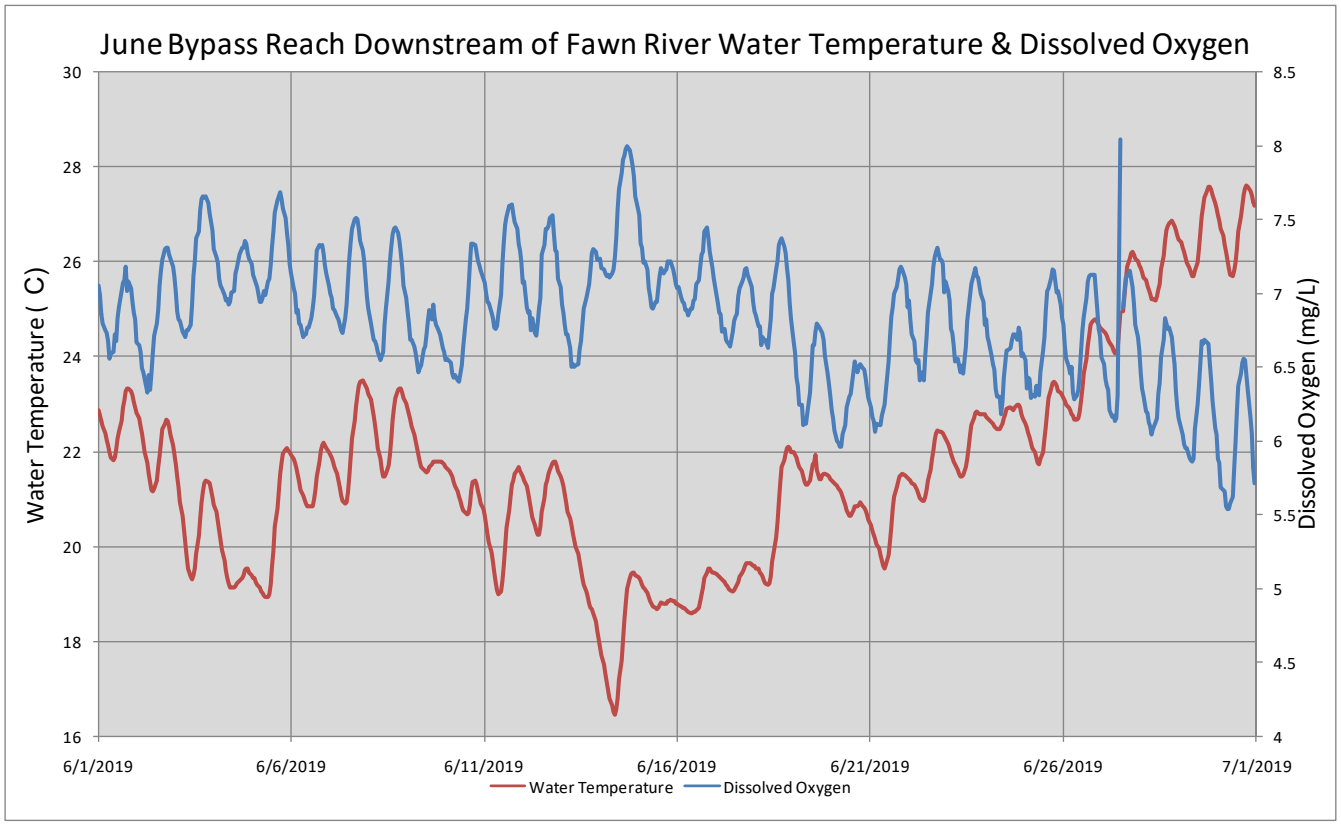
*During the visit on August 29, 2019, nearly all of the water from the reservoir was being routed through the power canal. There was little to no flow through the bypass reach during that visit. The exact date that this process began is unknown, but it is believed that it began somewhere between August 14 and 20, 2019. The data from both locations in the bypass reach show large drops in DO in mid- to late August. During the visit on September 30, 2019, water was once again flowing through the bypass reach.

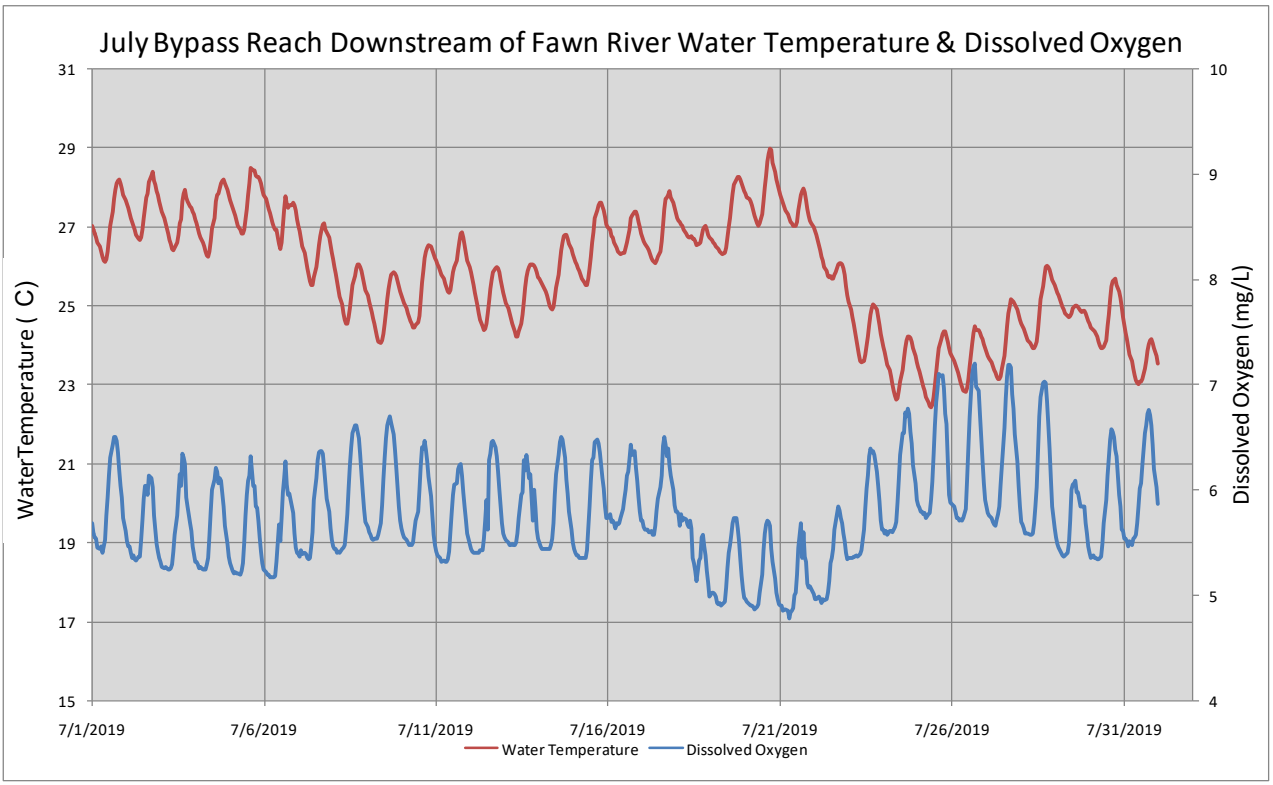

October Bypass Reach Upstream of Fawn River Water Temperature & Dissolved Oxygen
Water Temperature (C)
Dissolved Oxygen (mg/L)
22
20
18
16
14
12
10
8
11
10
9
8
7
6
5
4
10/1/2019
10/6/2019
10/11/2019
10/16/2019
10/21/2019
10/26/2019
10/31/2019
Water Temperature
Dissolved Oxygen

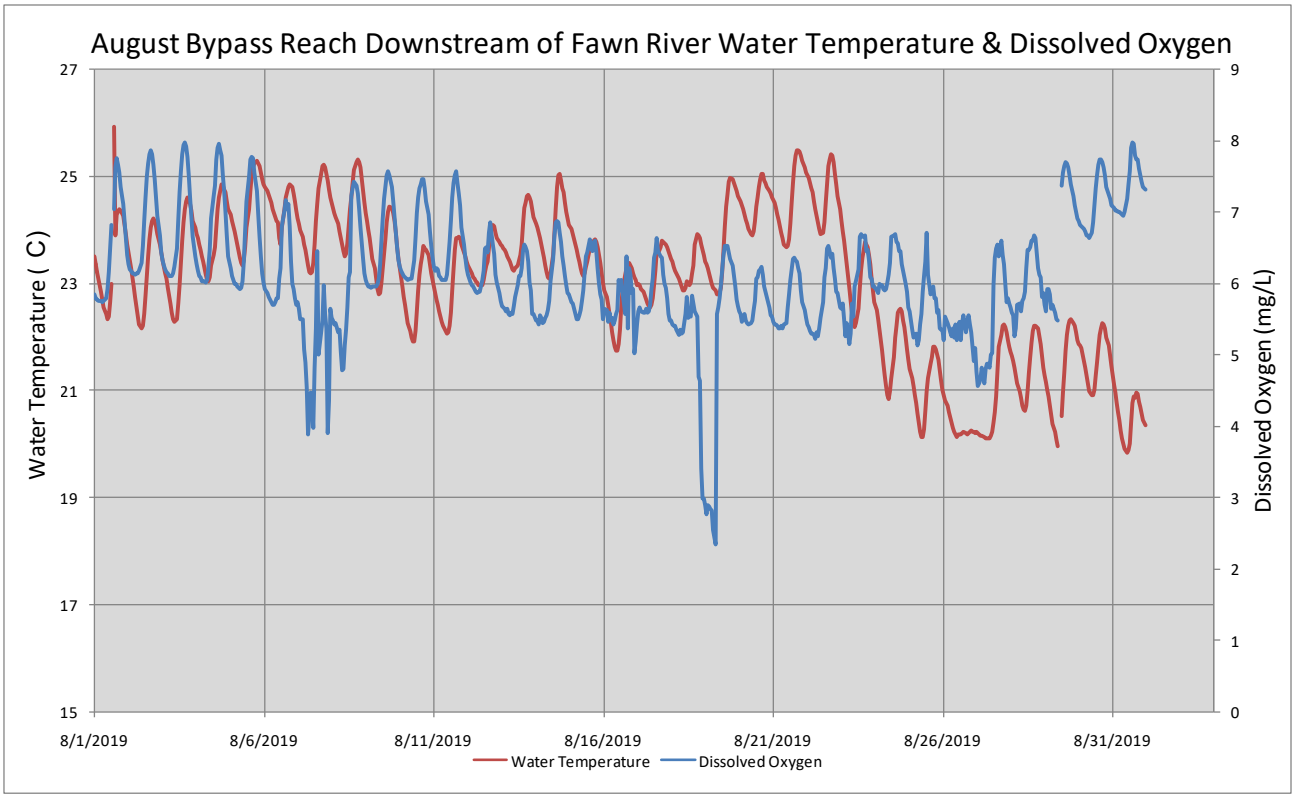
Continuous Water Temperature and Dissolved Oxygen Plots

- Bypass Reach Downstream of the Fawn River


May Bypass Reach Downstream of Fawn River Water Temperature & Dissolved Oxygen
Water Temperature (C)
Dissolved Oxygen (mg/L)
24
22
20
18
16
14
12
10
14
12
10
8
6
4
2
0
5/1/2019
5/6/2019
5/11/2019
5/16/2019
5/21/2019
5/26/2019
5/31/2019
Water Temperature
Dissolved Oxygen

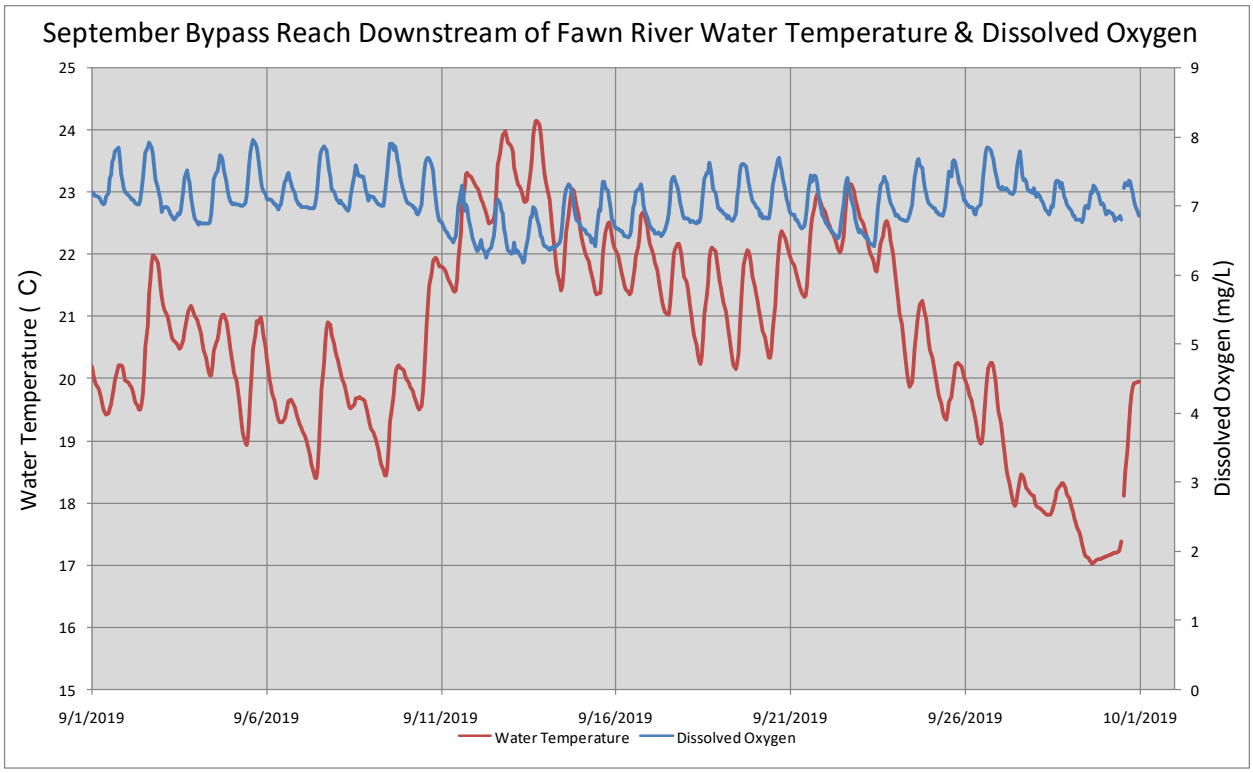

June Bypass Reach Downstream of Fawn River Water Temperature & Dissolved Oxygen
Water Temperature (C)
Dissolved Oxygen (mg/L)
30
28
26
24
22
20
18
16
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
6/1/2019
6/6/2019
6/11/2019
6/16/2019
6/21/2019
6/26/2019
7/1/2019
Water Temperature
Dissolved Oxygen





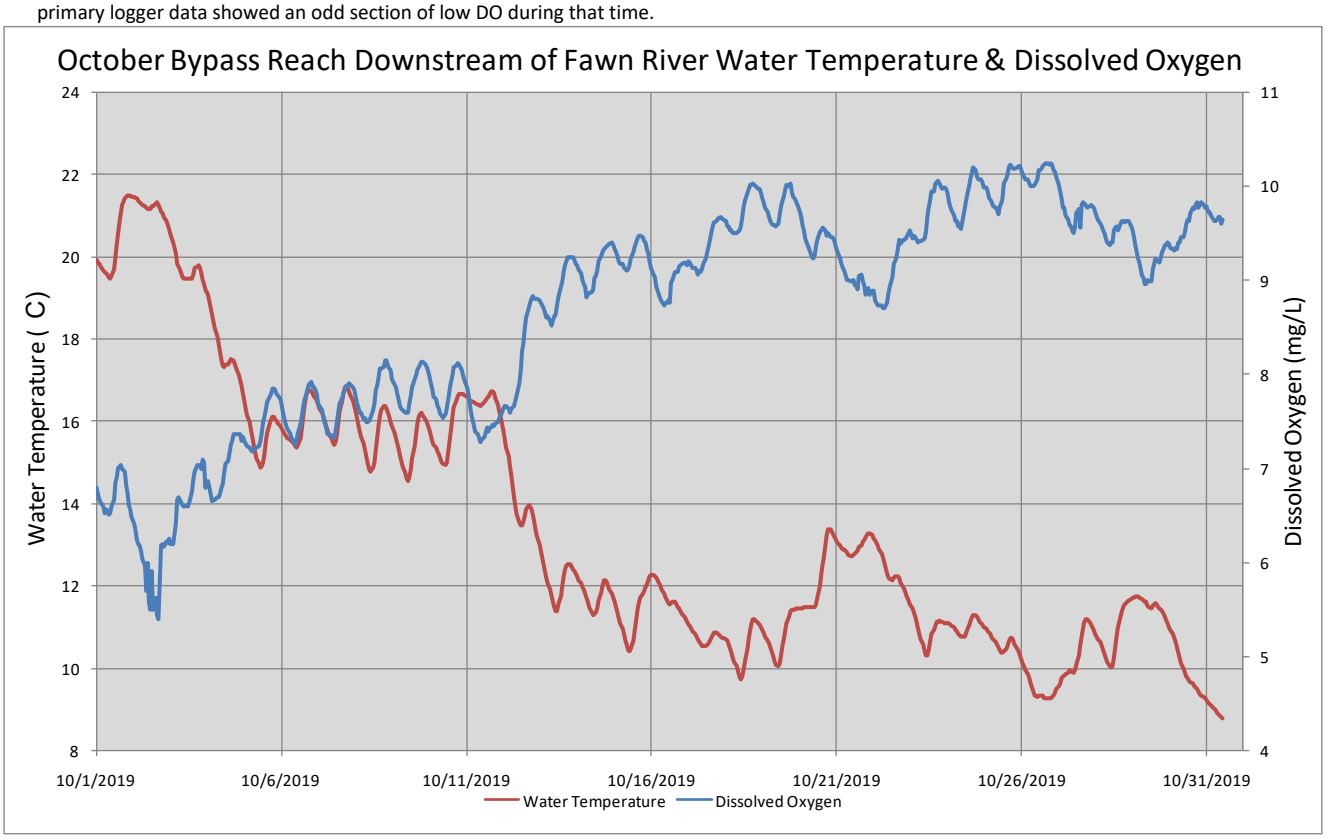
*During the visit on August 29, 2019, nearly all of the water from the reservoir was being routed through the power canal. There was little to no flow through the bypass reach during that visit. The exact date that this process began is unknown, but it is believed that it began somewhere between August 14 and 20, 2019. The data from both locations in the bypass reach show large drops in DO in mid- to late August. During the visit on September 30, 2019, water was once again flowing through the bypass reach.

*For the month of August, data from the primary logger in the bypass reach downstream of the Fawn River was used with the exception of August 17 at 11:00 through August 22, 2019 at 11:00. Data from the secondary logger was used for that time period due to oddly low DO readings observed with the primary data.

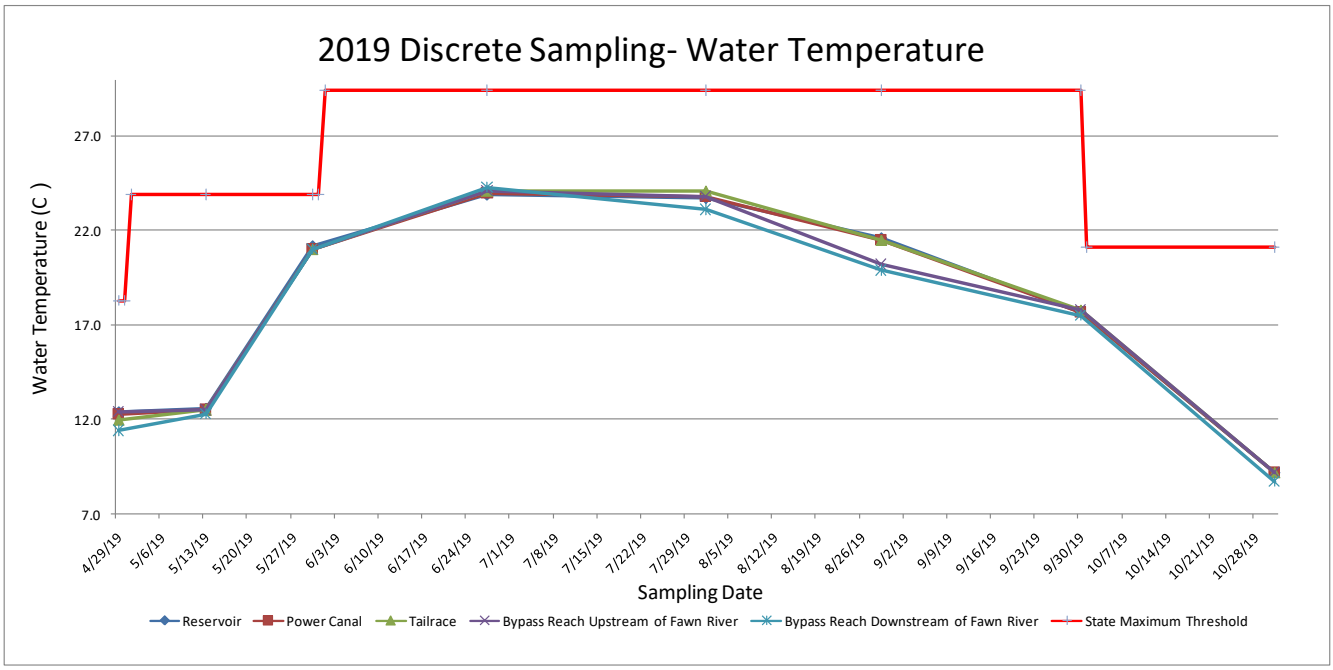


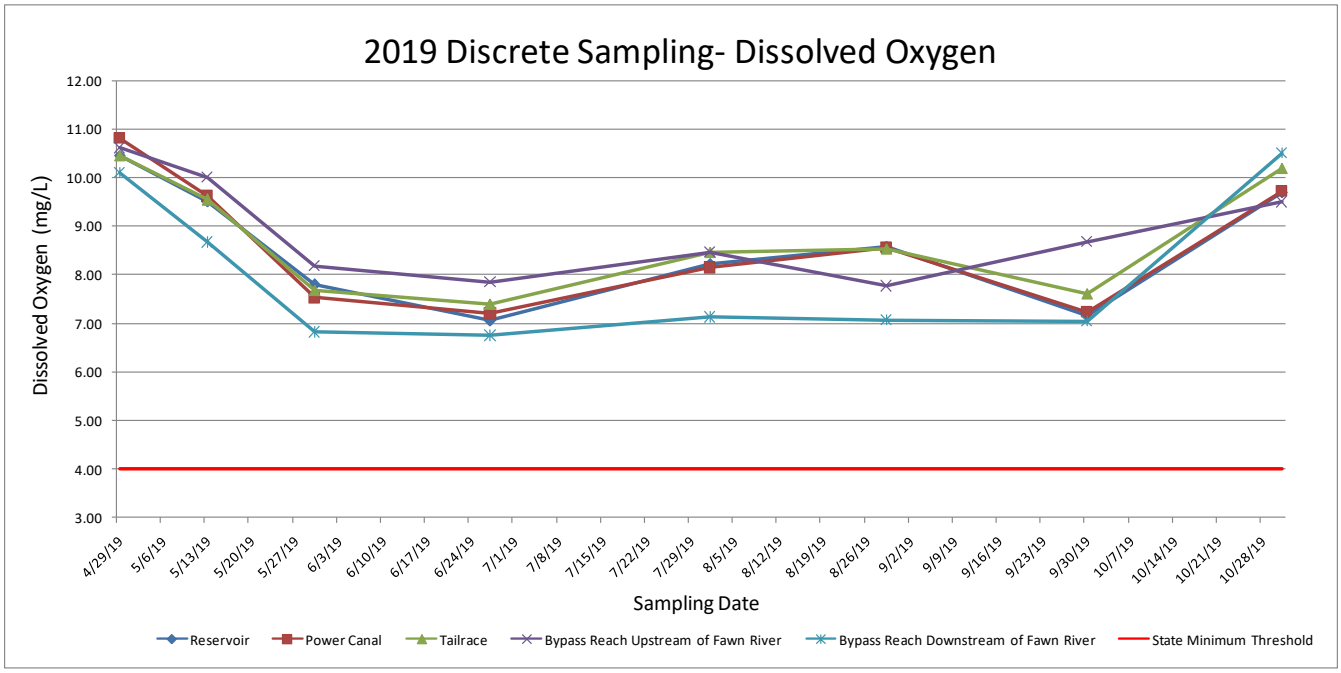
*During the visit on August 29, 2019, nearly all of the water from the reservoir was being routed through the power canal. There was little to no flow through the bypass reach during that visit. The exact date that this process began is unknown, but it is believed that it began somewhere between August 14 and 20, 2019. The data from both locations in the bypass reach show large drops in DO in mid- to late August. During the visit on September 30, 2019, water was once again flowing through the bypass reach.

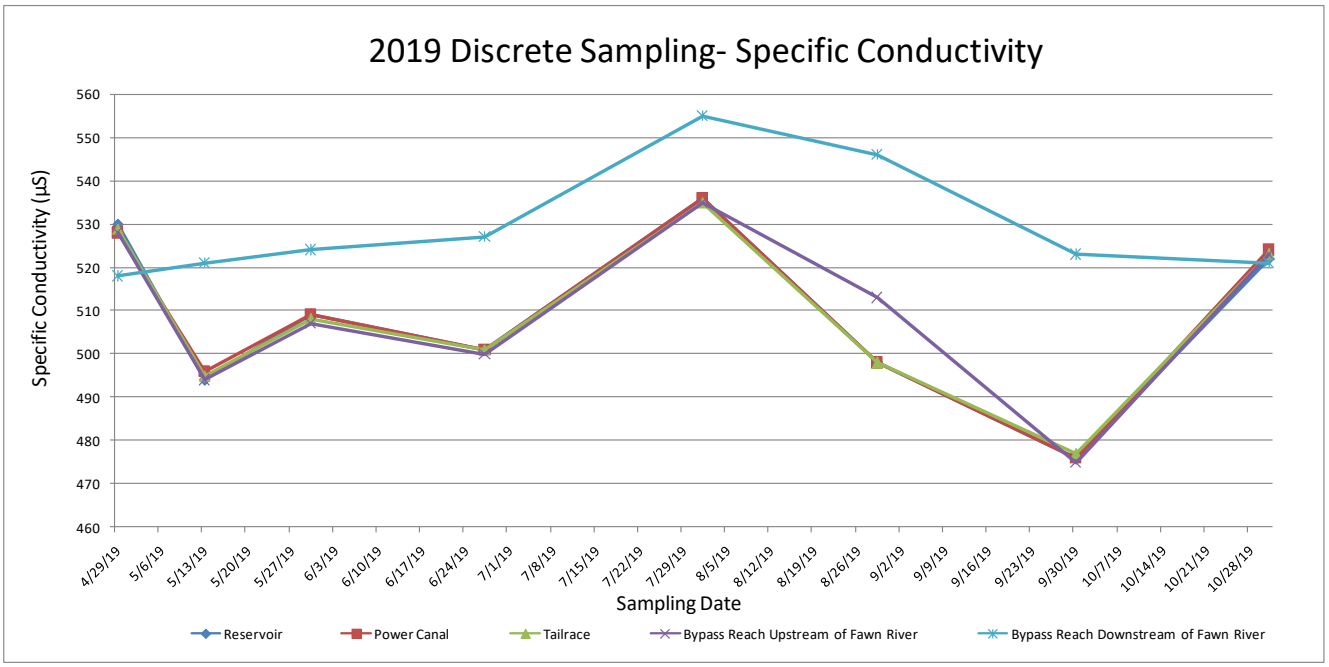
*The secondary logger data was used for the bypass reach downstream of the Fawn River from August 29 to September 30, 2019. The plot for the primary logger data showed an odd section of low DO during that time.

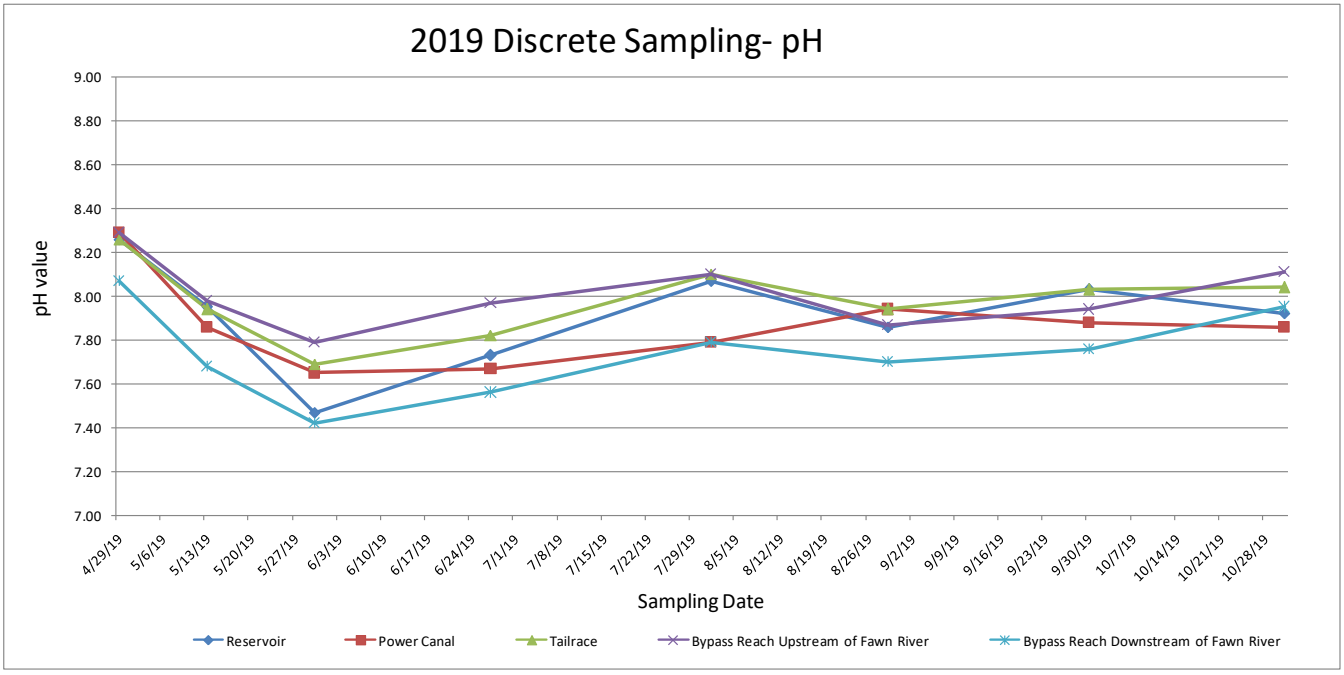


Appendix C
Discrete Multi-parameter Water Quality Plots


2019 Discrete Sampling- Water Temperature
Water Temperature (C)
27.0
22.0
17.0
12.0
7.0
4/29/19
5/6/19
5/13/19
5/20/19
5/27/19
6/3/19
6/10/19
6/17/19
6/24/19
7/1/19
7/8/19
7/15/19
7/22/19
7/29/19
8/5/19
8/12/19
8/19/19
8/26/19
9/2/19
9/9/19
9/16/19
9/23/19
9/30/19
10/7/19
10/14/19
10/21/19
10/28/19
Sampling Date
Reservoir
Power Canal
Tailrace
Bypass Reach Upstream of Fawn River
Bypass Reach Downstream of Fawn River
State Maximum Threshold


2019 Discrete Sampling- Dissolved Oxygen
Dissolved Oxygen (mg/L)
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
4/29/19
5/6/19
5/13/19
5/20/19
5/27/19
6/3/19
6/10/19
6/17/19
6/24/19
7/1/19
7/8/19
7/15/19
7/22/19
7/29/19
8/5/19
8/12/19
8/19/19
8/26/19
9/2/19
9/9/19
9/16/19
9/23/19
9/30/19
10/7/19
10/14/19
10/21/19
10/28/19
Sampling Date
Reservoir
Power Canal
Tailrace
Bypass Reach Upstream of Fawn River
Bypass Reach Downstream of Fawn River
State Minimum Threshold


2019 Discrete Sampling- Specific Conductivity
Specific Conductivity (µS)
560
550
540
530
520
510
500
490
480
470
460
4/29/19
5/6/19
5/13/19
5/20/19
5/27/19
6/3/19
6/10/19
6/17/19
6/24/19
7/1/19
7/8/19
7/15/19
7/22/19
7/29/19
8/5/19
8/12/19
8/19/19
8/26/19
9/2/19
9/9/19
9/16/19
9/23/19
9/30/19
10/7/19
10/14/19
10/21/19
10/28/19
Sampling Date
Reservoir
Power Canal
Tailrace
Bypass Reach Upstream of Fawn River
Bypass Reach Downstream of Fawn River


2019 Discrete Sampling- pH
pH value
9.00
8.80
8.60
8.40
8.20
8.00
7.80
7.60
7.40
7.20
7.00
4/29/19
5/6/19
5/13/19
5/20/19
5/27/19
6/3/19
6/10/19
6/17/19
6/24/19
7/1/19
7/8/19
7/15/19
7/22/19
7/29/19
8/5/19
8/12/19
8/19/19
8/26/19
9/2/19
9/9/19
9/16/19
9/23/19
9/30/19
10/7/19
10/14/19
10/21/19
10/28/19
Sampling Date
Reservoir
Power Canal
Tailrace
Bypass Reach Upstream of Fawn River
Bypass Reach Downstream of Fawn River

Appendix D
Sediment Results from Pace Analytical Laboratory

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

February 27, 2020

Michelle VanDenBrand
Great Lakes Environmental Center
739 Hastings Street
Traverse City, MI 49686

RE: Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

Dear Michelle VanDenBrand:
Enclosed are the analytical results for sample(s) received by the laboratory on October 01, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

Report revised to include Arsenic analysis.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Tod Noltemeyer

Tod Noltemeyer
tod.noltemeyer@pacelabs.com
(920)469-2436
Project Manager

Enclosures

cc: Dennis McCauley, Great Lakes Environmental Center, Inc.

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

CERTIFICATIONS

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

Pace Analytical Services Minneapolis

A2LA Certification #: 2926.01
Alabama Certification #: 40770
Alaska Contaminated Sites Certification #: 17-009
Alaska DW Certification #: MN00064
Arizona Certification #: AZ0014
Arkansas DW Certification #: MN00064
Arkansas WW Certification #: 88-0680
California Certification #: 2929
CNMI Saipan Certification #: MP0003
Colorado Certification #: MN00064
Connecticut Certification #: PH-0256
EPA Region 8+Wyoming DW Certification #: via MN 027-053-137
Florida Certification #: E87605
Georgia Certification #: 959
Guam EPA Certification #: MN00064
Hawaii Certification #: MN00064
Idaho Certification #: MN00064
Illinois Certification #: 200011
Indiana Certification #: C-MN-01
Iowa Certification #: 368
Kansas Certification #: E-10167
Kentucky DW Certification #: 90062
Kentucky WW Certification #: 90062
Louisiana DEQ Certification #: 03086
Louisiana DW Certification #: MN00064
Maine Certification #: MN00064
Maryland Certification #: 322
Massachusetts Certification #: M-MN064
Massachusetts DWP Certification #: via MN 027-053-137
Michigan Certification #: 9909
Minnesota Certification #: 027-053-137
Minnesota Dept of Ag Certifcation #: via MN 027-053-137
Minnesota Petrofund Certification #: 1240
Mississippi Certification #: MN00064
Missouri Certification #: 10100
Montana Certification #: CERT0092
Nebraska Certification #: NE-OS-18-06
Nevada Certification #: MN00064
New Hampshire Certification #: 2081
New Jersey Certification #: MN002
New York Certification #: 11647
North Carolina DW Certification #: 27700
North Carolina WW Certification #: 530
North Dakota Certification #: R-036
Ohio DW Certification #: 41244
Ohio VAP Certification #: CL101
Oklahoma Certification #: 9507
Oregon Primary Certification #: MN300001
Oregon Secondary Certification #: MN200001
Pennsylvania Certification #: 68-00563
Puerto Rico Certification #: MN00064
South Carolina Certification #:74003001
Tennessee Certification #: TN02818
Texas Certification #: T104704192
Utah Certification #: MN00064
Vermont Certification #: VT-027053137
Virginia Certification #: 460163
Washington Certification #: C486
West Virginia DEP Certification #: 382
West Virginia DW Certification #: 9952 C
Wisconsin Certification #: 999407970
Wyoming UST Certification #: via A2LA 2926.01

Pace Analytical Services Green Bay

1241 Bellevue Street, Green Bay, WI 54302
Florida/NELAP Certification #: E87948
Illinois Certification #: 200050
Kentucky UST Certification #: 82
Louisiana Certification #: 04168
Minnesota Certification #: 055-999-334
New York Certification #: 12064
North Dakota Certification #: R-150
Virginia VELAP ID: 460263
South Carolina Certification #: 83006001
Texas Certification #: T104704529-14-1
Wisconsin Certification #: 405132750
Wisconsin DATCP Certification #: 105-444
USDA Soil Permit #: P330-16-00157
Federal Fish & Wildlife Permit #: LE51774A-0

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

SAMPLE SUMMARY

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

Lab ID	Sample ID	Matrix	Date Collected	Date Received
40196278001	LRSS	Solid	09/25/19 13:45	10/01/19 09:30
40196278002	LRSSD	Solid	09/25/19 13:45	10/01/19 09:30
40196278003	MRSS	Solid	09/25/19 15:00	10/01/19 09:30
40196278004	URSS	Solid	09/25/19 16:10	10/01/19 09:30

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

SAMPLE ANALYTE COUNT

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
40196278001	LRSS	EPA 8082	BLM	10	PASI-G
		EPA 6010	TXW	9	PASI-G
		EPA 7471	AJT	1	PASI-G
		ASTM D2974-87	PCG	1	PASI-G
		EPA 9071	JER	1	PASI-M
		EPA 365.4	DAW	1	PASI-G
		EPA 9060	TJJ	6	PASI-G
40196278002	LRSSD	EPA 8082	BLM	10	PASI-G
		EPA 6010	TXW	9	PASI-G
		EPA 7471	AJT	1	PASI-G
		ASTM D2974-87	PCG	1	PASI-G
		EPA 9071	JER	1	PASI-M
		EPA 365.4	DAW	1	PASI-G
		EPA 9060	TJJ	6	PASI-G
40196278003	MRSS	EPA 8082	BLM	10	PASI-G
		EPA 6010	TXW	9	PASI-G
		EPA 7471	AJT	1	PASI-G
		ASTM D2974-87	PCG	1	PASI-G
		EPA 9071	JER	1	PASI-M
		EPA 365.4	DAW	1	PASI-G
		EPA 9060	TJJ	6	PASI-G
40196278004	URSS	EPA 8082	BLM	10	PASI-G
		EPA 6010	TXW	9	PASI-G
		EPA 7471	AJT	1	PASI-G
		ASTM D2974-87	AH	1	PASI-G
		EPA 9071	JER	1	PASI-M
		EPA 365.4	DAW	1	PASI-G
		EPA 9060	TJJ	6	PASI-G

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

PROJECT NARRATIVE

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

Method: EPA 8082
Description: 8082 GCS PCB
Client: Great Lakes Environmental Center
Date: February 27, 2020

General Information:
4 samples were analyzed for EPA 8082. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Sample Preparation:
The samples were prepared in accordance with EPA 3541 with any exceptions noted below.

Initial Calibrations (including MS Tune as applicable):
All criteria were within method requirements with any exceptions noted below.

Continuing Calibration:
All criteria were within method requirements with any exceptions noted below.

Surrogates:
All surrogates were within QC limits with any exceptions noted below.

QC Batch: 337743

S0: Surrogate recovery outside laboratory control limits.

- LCS (Lab ID: 1961714)
  - Decachlorobiphenyl (S)
- MS (Lab ID: 1961715)
  - Decachlorobiphenyl (S)
- MSD (Lab ID: 1961716)
  - Decachlorobiphenyl (S)

S3: Surrogate recovery exceeded laboratory control limits. Analyte presence below reporting limits in associated sample.

- BLANK (Lab ID: 1961713)
  - Decachlorobiphenyl (S)

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

PROJECT NARRATIVE

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

Method: EPA 6010
Description: 6010 MET ICP
Client: Great Lakes Environmental Center
Date: February 27, 2020

General Information:
4 samples were analyzed for EPA 6010. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Sample Preparation:
The samples were prepared in accordance with EPA 3050 with any exceptions noted below.

Initial Calibrations (including MS Tune as applicable):
All criteria were within method requirements with any exceptions noted below.

Continuing Calibration:
All criteria were within method requirements with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

PROJECT NARRATIVE

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

Method: EPA 7471
Description: 7471 Mercury
Client: Great Lakes Environmental Center
Date: February 27, 2020

General Information:
4 samples were analyzed for EPA 7471. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Sample Preparation:
The samples were prepared in accordance with EPA 7471 with any exceptions noted below.

Initial Calibrations (including MS Tune as applicable):
All criteria were within method requirements with any exceptions noted below.

Continuing Calibration:
All criteria were within method requirements with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

PROJECT NARRATIVE

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

Method: **EPA 9071**
Description: 9071 Oil and Grease, Soxhlet
Client: Great Lakes Environmental Center
Date: February 27, 2020

General Information:
4 samples were analyzed for EPA 9071. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Sample Preparation:
The samples were prepared in accordance with EPA 9071B with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

QC Batch: 636672

A matrix spike and/or matrix spike duplicate (MS/MSD) were performed on the following sample(s): 70106716002

M1: Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

- MS (Lab ID: 3431462)
  - Oil and Grease

Duplicate Sample:
All duplicate sample results were within method acceptance criteria with any exceptions noted below.

Additional Comments:

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

PROJECT NARRATIVE

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

Method: **EPA 365.4**
Description: 365.4 Total Phosphorus
Client: Great Lakes Environmental Center
Date: February 27, 2020

General Information:
4 samples were analyzed for EPA 365.4. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Sample Preparation:
The samples were prepared in accordance with EPA 365.4 with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

PROJECT NARRATIVE

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

Method: EPA 9060
Description: Total Organic Carbon Quad
Client: Great Lakes Environmental Center
Date: February 27, 2020

General Information:
4 samples were analyzed for EPA 9060. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

This data package has been reviewed for quality and completeness and is approved for release.

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

Sample: LRSS **Lab ID: 40196278001** Collected: 09/25/19 13:45 Received: 10/01/19 09:30 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	POL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082 GCS PCB	Analytical Method: EPA 8082 Preparation Method: EPA 3541								
PCB-1016 (Aroclor 1016)	**<110**	ug/kg	219	110	1	10/16/19 16:49	10/18/19 14:31	12674-11-2	
PCB-1221 (Aroclor 1221)	**<110**	ug/kg	219	110	1	10/16/19 16:49	10/18/19 14:31	11104-28-2	
PCB-1232 (Aroclor 1232)	**<110**	ug/kg	219	110	1	10/16/19 16:49	10/18/19 14:31	11141-16-5	
PCB-1242 (Aroclor 1242)	**<110**	ug/kg	219	110	1	10/16/19 16:49	10/18/19 14:31	53469-21-9	
PCB-1248 (Aroclor 1248)	**<110**	ug/kg	219	110	1	10/16/19 16:49	10/18/19 14:31	12672-29-6	
PCB-1254 (Aroclor 1254)	**<110**	ug/kg	219	110	1	10/16/19 16:49	10/18/19 14:31	11097-69-1	
PCB-1260 (Aroclor 1260)	**<110**	ug/kg	219	110	1	10/16/19 16:49	10/18/19 14:31	11096-82-5	
PCB, Total	**<110**	ug/kg	219	110	1	10/16/19 16:49	10/18/19 14:31	1336-36-3	
Surrogates									
Tetrachloro-m-xylene (S)	87	%	57-115		1	10/16/19 16:49	10/18/19 14:31	877-09-8	
Decachlorobiphenyl (S)	73	%	47-97		1	10/16/19 16:49	10/18/19 14:31	2051-24-3	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3050								
Arsenic	**28.8**	mg/kg	20.7	6.2	1	10/04/19 07:25	10/07/19 11:57	7440-38-2	
Cadmium	**0.78J**	mg/kg	2.1	0.57	1	10/04/19 07:25	10/07/19 11:57	7440-43-9	
Chromium	**16.4**	mg/kg	4.2	1.2	1	10/04/19 07:25	10/07/19 11:57	7440-47-3	
Copper	**24.2**	mg/kg	4.2	1.2	1	10/04/19 07:25	10/07/19 11:57	7440-50-8	
Lead	**30.0**	mg/kg	8.5	2.5	1	10/04/19 07:25	10/07/19 11:57	7439-92-1	
Nickel	**11.2**	mg/kg	4.2	1.1	1	10/04/19 07:25	10/07/19 11:57	7440-02-0	
Selenium	**<5.6**	mg/kg	18.5	5.6	1	10/04/19 07:25	10/07/19 11:57	7782-49-2	
Silver	**<1.3**	mg/kg	4.2	1.3	1	10/04/19 07:25	10/07/19 11:57	7440-22-4	
Zinc	**93.2**	mg/kg	17.0	5.1	1	10/04/19 07:25	10/07/19 11:57	7440-66-6	
7471 Mercury	Analytical Method: EPA 7471 Preparation Method: EPA 7471								
Mercury	**0.16**	mg/kg	0.14	0.043	1	10/10/19 09:50	10/11/19 10:52	7439-97-6	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**77.2**	%	0.10	0.10	1		10/02/19 18:59		
9071 Oil and Grease, Soxhlet	Analytical Method: EPA 9071 Preparation Method: EPA 9071B								
Oil and Grease	**1900J**	mg/kg	7290	1810	1	10/08/19 08:36	10/08/19 14:56		
365.4 Total Phosphorus	Analytical Method: EPA 365.4 Preparation Method: EPA 365.4								
Phosphorus	**830**	mg/kg	154	77.0	1	10/08/19 09:10	10/08/19 13:45	7723-14-0	
Total Organic Carbon Quad	Analytical Method: EPA 9060								
Total Organic Carbon	**93700**	mg/kg	25500	7660	1		10/09/19 06:03	7440-44-0	
Total Organic Carbon	**99100**	mg/kg	25600	7680	1		10/09/19 06:09	7440-44-0	
Total Organic Carbon	**99100**	mg/kg	25200	7570	1		10/09/19 06:15	7440-44-0	
Total Organic Carbon	**101000**	mg/kg	24400	7330	1		10/09/19 06:21	7440-44-0	
Mean Total Organic Carbon	**98200**	mg/kg	25200	7560	1		10/09/19 06:03	7440-44-0	
Surrogates									
RSD%	**3.2**	%			1		10/09/19 06:03		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

Sample: LRSSD **Lab ID: 40196278002** Collected: 09/25/19 13:45 Received: 10/01/19 09:30 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082 GCS PCB	Analytical Method: EPA 8082 Preparation Method: EPA 3541								
PCB-1016 (Aroclor 1016)	**<111**	ug/kg	223	111	1	10/16/19 16:49	10/18/19 14:49	12674-11-2	
PCB-1221 (Aroclor 1221)	**<111**	ug/kg	223	111	1	10/16/19 16:49	10/18/19 14:49	11104-28-2	
PCB-1232 (Aroclor 1232)	**<111**	ug/kg	223	111	1	10/16/19 16:49	10/18/19 14:49	11141-16-5	
PCB-1242 (Aroclor 1242)	**<111**	ug/kg	223	111	1	10/16/19 16:49	10/18/19 14:49	53469-21-9	
PCB-1248 (Aroclor 1248)	**<111**	ug/kg	223	111	1	10/16/19 16:49	10/18/19 14:49	12672-29-6	
PCB-1254 (Aroclor 1254)	**<111**	ug/kg	223	111	1	10/16/19 16:49	10/18/19 14:49	11097-69-1	
PCB-1260 (Aroclor 1260)	**<111**	ug/kg	223	111	1	10/16/19 16:49	10/18/19 14:49	11096-82-5	
PCB, Total	**<111**	ug/kg	223	111	1	10/16/19 16:49	10/18/19 14:49	1336-36-3	
Surrogates									
Tetrachloro-m-xylene (S)	85	%	57-115		1	10/16/19 16:49	10/18/19 14:49	877-09-8	
Decachlorobiphenyl (S)	72	%	47-97		1	10/16/19 16:49	10/18/19 14:49	2051-24-3	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3050								
Arsenic	**23.9**	mg/kg	20.4	6.1	1	10/04/19 07:25	10/07/19 12:00	7440-38-2	
Cadmium	**0.93J**	mg/kg	2.1	0.56	1	10/04/19 07:25	10/07/19 12:00	7440-43-9	
Chromium	**17.0**	mg/kg	4.2	1.2	1	10/04/19 07:25	10/07/19 12:00	7440-47-3	
Copper	**26.4**	mg/kg	4.2	1.2	1	10/04/19 07:25	10/07/19 12:00	7440-50-8	
Lead	**35.0**	mg/kg	8.4	2.5	1	10/04/19 07:25	10/07/19 12:00	7439-92-1	
Nickel	**12.3**	mg/kg	4.2	1.1	1	10/04/19 07:25	10/07/19 12:00	7440-02-0	
Selenium	**<5.5**	mg/kg	18.2	5.5	1	10/04/19 07:25	10/07/19 12:00	7782-49-2	
Silver	**<1.3**	mg/kg	4.2	1.3	1	10/04/19 07:25	10/07/19 12:00	7440-22-4	
Zinc	**104**	mg/kg	16.7	5.0	1	10/04/19 07:25	10/07/19 12:00	7440-66-6	
7471 Mercury	Analytical Method: EPA 7471 Preparation Method: EPA 7471								
Mercury	**0.19**	mg/kg	0.15	0.044	1	10/10/19 09:50	10/11/19 10:54	7439-97-6	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**77.6**	%	0.10	0.10	1		10/02/19 18:59		
9071 Oil and Grease, Soxhlet	Analytical Method: EPA 9071 Preparation Method: EPA 9071B								
Oil and Grease	**<1720**	mg/kg	6960	1720	1	10/10/19 08:35	10/10/19 14:50		
365.4 Total Phosphorus	Analytical Method: EPA 365.4 Preparation Method: EPA 365.4								
Phosphorus	**828**	mg/kg	126	63.2	1	10/08/19 09:10	10/08/19 13:46	7723-14-0	
Total Organic Carbon Quad	Analytical Method: EPA 9060								
Total Organic Carbon	**100000**	mg/kg	29800	8930	1		10/09/19 07:12	7440-44-0	
Total Organic Carbon	**97200**	mg/kg	30000	9010	1		10/09/19 07:17	7440-44-0	
Total Organic Carbon	**106000**	mg/kg	30200	9060	1		10/09/19 07:23	7440-44-0	
Total Organic Carbon	**107000**	mg/kg	30500	9140	1		10/09/19 07:29	7440-44-0	
Mean Total Organic Carbon	**103000**	mg/kg	30100	9030	1		10/09/19 07:12	7440-44-0	
Surrogates									
RSD%	**4.5**	%			1		10/09/19 07:12		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

Sample: MRSS **Lab ID: 40196278003** Collected: 09/25/19 15:00 Received: 10/01/19 09:30 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	POL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082 GCS PCB	Analytical Method: EPA 8082 Preparation Method: EPA 3541								
PCB-1016 (Aroclor 1016)	**<94.0**	ug/kg	188	94.0	1	10/16/19 16:49	10/18/19 15:07	12674-11-2	
PCB-1221 (Aroclor 1221)	**<94.0**	ug/kg	188	94.0	1	10/16/19 16:49	10/18/19 15:07	11104-28-2	
PCB-1232 (Aroclor 1232)	**<94.0**	ug/kg	188	94.0	1	10/16/19 16:49	10/18/19 15:07	11141-16-5	
PCB-1242 (Aroclor 1242)	**<94.0**	ug/kg	188	94.0	1	10/16/19 16:49	10/18/19 15:07	53469-21-9	
PCB-1248 (Aroclor 1248)	**<94.0**	ug/kg	188	94.0	1	10/16/19 16:49	10/18/19 15:07	12672-29-6	
PCB-1254 (Aroclor 1254)	**<94.0**	ug/kg	188	94.0	1	10/16/19 16:49	10/18/19 15:07	11097-69-1	
PCB-1260 (Aroclor 1260)	**<94.0**	ug/kg	188	94.0	1	10/16/19 16:49	10/18/19 15:07	11096-82-5	
PCB, Total	**<94.0**	ug/kg	188	94.0	1	10/16/19 16:49	10/18/19 15:07	1336-36-3	
Surrogates									
Tetrachloro-m-xylene (S)	83	%	57-115		1	10/16/19 16:49	10/18/19 15:07	877-09-8	
Decachlorobiphenyl (S)	73	%	47-97		1	10/16/19 16:49	10/18/19 15:07	2051-24-3	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3050								
Arsenic	**18.7**	mg/kg	17.1	5.1	1	10/04/19 07:25	10/07/19 12:07	7440-38-2	
Cadmium	**<0.47**	mg/kg	1.8	0.47	1	10/04/19 07:25	10/07/19 12:07	7440-43-9	
Chromium	**13.4**	mg/kg	3.5	0.98	1	10/04/19 07:25	10/07/19 12:07	7440-47-3	
Copper	**22.6**	mg/kg	3.5	0.97	1	10/04/19 07:25	10/07/19 12:07	7440-50-8	
Lead	**24.4**	mg/kg	7.0	2.1	1	10/04/19 07:25	10/07/19 12:07	7439-92-1	
Nickel	**9.3**	mg/kg	3.5	0.93	1	10/04/19 07:25	10/07/19 12:07	7440-02-0	
Selenium	**<4.6**	mg/kg	15.3	4.6	1	10/04/19 07:25	10/07/19 12:07	7782-49-2	
Silver	**<1.1**	mg/kg	3.5	1.1	1	10/04/19 07:25	10/07/19 12:07	7440-22-4	
Zinc	**84.2**	mg/kg	14.0	4.2	1	10/04/19 07:25	10/07/19 12:07	7440-66-6	
7471 Mercury	Analytical Method: EPA 7471 Preparation Method: EPA 7471								
Mercury	**0.13**	mg/kg	0.12	0.035	1	10/10/19 09:50	10/11/19 11:01	7439-97-6	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**73.4**	%	0.10	0.10	1		10/02/19 18:59		
9071 Oil and Grease, Soxhlet	Analytical Method: EPA 9071 Preparation Method: EPA 9071B								
Oil and Grease	**2120J**	mg/kg	6230	1540	1	10/10/19 08:35	10/10/19 14:50		
365.4 Total Phosphorus	Analytical Method: EPA 365.4 Preparation Method: EPA 365.4								
Phosphorus	**808**	mg/kg	119	59.7	1	10/08/19 09:10	10/08/19 13:46	7723-14-0	
Total Organic Carbon Quad	Analytical Method: EPA 9060								
Total Organic Carbon	**77100**	mg/kg	33400	10000	1		10/09/19 07:36	7440-44-0	
Total Organic Carbon	**77200**	mg/kg	33000	9910	1		10/09/19 07:42	7440-44-0	
Total Organic Carbon	**90900**	mg/kg	33800	10100	1		10/09/19 07:47	7440-44-0	
Total Organic Carbon	**83200**	mg/kg	32100	9620	1		10/09/19 07:53	7440-44-0	
Mean Total Organic Carbon	**82100**	mg/kg	33100	9920	1		10/09/19 07:36	7440-44-0	
Surrogates									
RSD%	**7.9**	%			1		10/09/19 07:36		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

ANALYTICAL RESULTS

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

Sample: URSS **Lab ID: 40196278004** Collected: 09/25/19 16:10 Received: 10/01/19 09:30 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082 GCS PCB	Analytical Method: EPA 8082 Preparation Method: EPA 3541								
PCB-1016 (Aroclor 1016)	**<155**	ug/kg	310	155	1	10/16/19 16:49	10/18/19 15:25	12674-11-2	
PCB-1221 (Aroclor 1221)	**<155**	ug/kg	310	155	1	10/16/19 16:49	10/18/19 15:25	11104-28-2	
PCB-1232 (Aroclor 1232)	**<155**	ug/kg	310	155	1	10/16/19 16:49	10/18/19 15:25	11141-16-5	
PCB-1242 (Aroclor 1242)	**<155**	ug/kg	310	155	1	10/16/19 16:49	10/18/19 15:25	53469-21-9	
PCB-1248 (Aroclor 1248)	**<155**	ug/kg	310	155	1	10/16/19 16:49	10/18/19 15:25	12672-29-6	
PCB-1254 (Aroclor 1254)	**<155**	ug/kg	310	155	1	10/16/19 16:49	10/18/19 15:25	11097-69-1	
PCB-1260 (Aroclor 1260)	**<155**	ug/kg	310	155	1	10/16/19 16:49	10/18/19 15:25	11096-82-5	
PCB, Total	**<155**	ug/kg	310	155	1	10/16/19 16:49	10/18/19 15:25	1336-36-3	
Surrogates									
Tetrachloro-m-xylene (S)	87	%	57-115		1	10/16/19 16:49	10/18/19 15:25	877-09-8	
Decachlorobiphenyl (S)	74	%	47-97		1	10/16/19 16:49	10/18/19 15:25	2051-24-3	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3050								
Arsenic	**30.2**	mg/kg	28.6	8.6	1	10/04/19 07:25	10/07/19 12:09	7440-38-2	
Cadmium	**<0.78**	mg/kg	2.9	0.78	1	10/04/19 07:25	10/07/19 12:09	7440-43-9	
Chromium	**20.3**	mg/kg	5.9	1.6	1	10/04/19 07:25	10/07/19 12:09	7440-47-3	
Copper	**24.5**	mg/kg	5.9	1.6	1	10/04/19 07:25	10/07/19 12:09	7440-50-8	
Lead	**29.4**	mg/kg	11.7	3.5	1	10/04/19 07:25	10/07/19 12:09	7439-92-1	
Nickel	**14.8**	mg/kg	5.9	1.6	1	10/04/19 07:25	10/07/19 12:09	7440-02-0	
Selenium	**<7.7**	mg/kg	25.6	7.7	1	10/04/19 07:25	10/07/19 12:09	7782-49-2	
Silver	**<1.8**	mg/kg	5.9	1.8	1	10/04/19 07:25	10/07/19 12:09	7440-22-4	
Zinc	**87.8**	mg/kg	23.5	7.0	1	10/04/19 07:25	10/07/19 12:09	7440-66-6	
7471 Mercury	Analytical Method: EPA 7471 Preparation Method: EPA 7471								
Mercury	**0.12J**	mg/kg	0.20	0.060	1	10/10/19 09:50	10/11/19 11:04	7439-97-6	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**83.8**	%	0.10	0.10	1		10/02/19 19:40		
9071 Oil and Grease, Soxhlet	Analytical Method: EPA 9071 Preparation Method: EPA 9071B								
Oil and Grease	**2800J**	mg/kg	10000	2480	1	10/10/19 08:35	10/10/19 14:50		
365.4 Total Phosphorus	Analytical Method: EPA 365.4 Preparation Method: EPA 365.4								
Phosphorus	**1190**	mg/kg	218	109	1	10/08/19 09:10	10/08/19 13:47	7723-14-0	
Total Organic Carbon Quad	Analytical Method: EPA 9060								
Total Organic Carbon	**129000**	mg/kg	52600	15800	1		10/09/19 07:58	7440-44-0	
Total Organic Carbon	**123000**	mg/kg	53900	16200	1		10/09/19 08:04	7440-44-0	
Total Organic Carbon	**151000**	mg/kg	50600	15200	1		10/09/19 08:10	7440-44-0	
Total Organic Carbon	**122000**	mg/kg	52400	15700	1		10/09/19 08:17	7440-44-0	
Mean Total Organic Carbon	**131000**	mg/kg	52400	15700	1		10/09/19 07:58	7440-44-0	
Surrogates									
RSD%	**10.4**	%			1		10/09/19 07:58		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

QC Batch: 336911 Analysis Method: EPA 7471
QC Batch Method: EPA 7471 Analysis Description: 7471 Mercury
Associated Lab Samples: 40196278001, 40196278002, 40196278003, 40196278004

METHOD BLANK: 1956727 Matrix: Solid
Associated Lab Samples: 40196278001, 40196278002, 40196278003, 40196278004

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Mercury	mg/kg	<0.010	0.035	0.010	10/11/19 10:15	

LABORATORY CONTROL SAMPLE: 1956728

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	mg/kg	0.83	0.83	100	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1956729 1956730

Parameter	Units	40196244001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	mg/kg	0.013J	1	1	1.0	1.0	100	100	85-115	1	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

QC Batch: 336056 Analysis Method: EPA 6010
QC Batch Method: EPA 3050 Analysis Description: 6010 MET
Associated Lab Samples: 40196278001, 40196278002, 40196278003, 40196278004

METHOD BLANK: 1951234 Matrix: Solid
Associated Lab Samples: 40196278001, 40196278002, 40196278003, 40196278004

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Arsenic	mg/kg	<1.5	4.9	1.5	10/07/19 11:09	
Cadmium	mg/kg	<0.13	0.50	0.13	10/07/19 11:09	
Chromium	mg/kg	<0.28	1.0	0.28	10/07/19 11:09	
Copper	mg/kg	0.30J	1.0	0.28	10/07/19 11:09	
Lead	mg/kg	<0.60	2.0	0.60	10/07/19 11:09	
Nickel	mg/kg	<0.26	1.0	0.26	10/07/19 11:09	
Selenium	mg/kg	<1.3	4.4	1.3	10/07/19 11:09	
Silver	mg/kg	<0.31	1.0	0.31	10/07/19 11:09	
Zinc	mg/kg	<1.2	4.0	1.2	10/07/19 11:09	

LABORATORY CONTROL SAMPLE: 1951235

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Arsenic	mg/kg	50	48.2	96	80-120	
Cadmium	mg/kg	50	50.2	100	80-120	
Chromium	mg/kg	50	49.8	100	80-120	
Copper	mg/kg	50	49.5	99	80-120	
Lead	mg/kg	50	50.6	101	80-120	
Nickel	mg/kg	50	51.6	103	80-120	
Selenium	mg/kg	50	51.0	102	80-120	
Silver	mg/kg	25	24.6	98	80-120	
Zinc	mg/kg	50	50.1	100	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1951236 1951237

Parameter	Units	40195979001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Arsenic	mg/kg	<1.6	54.9	55.1	49.2	49.4	90	90	75-125	0	20	
Cadmium	mg/kg	<0.15	54.9	55.1	50.5	51.1	92	93	75-125	1	20	
Chromium	mg/kg	6.0	54.9	55.1	56.0	58.1	91	95	75-125	4	20	
Copper	mg/kg	7.0	54.9	55.1	57.5	58.7	92	94	75-125	2	20	
Lead	mg/kg	6.3	54.9	55.1	55.6	55.7	90	90	75-125	0	20	
Nickel	mg/kg	5.4	54.9	55.1	57.1	56.8	94	93	75-125	0	20	
Selenium	mg/kg	<1.4	54.9	55.1	45.7	46.9	83	85	75-125	3	20	
Silver	mg/kg	<0.34	27.4	27.6	25.6	26.1	92	94	75-125	2	20	
Zinc	mg/kg	34.1	54.9	55.1	86.1	86.6	95	95	75-125	1	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

QC Batch: 337743 Analysis Method: EPA 8082
QC Batch Method: EPA 3541 Analysis Description: 8082 GCS PCB
Associated Lab Samples: 40196278001, 40196278002, 40196278003, 40196278004

METHOD BLANK: 1961713 Matrix: Solid
Associated Lab Samples: 40196278001, 40196278002, 40196278003, 40196278004

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
PCB-1016 (Aroclor 1016)	ug/kg	<25.0	50.0	25.0	10/18/19 13:00	
PCB-1221 (Aroclor 1221)	ug/kg	<25.0	50.0	25.0	10/18/19 13:00	
PCB-1232 (Aroclor 1232)	ug/kg	<25.0	50.0	25.0	10/18/19 13:00	
PCB-1242 (Aroclor 1242)	ug/kg	<25.0	50.0	25.0	10/18/19 13:00	
PCB-1248 (Aroclor 1248)	ug/kg	<25.0	50.0	25.0	10/18/19 13:00	
PCB-1254 (Aroclor 1254)	ug/kg	<25.0	50.0	25.0	10/18/19 13:00	
PCB-1260 (Aroclor 1260)	ug/kg	<25.0	50.0	25.0	10/18/19 13:00	
Decachlorobiphenyl (S)	%	101	47-97		10/18/19 13:00	S3
Tetrachloro-m-xylene (S)	%	98	57-115		10/18/19 13:00	

LABORATORY CONTROL SAMPLE: 1961714

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
PCB-1016 (Aroclor 1016)	ug/kg		<25.0			
PCB-1221 (Aroclor 1221)	ug/kg		<25.0			
PCB-1232 (Aroclor 1232)	ug/kg		<25.0			
PCB-1242 (Aroclor 1242)	ug/kg		<25.0			
PCB-1248 (Aroclor 1248)	ug/kg		<25.0			
PCB-1254 (Aroclor 1254)	ug/kg		<25.0			
PCB-1260 (Aroclor 1260)	ug/kg	500	450	90	64-115	
Decachlorobiphenyl (S)	%			99	47-97	S0
Tetrachloro-m-xylene (S)	%			98	57-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1961715 1961716

Parameter	Units	40197113007 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
PCB-1016 (Aroclor 1016)	ug/kg	<0.029 mg/kg			<28.9	<29.1					20	
PCB-1221 (Aroclor 1221)	ug/kg	<0.029 mg/kg			<28.9	<29.1					20	
PCB-1232 (Aroclor 1232)	ug/kg	<0.029 mg/kg			<28.9	<29.1					20	
PCB-1242 (Aroclor 1242)	ug/kg	<0.029 mg/kg			<28.9	<29.1					20	
PCB-1248 (Aroclor 1248)	ug/kg	<0.029 mg/kg			<28.9	<29.1					20	
PCB-1254 (Aroclor 1254)	ug/kg	<0.029 mg/kg			<28.9	<29.1					20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1961715 1961716

Parameter	Units	40197113007 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
PCB-1260 (Aroclor 1260)	ug/kg	<0.029 mg/kg	578	581	527	531	91	91	49-115	1	20	
Decachlorobiphenyl (S)	%						101	101	47-97			S0
Tetrachloro-m-xylene (S)	%						99	102	57-115			

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

QC Batch: 336151 Analysis Method: ASTM D2974-87
QC Batch Method: ASTM D2974-87 Analysis Description: Dry Weight/Percent Moisture
Associated Lab Samples: 40196278001, 40196278002, 40196278003

SAMPLE DUPLICATE: 1951880

Parameter	Units	40195521006 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	18.9	19.5	3	10	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

QC Batch: 336158
QC Batch Method: ASTM D2974-87
Associated Lab Samples: 40196278004

Analysis Method: ASTM D2974-87
Analysis Description: Dry Weight/Percent Moisture

SAMPLE DUPLICATE: 1951895

Parameter	Units	40195307029 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	20.9	21.6	3	10	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

QC Batch: 636672 Analysis Method: EPA 9071
QC Batch Method: EPA 9071B Analysis Description: 9071 SOX, Oil and Grease
Associated Lab Samples: 40196278001

METHOD BLANK: 3431459 Matrix: Solid
Associated Lab Samples: 40196278001

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Oil and Grease	mg/kg	65.0J	250	61.9	10/08/19 14:56	

LABORATORY CONTROL SAMPLE & LCSD: 3431460 3431461

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limits	RPD	Max RPD	Qualifiers
Oil and Grease	mg/kg	2000	2020	1940	101	97	78-114	4	18	

MATRIX SPIKE SAMPLE: 3431462

Parameter	Units	70106716002 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Oil and Grease	mg/kg	1330	7950	16900	196	78-114	M1

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

QC Batch: 637228 Analysis Method: EPA 9071
QC Batch Method: EPA 9071B Analysis Description: 9071 SOX, Oil and Grease
Associated Lab Samples: 40196278002, 40196278003, 40196278004

METHOD BLANK: 3434448 Matrix: Solid
Associated Lab Samples: 40196278002, 40196278003, 40196278004

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Oil and Grease	mg/kg	<61.9	250	61.9	10/10/19 14:50	

LABORATORY CONTROL SAMPLE: 3434449

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Oil and Grease	mg/kg	2000	1990	100	78-114	

MATRIX SPIKE SAMPLE: 3434450

Parameter	Units	40196278002 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Oil and Grease	mg/kg	<1720	55900	57500	101	78-114	

SAMPLE DUPLICATE: 3434451

Parameter	Units	40196278003 Result	Dup Result	RPD	Max RPD	Qualifiers
Oil and Grease	mg/kg	2120J	<1530		18	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

QC Batch: 336646 Analysis Method: EPA 365.4
QC Batch Method: EPA 365.4 Analysis Description: 365.4 Total Phosphorus
Associated Lab Samples: 40196278001, 40196278002, 40196278003, 40196278004

METHOD BLANK: 1955199 Matrix: Solid
Associated Lab Samples: 40196278001, 40196278002, 40196278003, 40196278004

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Phosphorus	mg/kg	<20.0	40.0	20.0	10/08/19 13:38	

LABORATORY CONTROL SAMPLE: 1955200

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Phosphorus	mg/kg	500	490	98	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1955201 1955202

Parameter	Units	40196404003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Phosphorus	mg/kg	17800	65000	65600	86600	94400	106	117	80-120	9	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

QC Batch: 336757 Analysis Method: EPA 9060
QC Batch Method: EPA 9060 Analysis Description: 9060 TOC Average
Associated Lab Samples: 40196278001, 40196278002, 40196278003, 40196278004

METHOD BLANK: 1955841 Matrix: Solid
Associated Lab Samples: 40196278001, 40196278002, 40196278003, 40196278004

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Mean Total Organic Carbon	mg/kg	<194	647	194	10/09/19 04:50	

LABORATORY CONTROL SAMPLE: 1955842

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mean Total Organic Carbon	mg/kg	120000	121000	101	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1955843 1955844

Parameter	Units	40196278001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mean Total Organic Carbon	mg/kg	98200	233000	231000	327000	326000	98	99	50-150	0	30	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1955845 1955846

Parameter	Units	40196606001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mean Total Organic Carbon	mg/kg	364000	817000	821000	1230000	1200000	106	102	50-150	2	30	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALIFIERS

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-G	Pace Analytical Services - Green Bay
PASI-M	Pace Analytical Services - Minneapolis

ANALYTE QUALIFIERS

M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.
S0	Surrogate recovery outside laboratory control limits.
S3	Surrogate recovery exceeded laboratory control limits. Analyte presence below reporting limits in associated sample.

Pace Analytical Services, LLC
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: HDR/AEP-CONSTANTINE
Pace Project No.: 40196278

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
40196278001	LRSS	EPA 3541	337743	EPA 8082	337745
40196278002	LRSSD	EPA 3541	337743	EPA 8082	337745
40196278003	MRSS	EPA 3541	337743	EPA 8082	337745
40196278004	URSS	EPA 3541	337743	EPA 8082	337745
40196278001	LRSS	EPA 3050	336056	EPA 6010	336536
40196278002	LRSSD	EPA 3050	336056	EPA 6010	336536
40196278003	MRSS	EPA 3050	336056	EPA 6010	336536
40196278004	URSS	EPA 3050	336056	EPA 6010	336536
40196278001	LRSS	EPA 7471	336911	EPA 7471	336972
40196278002	LRSSD	EPA 7471	336911	EPA 7471	336972
40196278003	MRSS	EPA 7471	336911	EPA 7471	336972
40196278004	URSS	EPA 7471	336911	EPA 7471	336972
40196278001	LRSS	ASTM D2974-87	336151		
40196278002	LRSSD	ASTM D2974-87	336151		
40196278003	MRSS	ASTM D2974-87	336151		
40196278004	URSS	ASTM D2974-87	336158		
40196278001	LRSS	EPA 9071B	636672	EPA 9071	636987
40196278002	LRSSD	EPA 9071B	637228	EPA 9071	637501
40196278003	MRSS	EPA 9071B	637228	EPA 9071	637501
40196278004	URSS	EPA 9071B	637228	EPA 9071	637501
40196278001	LRSS	EPA 365.4	336646	EPA 365.4	336677
40196278002	LRSSD	EPA 365.4	336646	EPA 365.4	336677
40196278003	MRSS	EPA 365.4	336646	EPA 365.4	336677
40196278004	URSS	EPA 365.4	336646	EPA 365.4	336677
40196278001	LRSS	EPA 9060	336757		
40196278001	LRSS	EPA 9060	336758		
40196278002	LRSSD	EPA 9060	336757		
40196278002	LRSSD	EPA 9060	336758		
40196278003	MRSS	EPA 9060	336757		
40196278003	MRSS	EPA 9060	336758		
40196278004	URSS	EPA 9060	336757		
40196278004	URSS	EPA 9060	336758		

Pace Analytical®
www.pacelabs.com

UPPER MIDWEST REGION
MN: 612-607-1700 WI: 920-469-2436

Page 1 of 1

40196278

CHAIN OF CUSTODY

*Preservation Codes
A=None B=HCL C=H2SO4 D=HNO3 E=DI Water F=Methanol G=NaOH
H=Sodium Bisulfate Solution I=Sodium Thiosulfate J=Other

(Please Print Clearly)	
Company Name:	GLEC
Branch/Location:	Traverse City, MI
Project Contact:	Dennis McCauley
Phone:	231-941-2230
Project Number:	
Project Name:	HDR/AEP- Constantine
Project State:	MI
Sampled By (Print):	Craig Davis
Sampled By (Sign):	
PO #:	Regulatory Program:

Quote #:	490336
Mail To Contact:	Dennis McCauley
Mail To Company:	GLEC
Mail To Address:	739 Hastings ST Traverse City, MI 49686
Invoice To Contact:	Amelia Howard
Invoice To Company:	GLEC
Invoice To Address:	739 Hastings ST Traverse City, MI 49686
Invoice To Phone:	231-941-2230

Data Package Options (billable)
☐ EPA Level III
☐ EPA Level IV

MS/MSD
☐ On your sample (billable)
☐ NOT needed on your sample

Matrix Codes
A = Air, B = Biota, C = Charcoal, O = Oil, S = Soil, SI = Sludge, W = Water, DW = Drinking Water, GW = Ground Water, SW = Surface Water, WW = Waste Water, WP = Wipe

PACE LAB #	CLIENT FIELD ID	COLLECTION DATE	COLLECTION TIME	MATRIX	Analyses Requested: Y/N	Pick Letter	Metals, Phosphorus, PCBs, TOC, Moisture	Oil & Grease	CLIENT COMMENTS	LAB COMMENTS (Lab Use Only)	Profile #
					FILTERED? (YES/NO)		N	N			
					PRESERVATION (CODE)*		A	A			
001	LRSS 001	9/25	1345	Sed			X				
002	LRSS 001	9/25	1345	"				X			
003	LRSSD 002	9/25	1345	"			X				
004	LRSSD 002	9/25	1345	"				X			
005	MRSS 003	9/25	1500	"			X				
006	MRSS 003	9/25	1500	"				X			
007	URSS 004	9/25	1610	"			X	X	Only 1 jar of P Sample available		
STB 10/1/19											

Rush Turnaround Time Requested - Prelims
(Rush TAT subject to approval/surcharge)
Date Needed:

Transmit Prelim Rush Results by (complete what you want):
Email #1:
Email #2:
Telephone:
Fax:

Samples on HOLD are subject to special pricing and release of liability

Relinquished By:	Date/Time:	Received By:	Date/Time:
	9/30/19 - 1415		
Relinquished By: Fed Ex	Date/Time: 10/1/19 0930	Received By: John T. Brunette Pace	Date/Time: 10/1/19 0930
Relinquished By:	Date/Time:	Received By:	Date/Time:
Relinquished By:	Date/Time:	Received By:	Date/Time:
Relinquished By:	Date/Time:	Received By:	Date/Time:

PACE Project No. 40196278

Receipt Temp = 1 °C

Sample Receipt pH OK / Adjusted

Cooler Custody Seal Present / ~~Not Present~~ Intact / Not Intact

Version 6.0 06/14/06

C019a(27Jun2006)

ORIGINAL

Pace Analytical Services, LLC
1241 Bellevue Street, Suite 9
Green Bay, WI 54302

Sample Preservation Receipt Form

Client Name: GLEC Project # 4019628

All containers needing preservation have been checked and noted below: □Yes □No ☒N/A

Lab Lot# of pH paper: Lab Std #ID of preservation (if pH adjusted): Initial when completed: Date/ Time:

Pace Lab #	Glass							Plastic							Vials						Jars			General			VOA Vials (>6mm) *	H2SO4 pH ≤2	NaOH+Zn Act pH ≥9	NaOH pH ≥12	HNO3 pH ≤2	pH after adjusted	Volume (mL)
	AG1U	AG1H	AG4S	AG4U	AG5U	AG2S	BG3U	BP1U	BP2N	BP2Z	BP3U	BP3B	BP3N	BP3S	DG9A	DG9T	VG9U	VG9H	VG9M	VG9D	JGFU	WGFU	WPFU	SP5T	ZPLC	GN							
001																					2												2.5 / 5 / 10
002																					2												2.5 / 5 / 10
003																					2												2.5 / 5 / 10
004																					1												2.5 / 5 / 10
005																																	2.5 / 5 / 10
006																																	2.5 / 5 / 10
007																																	2.5 / 5 / 10
008																																	2.5 / 5 / 10
009																																	2.5 / 5 / 10
010																																	2.5 / 5 / 10
011																																	2.5 / 5 / 10
012																																	2.5 / 5 / 10
013																																	2.5 / 5 / 10
014																																	2.5 / 5 / 10
015																																	2.5 / 5 / 10
016																																	2.5 / 5 / 10
017																																	2.5 / 5 / 10
018																																	2.5 / 5 / 10
019																																	2.5 / 5 / 10
020																											STB 10/1/19						2.5 / 5 / 10

Exceptions to preservation check: VOA, Coliform, TOC, TOX, TOH, O&G, WI DRO, Phenolics, Other: _____ Headspace in VOA Vials (>6mm) : □Yes □No ☒N/A ***If yes look in headspace column**

AG1U	1 liter amber glass	BP1U	1 liter plastic unpres	DG9A	40 mL amber ascorbic	JGFU	4 oz amber jar unpres
AG1H	1 liter amber glass HCL	BP2N	500 mL plastic HNO3	DG9T	40 mL amber Na Thio	WGFU	4 oz clear jar unpres
AG4S	125 mL amber glass H2SO4	BP2Z	500 mL plastic NaOH, Znact	VG9U	40 mL clear vial unpres	WPFU	4 oz plastic jar unpres
AG4U	120 mL amber glass unpres	BP3U	250 mL plastic unpres	VG9H	40 mL clear vial HCL		
AG5U	100 mL amber glass unpres	BP3B	250 mL plastic NaOH	VG9M	40 mL clear vial MeOH	SP5T	120 mL plastic Na Thiosulfate
AG2S	500 mL amber glass H2SO4	BP3N	250 mL plastic HNO3	VG9D	40 mL clear vial DI	ZPLC	ziploc bag
BG3U	250 mL clear glass unpres	BP3S	250 mL plastic H2SO4			GN:	

Appendix E. Fisheries Study

Fisheries Survey Report

Constantine Project (FERC No. 10661)
March 31, 2020

Contents

Tables

Figures

Appendices

1. Project Introduction and Background

Indiana Michigan Power Company (I&M), a unit of American Electric Power (AEP), is the Licensee, owner, and operator of the 1.2-megawatt Constantine Hydroelectric Project (Project) (FERC No. 10661). The Project is located along the St. Joseph River in St. Joseph County, Michigan.

I&M operates and maintains the Project under a license from the Federal Energy Regulatory Commission (FERC or Commission). The Project's existing license expires on September 30, 2023. I&M is pursuing a subsequent license for the Project using the Commission's Integrated Licensing Process (ILP) as defined in 18 Code of Federal Regulations (CFR) Part 5.

In accordance with 18 CFR § 5.15, I&M has conducted studies as provided in the March 15, 2019 Revised Study Plan (RSP) and schedule approved in the Commission's April 9, 2019 Study Plan Determination (SPD) for the Project. This report describes the methods and results of the Fisheries Survey conducted in support of preparing an application for a subsequent license for the Project.

Existing relevant and reasonably available information regarding the fish community in the Project vicinity was summarized in Section 5.4 of the Pre-Application Document (PAD) (I&M 2018). The St. Joseph River is characterized as a warmwater stream (I&M 1988), and the middle reach (from Mendon, Michigan to Elkhart, Indiana) of the St. Joseph River is managed for Channel Catfish (*Ictalurus punctatus*), Smallmouth Bass (*Micropterus dolomieui*), and Walleye (*Sander vitreus*) (Wesley and Duffy 1999). Historically, the Michigan Department of Natural Resources (MDNR) has stocked Walleye and Channel Catfish in this reach of the St. Joseph River (Wesley and Duffy 1999). Over the past eleven years (2006 to 2016) nearly 275,000 Walleye (just over an inch long) have been stocked in the river in St. Joseph County. Stocking occurred in 2006, 2012, 2014, and 2016 (MDNR 2017). Channel Catfish have not been stocked in this area of the river since 1999 (MDNR 2017).

In the summer of 1972, the MDNR conducted a fish survey along the St. Joseph River using electrofishing and fyke nets. Fifty-two sampling locations were established along the mainstem of the river from its headwaters to the mouth. One segment included from below the dam in Three Rivers, Michigan, to the Constantine dam and another segment included from Constantine dam to the Mottville dam (Shepherd 1975, as cited in I&M 1988). Twenty-two taxa were collected in the segments upstream and downstream of the Constantine dam (Table 1). Although abundance data were not available from this study, Wesley and Duffy (1999) summarized the Shepherd (1975) survey and indicated Bluegill (*Lepomis macrochirus*), Black Crappie (*Pomoxis nigromaculatus*), and Smallmouth Bass were the most abundant sport fish collected. Redhorse (*Moxostoma spp*.), Spotted Sucker (*Minytrema melanops*), Longnose Gar (*Lepisosteus osseus*), and Golden Shiner (*Notemigonus crysoleucas*) were also abundant (Shepherd 1975, as cited in I&M 1988; Wesley and Duffy 1999).

Table 1. Fish Species Collected During Previous Studies from Two Study Reaches of the St. Joseph River

Common Name	Scientific Name	Three Rivers Dam to Constantine Dam	Constantine Dam to Mottville Dam
Black Crappie*	*Pomoxis nigromaculatus*	X	X
Bluegill*	*Lepomis macrochirus*	X	X
Bluntnose Minnow	*Pimephales notatus*		X
Common Carp	*Cyprinus carpio*	X	X
Common Shiner	*Luxilus cornutus*	X	
Golden Shiner	*Notemigonus crysoleucas*		X
Green Sunfish*	*Lepomis cyanellus*		X
Northern Hogsucker	*Hypentelium nigricans*		X
Largemouth Bass*	*Micropterus salmoides*	X	X
Logperch	*Percina caprodes*	X	X
Longnose Gar	*Lepisosteus osseus*	X	X
Northern Pike*	*Esox lucius*	X	X
Pumpkinseed*	*Lepomis gibbosus*	X	X
Redhorse	*Moxostoma spp.*	X	X
Rock Bass*	*Ambloplites rupestris*	X	X
Smallmouth Bass*	*Micropterus dolomieui*	X	X
Spotfin Shiner	*Cyprinella spiloptera*		X
Spotted Gar	*Lepisosteus oculatus*		X
Spotted Sucker	*Minytrema melanops*	X	X
Warmouth Bass*	*Lepomis gulosus*		X
White Sucker	*Catostomus commersonii*	X	X
Yellow Bullhead	*Ameiurus natalis*	X	

*Identified as game fish, X indicates fish present.

Source: Shepherd 1975, as cited in I&M 1988.

From April 1990 through January 1991, a fish entrainment and riverine community study was conducted at the Project. Annual estimates of entrainment and associated mortality were calculated for the Project. The survey calculated an annual entrainment rate by extrapolating the results of a single-turbine tailrace netting survey conducted at the Constantine Project. Mortality estimates were calculated using mortality rates from the entrainment mortality study completed at the Buchanan Hydroelectric Project (FERC Project 2551), which shares a nearly identical operating head and turbine placement relative to tailwater elevation (AEP 1991). The Constantine fish entrainment study also compiled comprehensive fish community data through seining, netting, and electrofishing in the Project's reservoir and the bypass reach. The study concluded that entrainment mortality was relatively low with annual fish losses calculated at 7,751 fish. In the community assessment around the Project, 8,752 fish of 46 species were collected. The study found that the fish community was "diverse and the populations are abundant in the St. Joseph River near the Constantine Project" (AEP 1991).

In 1998, the MDNR conducted a general survey to evaluate the fish community and the Walleye stocking program upstream of the Constantine dam using electrofishing, trap nets, and gill nets in June and July (MDNR 1998). Nineteen species were collected during the survey (Table 2). Bluegill, Black Crappie, Channel Catfish, Walleye, and Smallmouth Bass were identified as the primary sport fish.

Table 2. MDNR Fish Community and Walleye Survey Upstream of the Constantine Dam in June and July 1998

Common Name	Scientific Name	Number	Relative Abundance* (%)
Black Crappie	*Pomoxis nigromaculatus*	45	7.1
Bluegill	*Lepomis macrochirus*	296	46.7
Bowfin	*Amia calva*	1	0.2
Bullhead catfishes	(family) *Ictaluridae*	2	0.3
Common Carp	*Cyprinus carpio*	18	2.8
Channel Catfish	*Ictalurus punctatus*	29	4.6
White Sucker	*Catostomus commersonii*	3	0.5
Hybrid sunfish	*Lepomis sp.*	4	0.6
Largemouth Bass	*Micropterus salmoides*	13	2.1
Longnose Gar	*Lepisosteus osseus*	16	2.5
Logperch	*Percina caprodes*	2	0.3
Northern Pike	*Esox lucius*	1	0.2
Pumpkinseed	*Lepomis gibbosus*	9	1.4
Redhorse	*Moxostoma spp.*	95	15
Rock Bass	*Ambloplites rupestris*	4	0.6
Smallmouth Bass	*Micropterus dolomieui*	34	5.4
Spotted Sucker	*Minytrema melanops*	44	6.9
Walleye	*Sander vitreus*	14	2.2
Yellow Perch	*Perca flavecens*	4	0.6
	TOTAL	634	100

*As Percent of Total Fish Collected
Source: MDNR 1998.

In March 2019, fish collections and relocations were made by electrofishing in the Project's power canal (Table 3). These collections took place during drawdown for scheduled maintenance work, unrelated to these relicensing proceedings.

Table 3. Number of Live Fish Relocated from Project Area

Common Name	Scientific Name	Collection Date		Total
		3/28/2019	3/29/2019	
Rock Bass	*Ambloplites rupestris*	9	18	**27**
Yellow Bullhead	*Ameiurus natalis*	18	17	**35**
Greenside Darter	*Etheostoma blennioides*	-	3	**3**
Rainbow Darter	*Etheostoma caeruleum*	69	174	**243**
Johnny Darter	*Etheostoma nigrum*	14	16	**30**
Northern Hogsucker	*Hypentelium nigricans*	3	1	**4**
Channel Catfish	*Ictalurus punctatus*	-	9	**9**
Brook Silverside	*Labidesthes sicculus*	3	-	**3**
Green Sunfish	*Lepomis cyanellus*	1	-	**1**
Bluegill	*Lepomis macrochirus*	9	7	**16**
Common Shiner	*Luxilus cornutus*	1	3	**4**
Smallmouth Bass	*Micropterus dolomieu*	186	139	**325**
Largemouth Bass	*Micropterus salmoides*	1	1	**2**
Golden Redhorse	*Moxostoma erythrurum*	10	7	**17**
Shorthead Redhorse	*Moxostoma macrolepidotum*	2	-	**2**
Stonecat	*Noturus flavus*	-	1	**1**
Yellow Perch	*Perca flavescens*	3	3	**6**
Logperch	*Percina caprodes*	70	99	**169**
Blackside Darter	*Percina maculate*	3	17	**20**
Black Crappie	*Poxomis nigromaculatus*	-	1	**1**
Walleye	*Sander vitrus*	12	-	**12**
Total Individuals		**414**	**516**	**930**
Total Species		**17**	**17**	**21**

Source: Cardno 2019.

A diverse fish community of twenty-one species were collected and relocated. Primary game fish like those identified during the MDNR 1998 survey were present: Black Crappie, Bluegill, Channel Catfish, Smallmouth Bass, and Walleye.

2. Study Goals and Objectives

In accordance with I&M's RSP and the Commission's SPD for the Project, the goal of the Fisheries Survey was to collect baseline fisheries data in the Project area. The specific goals and objectives of this study were as follows:

- Collect a comprehensive baseline for existing fishery resources in the vicinity of the Project.
- Compare current fisheries data to historical fisheries data to determine any significant changes to fish species composition.
- Analyze tissue samples for mercury and PCB concentrations.
- Confirm intake velocities for fish impingement and entrainment potential.

3. Study Area

3.1. Fish Collections

The study area for fish community sampling consisted of locations throughout the Project's reservoir and bypass reach. The Project's power canal was initially included in the study area but was excluded based on communication with MDNR staff from the Fisheries Division in the Southern Lake Michigan Unit, who agreed that the stranded fish survey of the power canal in spring 2019 provided sufficient data to predict the species present (McCauley, personal communication, July 10-11, 2019).

Pursuant to the approved RSP, fish collections were made in the Project's reservoir and bypass reach sections in both near-shore (shallow) and mid-channel (deep) habitats; and in all available types of fish cover found within these zones to accurately characterize the fish community in the area of the Constantine Project. Collection areas were categorized as open-water, shoreline, backwater, macrophyte beds, and the bypass reach. Figure 1 shows the location of 33 collections completed in the reservoir and bypass reach.

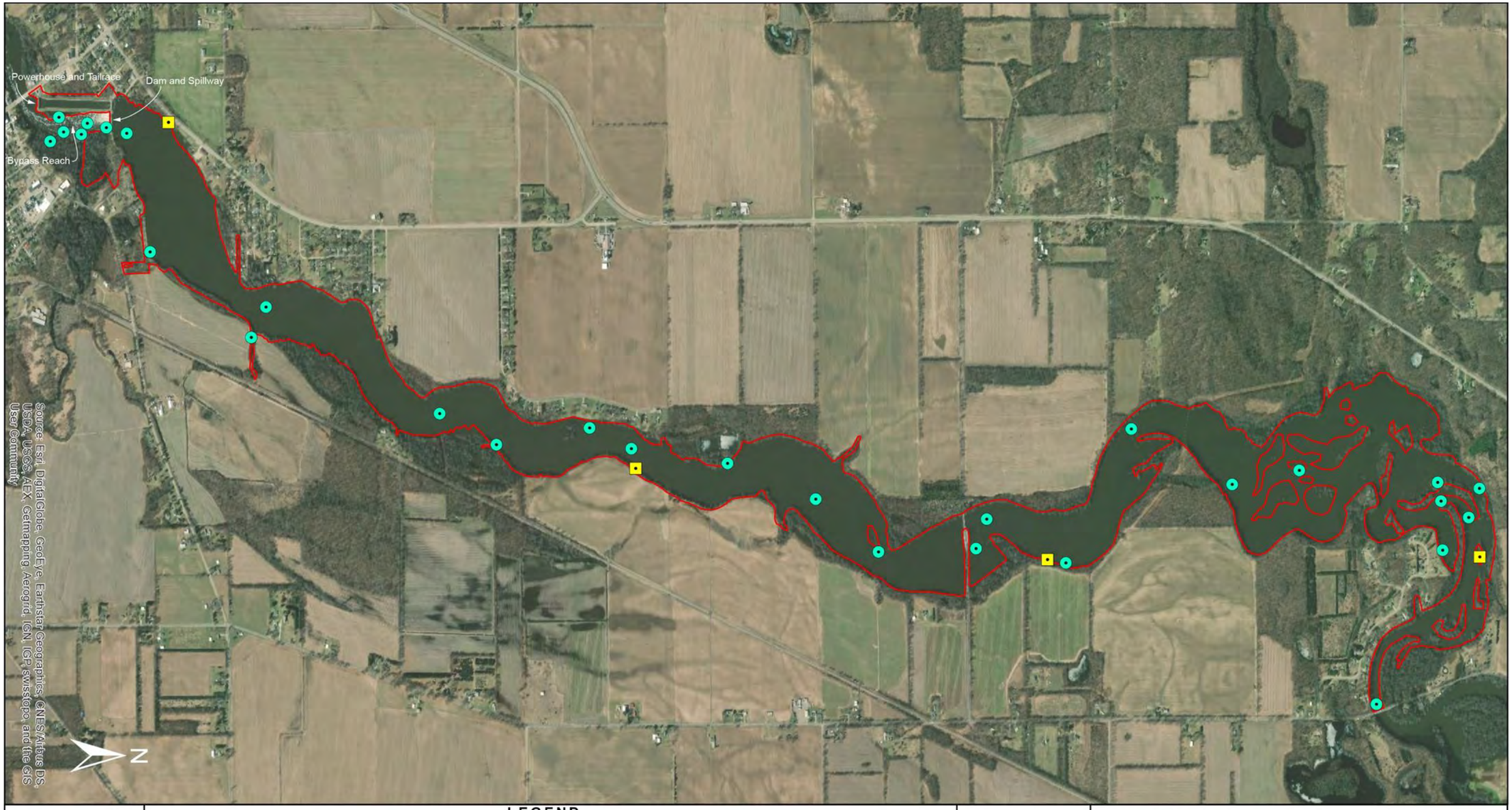


Figure 1. Fish Survey Locations

The location of each collection area was geo-referenced using a handheld Global Positioning System (GPS) unit. The habitat type, fish cover percentage and type, water depth, water current speed, and substrate type were noted. Table 12 in Section 7 contains all collection area locations and details.

3.2.Intake Velocities

In order to confirm intake velocities at the Project, a survey was conducted at two locations within the Project's power canal (see Figure 2).

Figure 2. Velocity Transects

The velocity transects were located downstream of the power canal headgates (Transect 1) and upstream of the powerhouse (Transect 2), geolocation of each transect is provided in Table 4.

Table 4. Coordinates for the Transect End-points for Current Velocity Sampling

Transect	Right Bank	Left Bank
Transect 1	41.84716, -85.66943	41.84710, -85.66908
Transect 2	41.84413, -85.66953	41.84415, -85.66902

4. Methodology

4.1. Fish Collections

4.1.1. Fyke Nets

Four fyke nets (trap nets) were set in locations spread over the length of the Project's reservoir (Figure 1). The fyke nets consisted of a single 50-foot lead net running to a 4-foot by 6-foot rectangular net frame with one-half inch mesh. Each net was set in the afternoon and retrieved the following morning on two consecutive days during the September sampling. The nets were set in relatively shallow, near-shore habitat with the lead net running perpendicular to shore to guide fish swimming parallel to shore into the trap end.

4.1.2. Electrofishing

Electrofishing was conducting via a 16-foot boat with a direct current (DC) electrofisher. The electrofisher was controlled by a Smith-Root 5.0 gas powered pulsator (GPP) running to a boom-mounted array and powered by a 5,000-watt generator. Output was set at each site according to conditions but was generally at 60 pulses per second and power limited to produce 5-6 amps. Each collection location was electrofished thoroughly for between 10-15 minutes, recorded in seconds for catch per unit effort (CPUE) calculation, and traveling a distance approximately 100-250 meters (m) depending on the density of the fish cover and until the operators felt confident that all habitats present had been adequately sampled. CPUE is calculated as individuals captured per hour.

4.2. Fish Processing

4.2.1. Fish Enumeration

Collected fish were held in a live well until the end of the transect when they were counted and identified to species. After enumeration, fish were released near the point of capture. Individual fish were measured to the nearest millimeter (mm) and weighed to the nearest gram. When more than 30 individuals of a single species were collected, those excess fish were only counted and a minimum and maximum length was recorded. For very small fish, individuals were batch weighed in order to register a valid weight on the scale.

4.2.2. Fish Tissue

Per the RSP, fish tissue samples were obtained from ten (10) legal size Largemouth Bass (*Micropterus salmoides*) (resident predator fish) and ten (10) Shorthead Redhorse (bottom feeder fish) that were representative of the sizes that may be consumed by anglers. The ten Largemouth Bass were divided into two size groups and analyzed separately. Specimens for tissue samples were collected and processed following the methodologies outlined in EPA 823-B-00-007 – Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories Volume 1 Fish Sampling and Analysis Third Edition (Appendix A). Collected tissue for analysis was skinless filet, the most conservative method (U.S. Environmental Protection Agency 2000). Methods used for analysis conformed to requirements stated in EPA 823-B-00-007. Fish tissue samples were analyzed for PCB Aroclors by EPA Method 8082, for PCB Congeners by EPA Method 1668, and for total mercury by EPA Method 7473. (Table 5).

Table 5. Fish Contaminant Parameters, Units and Maximum Required Detection Levels for Tissue Samples Collected from the AEP/Constantine Hydroelectric Plant Reservoir

Parameter	Reporting Units	Detection Level
Mercury	mg/kg	0.010
PCBs (Aroclors 1242, 1248, 1254 and 1260)	mg/kg	0.025
Total PCBs	mg/kg	0.025

(Placeholder pending lab results, confirm and update based on lab report)

4.3.Supporting Data

4.3.1. In-situ Water Quality

Discrete multi-parameter water quality measurements of temperature, dissolved oxygen (DO) concentration, pH, and specific conductance were collected at the fish sampling locations using a calibrated YSI ProDSS® multi-parameter sonde. Visual estimates of the water clarity were made by recording the depth at which a Secchi disk disappeared at fish collection sites, recorded to the nearest tenth of a meter. However, at some fish collection locations the current was too swift to accurately measure using a Secchi disk, these locations were marked as Secchi depth N/A.

4.3.2. Intake Velocities

Measurements were collected to determine the average approach velocity of water in the power canal and entering the Project's trashrack structure. Interference to the surveying unit was encountered while trying to record measurements 1-foot upstream of the Project's trashracks. In order to record useable measurements, the velocity profile transect for this location was shifted slightly upstream in the power canal.

Each velocity profile event consisted of bank-to-bank transects using an acoustic doppler current profiler (ADCP). A total of six velocity transect measurements were completed during June 12th, 2019, three at each transect location. A M9 RiverSurveyor ADCP system and hydroboard were used, designed to measure river discharge, 3-dimensional water velocity, and bathymetry. The RiverSurveyor Power and Communication Module (PCM) contains a differential GPS and 2.4 gigahertz (GHz) Bluetooth radio. The

ADCP utilizes a nine-beam system with two sets of four profiling beams (each set having its own frequency) and one vertical beam (see Figure 3).

The ADCP has two sets of velocity measurement transducers, both in a Janus configuration – four 3.0-megahertz (MHz) transducers and four 1.0-MHz transducers. The M9 RiverSurveyor has a velocity profiling range of up to 40 m and a discharge measurement range of 80 m (when referencing GPS and the vertical beam).

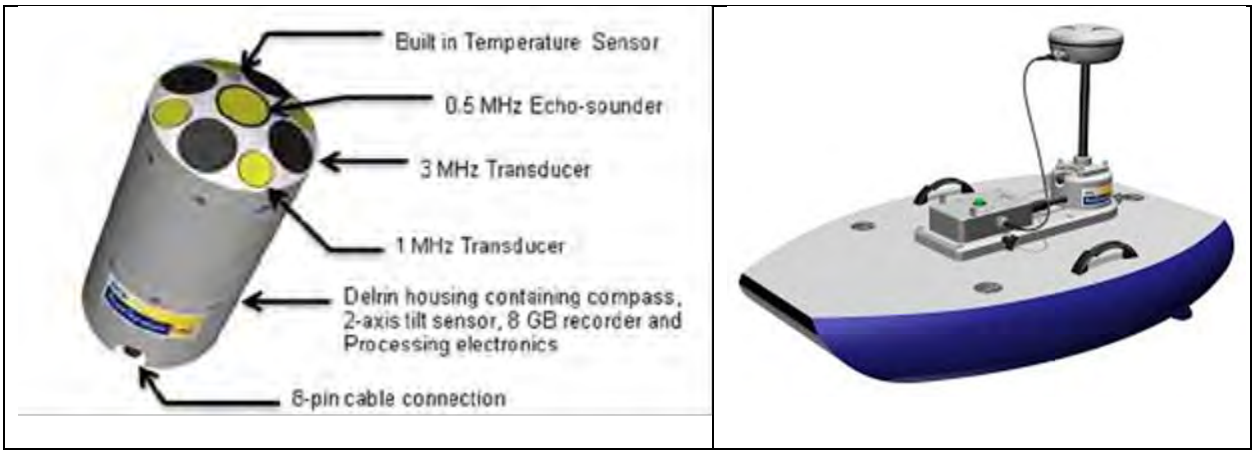


Figure 3. M9 RiverSurveyor Features and HydroBoard

With respect to bathymetry, the vertical acoustic beam, operating at 500 kilohertz (kHz), provides direct measurements below the instrument in the same manner as a single beam echo sounder. The four velocity beams, operating at 1000 kHz, each measure an additional depth and are projected at a 25-degree angle from the vertical axis. When the water depth gets shallow (approximately less than 5 m), the four 3000 kHz beams measure the bottom depth in place of the 1000 kHz beams. The M9 RiverSurveyor system test and compass calibration were successfully completed each day consistent with Great Lakes Environmental Center, Inc.'s (GLEC) Standard Operating Procedure (Appendix D).

5. Study Results

5.1. Fish Collections

5.1.1. Fish Community Baseline Survey

Field staff collected 2,343 individuals representing 46 species during the June and September fish sampling. Table 6 shows the total number of individuals of each species and where they were captured.

Table 6. Species Captured by Fyke Net or Electrofishing in the Constantine Project's Reservoir and Bypass Reach During All Sampling Events

Family Common Name	*Species Common Name*	*Scientific Name*	*Bypass Reach*	*Reservoir*	*Total*	*Relative Abundance*
Bowfins	Bowfin	*Amia calva*	288	14	302	12.90%
Bullhead Catfishes	Brown Bullhead	*Ameiurus nebulosus*		4	4	0.20%
	Channel Catfish	*Ictalurus punctatus*	2		2	0.10%

	Flathead Catfish	*Pylodictis olivaris*		1	1	0.00%
	Yellow Bullhead	*Ameiurus natalis*	2	11	13	0.60%
Carps & Minnows	Bluntnose Minnow	*Pimephales notatus*	8	221	229	9.80%
	Common Carp	*Cyprinus carpio*	7	13	20	0.90%
	Emerald Shiner	*Notropis atherinoides*	1	16	17	0.70%
	Golden Shiner	*Notemigonus crysoleucas*		21	21	0.90%
	Mimic Shiner	*Notropis volucellus*	92	143	235	10.00%
	Sand Shiner	*Notropis stramineus*	6		6	0.30%
	Spotfin Shiner	*Cyprinella spiloptera*	18	36	54	2.30%
	Striped Shiner	*Luxilus chrysocephalus*		8	8	0.30%
Gars	Longnose Gar	*Lepisosteus osseus*	3	1	4	0.20%
Herrings & Shads	Gizzard Shad	*Dorosoma cepedianum*		37	37	1.60%
Lampreys	Chestnut Lamprey	*Ichthyomyzon castaneus*	1	1	2	0.10%
Perches	Blackside Darter	*Percina maculata*	3	1	4	0.20%
	Greenside Darter	*Etheostoma blennioides*	1		1	0.00%
	Johnny Darter	*Etheostoma nigrum*		1	1	0.00%
	Logperch	*Percina caprodes*	2	16	18	0.80%
	Pirate Perch	*Aphredoderus sayanus*		2	2	0.10%
	Rainbow Darter	*Etheostoma caeruleum*	2		2	0.10%
	Walleye	*Sander vitreus*	2		2	0.10%
	Yellow Perch	*Perca flavescens*	5	11	16	0.70%
Pikes & Pickerels	Grass Pickerel	*Esox americanus vermiculatus*		8	8	0.30%
	Northern Pike	*Esox lucius*	3	1	4	0.20%
Silversides	Brook Silverside	*Labidesthes sicculus*	4	15	19	0.80%
Suckers	Black Redhorse	*Moxostoma duquesnei*		2	2	0.10%
	Golden Redhorse	*Moxostoma erythrurum*	11	65	76	3.20%
	Greater Redhorse	*Moxostoma valenciennesi*		13	13	0.60%
	Northern Hogsucker	*Hypentelium nigricans*		1	1	0.00%
	River Redhorse	*Moxostoma carinatum*		2	2	0.10%
	Shorthead Redhorse	*Moxostoma macrolepidotum*	20	38	58	2.50%
	Silver Redhorse	*Moxostoma anisurum*	2	13	15	0.60%
	Spotted Sucker	*Minytrema melanops*		63	63	2.70%
	White Sucker	*Catostomus commersonii*	1	3	4	0.20%
Sunfishes	Black Crappie	*Pomoxis nigromaculatus*	1	15	16	0.70%
	Bluegill	*Lepomis macrochirus*	99	632	731	31.20%
	Green Sunfish	*Lepomis cyanellus*	7	2	9	0.40%
	Largemouth Bass	*Micropterus salmoides*	16	87	103	4.40%
	Northern Sunfish	*Lepomis peltastes*	14	1	15	0.60%
	Pumpkinseed	*Lepomis gibbosus*	11	42	53	2.30%
	Rock Bass	*Ambloplites rupestris*	35	38	73	3.10%

	Smallmouth Bass	*Micropterus dolomieu*	43	23	66	2.80%
	Warmouth	*Lepomis gulosus*	8	2	10	0.40%
	White Crappie	*Pomoxis annularis*		1	1	0.00%
Totals	**(Species: 46)**		**718**	**1625**	**2343**	

Bluegill, Bowfin (*Amia calva*), Mimic Shiner (*Notropis volucellus*), Largemouth Bass, Golden Redhorse (*Moxostoma erythrurum*), and Rock Bass (*Ambloplites rupestris*) were the most abundant species collected and represent approximately 75 percent of all individuals captured. Some species captured were collected in sparse numbers with 17 species represented by less than five individuals, and five species with only a single individual caught. In total 1,625 fish were captured in the reservoir compared to 718 in the bypass reach.

Flathead Catfish (*Pylodictis olivaris*) was the only species caught only in the fyke net and not while electrofishing. Fyke nets were set in the Project's reservoir and had a CPUE of 1.88 fish per hour or approximately 45 fish per 24-hours on average.

Table 7 shows the CPUE for electrofishing collections in the reservoir and the bypass reach with the spillway tailwater excluded. During the September sampling, Bowfin were congregated at the base of the bypass spillway in great numbers, they represented half of all individuals caught in that area. When the catch from this area was included in the CPUE aggregate the overall bypass reach showed an increase in CPUE with 359 fish per hour and an individual CPUE in the spillway tailwater of 1,045 fish per hour. Excluding the spillway tailwater area and fyke nets, the CPUE in each area of the Project were relatively similar with 218 fish per hour in the spillway and 240 in the reservoir.

Table 7. Catch Per Unit Effort for Electrofishing in the Constantine Project's Reservoir and Bypass Reach in Total and by Habitat Type (Excludes Bypass Spillway Tailwater)

Area	Habitat	CPUE (ind/hr)
Bypass Reach		218
	Backwater	172
	Bypass Mid-Channel	73
	River Mouth	248
	Shoreline	342
Reservoir		240
	Backwater	286
	Macrophyte Bed	399
	Open Water	96
	Shoreline	449
Total		235

* Individual fish collected per hour.

5.1.2. Fish Tissue

During fish collections in September, field crews collected (10) Largemouth Bass and (10) Shorthead Redhorse for fish tissue analysis via boat electrofishing. After four days of collections, five Largemouth

Bass were included at less than the legal size (355.6 mm) because ten individuals of legal size were not collected; those five individuals ranged in size from 295-315 mm. Five Largemouth Bass greater than 360 mm were also collected for analysis. Field staff were unable to collect enough individuals of either of the preferred species, Common Carp or Channel Catfish, and substituted (10) Shorthead Redhorse to represent the bottom feeder fish species; those individuals ranged in size from 423-562 mm.

<insert fish tissue results from Pace Labs when available>

5.2.Supporting Data

5.2.1. In-situ Water Quality

The complete in-situ water quality data are presented in Appendix C, and the minimum, maximum, and average values are listed below in Table 8.

Table 8. Minimum, Maximum, and Average Values for In-situ Water Quality at Fish Collection Sites in June and September

	pH		Dissolved Oxygen (mg/L)		Specific Conductance (µS/cm)		Surface Temperature (°C)		Secchi Disk Depth (m)		Depth (m)	
	June	Sept	June	Sept	June	Sept	June	Sept	June	Sept	June	Sept
Minimum	7.61	7.88	6.05	7.28	486	504	19.5	17.6	0.80	0.50	0.7	0.5
Maximum	8.13	8.24	9.00	9.55	546	611	21.9	22.7	1.10	2.00	4.5	3.7
Average	7.98	8.12	7.95	8.17	510	521	20.3	20.2	0.95	1.30	1.9	2.0

5.2.2. Intake Velocities

The results of the ADCP velocity survey are shown below in Table 9. The average current velocity for Transect 1 and 2 was 1.57 feet per second (ft/s) and 1.33 ft/s respectively.

Table 9. Summary Results from Six ADCP Transects in the Project's Power Canal

Transect Number	File Reference	Direction	Start Date	Start Time	Transect Width ft	Transect Area ft^2	Mean River Velocity ft/s	Boat Speed ft/s	Left Q cfs	Right Q cfs	Total Q cfs	Average Current Velocity ft/s	Average Transect Q cfs
Transect 1	4851	left bank to right bank	6/12/2019	9:48:52 AM	96.5	772.1	1.579	0.601	0.76	0.00	1219.4	1.57	1,218.9
	5937	left bank to right bank	6/12/2019	9:59:39 AM	95.2	777.8	1.576	0.690	0.43	0.00	1226.0		
	3534	right bank to left bank	6/12/2019	10:35:33 AM	94.1	774.2	1.565	0.523	0.61	0.26	1211.3		
Transect 2	3009	right bank to left bank	6/12/2019	11:30:05 AM	109.2	936.0	1.328	0.650	0.53	0.62	1243.3	1.33	1,234.8
	5620	left bank to right bank	6/12/2019	11:56:14 AM	108.0	933.3	1.316	0.662	0.14	0.51	1228.4		
	0921	left bank to right bank	6/12/2019	12:09:15 PM	101.5	906.2	1.36	0.870	0.06	0.00	1232.8		

The average flow rate in Transects 1 and 2 was 1,218.9 cubic feet per second (cfs) and 1,234.8 cfs, respectively, during the study.

6. Summary and Discussion

6.1. Fish Community

6.1.1. Fish Community Baseline Survey Compared to Historical Community Data

During fish collections in June and September 2019 GLEC documented a diverse and abundant fish community. The 2,343 fish representing 46 species are equal in species richness to collections made in the area in the historical record. The June and September fish sampling collected the same or more species than historical sampling records as described in the introduction (Table 10). It appears that the community has not changed significantly since the last major survey.

Species collected in the past, but missing from this year's collections included Brook (*Lampetra planeri*) and Silver Lamprey (*Ichthyomyzon unicuspis*), Central Stoneroller (*Campostoma anomalum*), Common Shiner (*Luxilus cornutus*), Creek Chub (*Semotilus atromaculatus*), Fathead Minnow (*Pimephales promelas*), Spotted Gar (*Lepisosteus oculatus*), and Stonecat (*Noturus flavus*). During the 2019 fish collection, six species were collected that were not seen in past records including: Brown Bullhead (*Ameiurus nebulosus*), Emerald Shiner (*Notropis atherinoides*), Flathead Catfish, Northern Sunfish (*Lepomis peltastes*), Pirate Perch (*Aphredoderus sayanus*), and White Crappie (*Pomoxis annularis*). Most species collected remain the same from the last broad survey completed by AEP in 1990-1991.

Table 10. Comparison of Fish Species Collected Near the Constantine Project in Various Surveys

Common Name	Shepherd 1975	AEP 1991	MDNR 1998	Cardno 2019	GLEC 2019
American Brook Lamprey		X			
Black Crappie	X	X	X	X	X
Black Redhorse		X			X
Blackside Darter		X		X	X
Bluegill	X	X	X	X	X
Bluntnose Minnow	X	X			X
Bowfin		X	X		X
Brook Silverside		X	X	X	X
Brown Bullhead					X
Central Stoneroller		X			
Channel Catfish		X	X	X	X
Chestnut Lamprey		X			X
Common Carp	X	X	X		X
Common Shiner	X	X		X	
Creek Chub		X			
Emerald Shiner					X
Fathead Minnow		X			
Flathead Catfish					X
Gizzard Shad					X
Golden Redhorse		X		X	X
Golden Shiner	X	X			X
Grass Pickerel		X			X
Greater Redhorse		X			X
Green Sunfish	X	X		X	X

Greenside Darter				X	X
Johnny Darter		X		X	X
Largemouth Bass	X	X	X	X	X
Logperch	X	X	X	X	X
Longear Sunfish		X			
Longnose Gar	X	X	X		X
Mimic Shiner		X		X	X
Northern Hogsucker	X	X			X
Northern Pike	X	X	X		X
Northern Sunfish					X
Pirate Perch					X
Pumpkinseed	X	X	X		X
Rainbow Darter		X		X	X
River Redhorse		X			X
Redhorse Sp.			X		
Rock Bass	X	X	X	X	X
Rosyface Shiner		X			
Sand Shiner		X			X
Shorthead Redhorse		X		X	X
Silver Lamprey		X			
Silver Redhorse		X			X
Smallmouth Bass	X	X	X	X	X
Spotfin Shiner	X	X			X
Spotted Gar	X				
Spotted Sucker	X	X	X		X
Stonecat				X	
Striped Shiner		X			X
Walleye		X	X	X	X
Warmouth	X	X			X
White Crappie					X
White Sucker	X	X	X		X
Yellow Bullhead	X	X		X	X
Yellow Perch		X	X	X	X

6.1.2. Fish Tissue

<insert fish tissue analysis when results are available>

6.1.3. Intake Velocities for Fish Impingement and Entrainment Potential

The intake velocities recorded at two locations within the power canal were similar to those reported in the entrainment survey completed in 1991 (AEP 1991). As reported in the PAD, during original licensing in 1988 velocities were measured as 1.8 feet per second (fps) through the trackracks and 1.3 fps at the face of the trackracks (I&M 2018). This is very similar to average velocities measured in the power canal by the ADCP sensors in June, 2019 of 1.57 fps (47.9 centimeters per second [cm/s]) just downstream of the headgate structure (Transect 1) and 1.33 fps (40.5 cm/s) upstream of the trashracks (Transect 2). This supports the assumption made in the PAD that velocities would likely remain unchanged as there have been no change to Project operations or modification of significant Project features.

Table 11 is a comparison of published swim speeds for several freshwater fish that include the species collected during the 2019 Constantine assessment. Entrainment susceptibility may be judged in part by the ability of a fish to swim against the current upstream of the powerhouse. The average swim speeds reported are very similar to the measured water velocity in the power canal, whereas the published maximum or burst swim speeds often exceed the velocity measurements in the power canal.

Table 11. Experimental Observations of Prolonged Swimming Speeds Grouped by Genus

Family	Genus	Number Fish Tested	Average of Minimum Swim Speed	Average of Swim Speed	Average of Maximum Swim Speed	Unit of Swim Speed
Catostomidae	*Catostomus*	4		48.7		cm/s
Centrarchidae	*Lepomis*	5		30.0		cm/s
Centrarchidae	*Micropterus*	11	50.0 [1]	43.0 [2]	118.0 [1]	cm/s
Cyprinidae	*Campostoma*	1	27.9	39.9	53.6	cm/s
Cyprinidae	*Cyprinus*	2	64.9	98.1	131.0	cm/s
Cyprinidae	*Notemigonus*	1	30.9		71.3	cm/s
Cyprinidae	*Notropis*	4		33.5		cm/s
Esocidae	*Esox*	2	19.0		47.4	cm/s
Percidae	*Etheostoma*	3	14.3	29.6	42.1	cm/s
Percidae	*Sander*	9	36.5	31.0	90.5	cm/s
Petromyzontidae	*Lampetra*	4	15.2	62.8	45.7	cm/s
[1] Minimum and Maximum Speed from *Micropterus dolomieui*						
[2] Average Speed from *Micropterus salmoides*						

Source: FishXing Version 3.0 Beta, 2006.

Fish entrainment is also affected by the downstream migration or movement of fish and the downstream drift of larval and juvenile fish. No estimates of fish entrainment were completed with this study.

6.2.Variances from FERC-Approved Study Plan

Visual estimates of the water clarity were made by recording the depth at which a Secchi disk disappeared at fish collection sites, recorded to the nearest tenth of a meter. However, at some fish collection locations the current was too swift to accurately measure transparency using a Secchi disk, these locations were marked as Secchi-depth N/A.

During the measurement of intake velocities in the power canal interference to the surveying unit was encountered while trying to record measurements 1-foot upstream of the Project's trashracks as specified in the RSP. In order to record useable measurements, the velocity profile transect for this location was shifted slightly upstream in the power canal to the point where interference was alleviated and velocities could be successfully recorded.

The Project's power canal was initially included in the study area pursuant to the RSP but was excluded based on communication with MDNR staff from the Fisheries Division in the Southern Lake Michigan Unit, who agreed that the stranded fish survey of the power canal in spring 2019 provided sufficient

data to predict the species present (McCauley, personal communication, July 10-11, 2019). No additional fish collections were made in the power canal during this survey.

During collection of fish tissue samples field staff were unable to collect enough individuals of either of the preferred bottom-feeding species identified in the RSP, Common Carp or Channel Catfish. Field staff substituted (10) Shorthead Redhorse to represent the bottom feeder fish species.

6.3.Agency Correspondence and/or Consultation

Email communication (Appendix E) between Dennis McCauley of GLEC and MDNR's Fisheries Division, Southern Lake Michigan Management Unit, was initiated to confirm exclusion of the Project's power canal from fish collection efforts. Brian Gunderman, the Unit Manager, replied that the nearby collections in the Project's reservoir and bypass reach, along with the relocation collections in the power canal during maintenance work in spring of 2019 (unrelated to FERC relicensing), made collections by GLEC unnecessary (McCauley 2019).

7. Field Location Notes

Table 12. Sampling Locations and Dates in the Constantine Project's Reservoir and Bypass Reach

Sampling ID	Date	Latitude	Longitude	Substrate	Meso-habitat Type
BPBD-F	09/27/19	41.84700	-85.66810	gravel	Shoreline, Open water
BPBW1-S	06/02/19	41.84489	-85.66789	silt	Backwater
BPBW2-S	06/02/19	41.84423	-85.66743	silt	Backwater
BPMC-F	09/27/19	41.84666	-85.66832	gravel	Open water
BPMC-S	06/02/19	41.84606	-85.66832	gravel	Open water
BPRM-S	06/02/19	41.84576	-85.66778	sand	River mouth
BPSL-F	09/27/19	41.84627	-85.66885	rip rap	Shoreline
BPSL-S	06/02/19	41.84466	-85.66862	gravel/cobble	Shoreline
BW1-S	06/03/19	41.91281	-85.64729	silt	Backwater
BW2-S	06/04/19	41.88982	-85.64738	silt	Backwater
BW3-S	06/04/19	41.85413	-85.65778	silt	Backwater
BW4-F	09/26/19	41.91461	-85.65034	silt	Backwater
FKN1-F	09/24/19	41.91463	-85.64696	silt	Shoreline
FKN1-F2	09/25/19	41.91463	-85.64696	silt	Shoreline
FKN2-F	09/24/19	41.89335	-85.64684	silt	Shoreline
FKN2-F2	09/25/19	41.89335	-85.64684	silt	Shoreline
FKN3-F	09/24/19	41.87306	-85.65133	sand	Shoreline
FKN3-F2	09/25/19	41.87306	-85.65133	sand	Shoreline
FKN4-F	09/24/19	41.85005	-85.66837	sand	Shoreline
FKN4-F2	09/25/19	41.85005	-85.66837	sand	Shoreline
MB1-S	06/03/19	41.91272	-85.64971	sand	Macrophyte bed
MB2-S	06/04/19	41.88502	-85.64721	sand/silt	Macrophyte bed
MB3-S	06/04/19	41.87080	-85.65331	gravel	Macrophyte bed
MB4-F	09/26/19	41.91256	-85.65064	silt	Macrophyte bed
MB5-F	09/26/19	41.90244	-85.65054	silt	Macrophyte bed
OW10-F	09/26/19	41.90954	-85.63972	silt	Open water
OW10-S	06/03/19	41.90954	-85.63972	gravel	Open water
OW1-F	09/24/19	41.84805	-85.66791	silt	Open water
OW1-S	06/03/19	41.84800	-85.66783	silt	Open water
OW2-F	09/24/19	41.85486	-85.65927	silt	Open water
OW2-S	06/03/19	41.85486	-85.65927	silt	Open water
OW3-F	09/25/19	41.86342	-85.65402	silt	Open water
OW3-S	06/03/19	41.86342	-85.65402	sand/silt	Open water
OW4-F	09/25/19	41.87286	-85.65230	silt	Open water
OW4-S	06/03/19	41.87286	-85.65230	sand/silt	Open water
OW5-F	09/25/19	41.88193	-85.64982	silt	Open water
OW5-S	06/03/19	41.88193	-85.64982	sand	Open water
OW6-S	06/03/19	41.89036	-85.64883	sand	Open water
OW7-S	06/03/19	41.89747	-85.65327	sand	Open water
OW8-S	06/03/19	41.90574	-85.65122	silt	Open water
OW9-F	09/26/19	41.91408	-85.64891	silt	Open water
OW9-S	06/03/19	41.91408	-85.64891	sand	Open water
SL1-S	06/04/19	41.89425	-85.64667	silt	Shoreline
SL2-S	06/04/19	41.87759	-85.65158	sand	Shoreline
SL3-F	09/24/19	41.84916	-85.66199	small boulders	Shoreline
SL3-S	06/04/19	41.84916	-85.66199	small boulders	Shoreline
SL4-F	09/25/19	41.86620	-85.65250	silt	Shoreline

8. References

American Electric Power (AEP). 1991. 1990-1991 Studies of Fish Entrainment and St. Joseph River Fish Populations near the Constantine Hydroelectric Project, FERC Project 10661. [Online] URL: https://www.ferc.gov/docs-filing/elibrary.asp. Accessed December 10, 2019.

Cardno. 2019. Stranded Fish and Mussel Survey Report Constantine Dam Head Race, St. Joseph River Drawdown St. Joseph County, Michigan May 13, 2019. Internal Report to American Electric Power.

FishXing Version 3.0 Beta, 2006. Swim Speed Table. 2006. [Online] URL: http://www.fsl.orst.edu/geowater/FX3/help/SwimData/Swim_Speed_Table.htm.

Indiana Michigan Power Company (I&M). 1988. Constantine Hydroelectric Project. Application for License for a Minor Water Power Project.

Indiana Michigan Power Company (I&M). 2018. Pre-Application Document for the Constantine Hydroelectric Project FERC No. 10661. June 4, 2018.

McCauley DJ. 2019. Personal Communication. Email communication between Dennis McCauley of Great Lakes Environmental Center, Inc. (GLEC) and the Michigan DNR's Fisheries Division, Southern Lake Michigan Management Unit, Brian Gunderman, Unit Manager. July 11, 2019.

Michigan Department of Natural Resources (MDNR). 1998. Saint Joseph River (Constantine) Water Survey. 6/22/1998 – 07/16/1998.

Michigan Department of Natural Resources (MDNR). 2017. Fish Stocking Database. Online [URL]: http://www.michigandnr.com/fishstock/.

Shepherd, R. 1975. Inventory of Fish and Evaluation of Water Quality During Minimum Flow Period in the St. Joseph River. Michigan Dept. Nat. Resource, Tech. Rep. No. 75-9, 84 pp.

U.S. Environmental Protection Agency (USEPA) Office of Water. 2000. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. EPA 823-B-00-007.

Wesley, J.K. and J.E. Duffy. 1999. St. Joseph River Assessment. Michigan Department of Natural Resources Fisheries Division. Online [URL]: https://quod.lib.umich.edu/cache/4/9/6/4968779.0001.001/00000001.tif.251.pdf.

Appendix A. Guidance for Fish Advisories

United States Environmental Protection Agency | Office of Water (4305) | EPA 823-B-00-007 November 2000

Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories

Volume 1
Fish Sampling and Analysis
Third Edition

https://www.epa.gov/sites/production/files/2015-06/documents/volume1.pdf

Appendix B. Fish Tissue

<insert Fish Tissue lab results when available>

Appendix C. In-situ Water Quality Values

June In-situ Water Quality Values

Sampling ID	pH	Dissolved Oxygen (mg/L)	Sp. Cond. (µS/cm)	Surface Temp. (°C)	Secchi Disk Depth (m)	Depth (m)
BPBW1-S	7.74	7.24	532	21.9	n/a	2.1
BPBW2-S	7.61	6.05	546	20.5	0.90	0.8
BPMC-S	8.00	8.13	494	21.4	n/a	1.9
BPSL-S	8.01	8.31	494	21.7	n/a	2.0
BPRM-S	7.75	7.04	537	21.6	n/a	1.1
BW1-S	8.08	8.97	513	20.6	n/a	0.7
BW2-S	7.74	8.19	486	19.8	0.80	0.8
BW3-S	8.04	7.90	503	19.5	n/a	1.0
MB1-S	8.04	8.40	514	20.6	n/a	0.7
MB2-S	8.01	7.67	506	19.6	1.00	1.4
MB3-S	8.05	8.00	507	19.8	1.00	1.5
OW1-S	7.93	7.40	506	20.2	1.00	n/a
OW2-S	8.05	7.46	506	20.0	0.90	n/a
OW3-S	8.05	7.50	507	20.0	1.00	n/a
OW4-S	8.10	7.60	507	20.0	1.00	4.5
OW5-S	8.04	7.81	507	19.9	0.95	2.6
OW6-S	8.06	8.13	508	20.0	n/a	3.4
OW7-S	8.03	8.53	509	20.1	n/a	3.7
OW8-S	8.00	8.73	509	20.1	n/a	2.1
OW9-S	8.13	8.90	510	20.3	n/a	2.4
OW10-S	8.09	9.00	513	20.4	n/a	3.7
SL1-S	7.87	7.60	506	19.6	1.10	1.4
SL2-S	8.00	7.80	506	19.6	0.80	0.8
SL3-S	8.05	8.52	502	20.1	0.90	1.4
Minimum	7.61	6.05	486	19.5	0.80	0.7
Maximum	8.13	9.00	546	21.9	1.10	4.5
Average	7.98	7.95	509	20.	0.95	1.9

September In-situ Water Quality Values

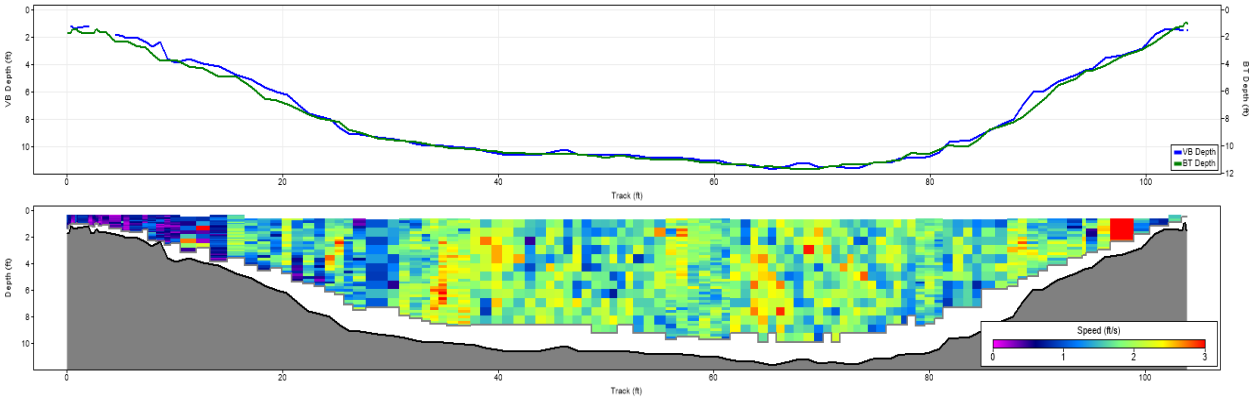
Sampling ID	pH	Dissolved Oxygen (mg/L)	Sp. Cond. (µS/cm)	Surface Temp. (°C)	Secchi Disk Depth (m)	Depth (m)
BPBD-F	8.04	7.75	551	18.0	1.5	2.1
BPMC-F	7.88	7.47	585	17.6	1.25	3.0
BPSL-F	7.91	7.59	582	17.6	0.5	0.5
BW4-F	8.23	8.35	512	19.6	0.8	0.8
FKN1-F	8.05	7.45	511	20.0	1.25	1.8
FKN1-F2	7.94	7.52	511	19.4	1.25	1.8
FKN2-F	8.09	7.28	509	20.5	1.25	1.9
FKN2-F2	8.07	7.69	512	19.9	1.25	1.9
FKN3-F	8.09	7.84	508	21.2	1.25	2.7
FKN3-F2	8.10	8.41	510	20.2	1.25	2.7
FKN4-F	8.14	8.30	506	22.6	1.25	1.6
FKN4-F2	8.14	8.33	507	20.6	1.25	1.6
MB4-F	8.16	8.01	513	19.4	1.25	1.3
MB5-F	8.24	8.97	510	20.0	1.25	2.3
OW1-F	8.16	8.48	506	22.2	2	3.0
OW2-F	8.24	9.55	505	22.6	2	2.0
OW3-F	8.15	8.52	508	20.4	1.25	1.4
OW4-F	8.19	8.86	510	20.5	1.4	3.1
OW5-F	8.16	8.53	511	20.3	1.5	3.7
OW9-F	8.18	7.71	511	19.3	1.3	1.3
OW10-F	8.14	7.58	611	19.2	1.5	2.3
SL3-F	8.20	9.08	504	22.7	1.25	1.5
SL4-F	8.15	8.74	510	20.4	1.25	1.3
Minimum	7.88	7.28	504	17.6	0.50	0.5
Maximum	8.24	9.55	611	22.7	2.00	3.7
Average	8.12	8.17	521	20.1	1.30	1.9

Appendix D. Acoustic Doppler Current Profiler

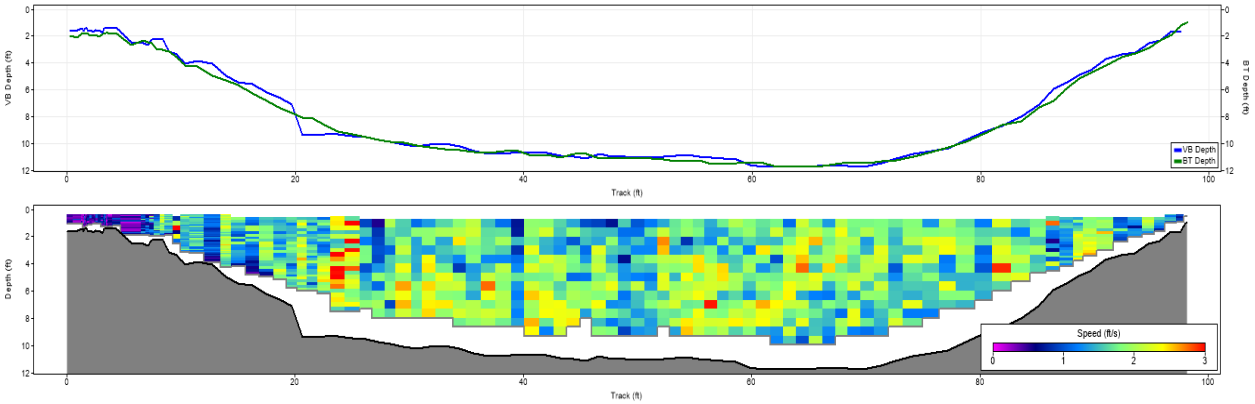
Fisheries Survey Report
Constantine Project (FERC No. 10661)

File	File Reference	Direction	Left Bank Distance ft	Right Bank Distance ft	Start Date	Start Time	Duration minutes	Track Length ft	DMG ft	Transect Width ft	Transect Area ft²	Mean River Velocity ft/s	Boat Speed ft/s	Left Q cfs	Right Q cfs	Total Q cfs
20190612094851r.rivr	4851	left bank to right bank	2.0	2.0	6/12/2019	9:48:52 AM	0:02:54	104.5	92.5	96.5	772.1	1.579	0.601	0.76	0.00	1219.4
20190612095937r.rivr	5937	left bank to right bank	2.0	2.0	6/12/2019	9:59:39 AM	0:02:25	100.0	91.2	95.2	777.8	1.576	0.690	0.43	0.00	1226.0
20190612103534r.rivr	3534	right bank to left bank	2.0	2.0	6/12/2019	10:35:33 AM	0:03:27	108.3	90.1	94.1	774.2	1.565	0.523	0.61	0.26	1211.3
						Mean	0:02:55	104.27	91.28	95.28	774.70	1.573	0.604	0.6	0.09	1,218.87
						Std Dev	0:00:25	3.39	0.98	0.981	2.337	0.006	0.068	0.13	0.12	6.00
						COV	0	0.033	0.011	0.01	0.003	0.004	0.113	0.221	1.414	0.01

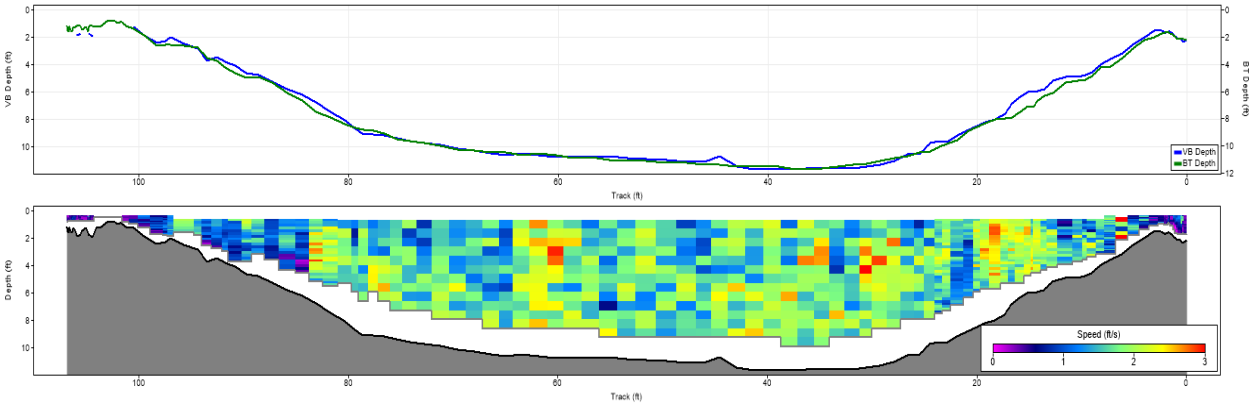
File Reference: 4851



File Reference: 5937

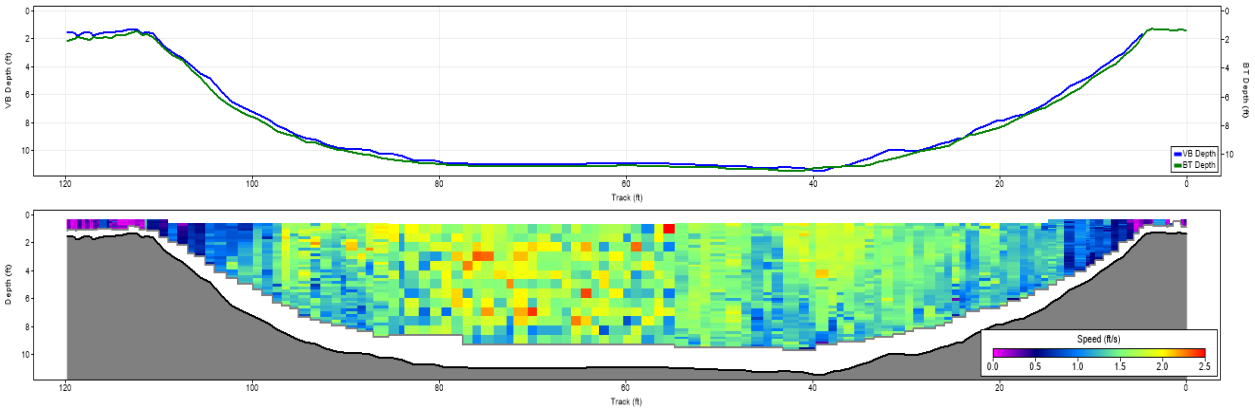


File Reference: 3534

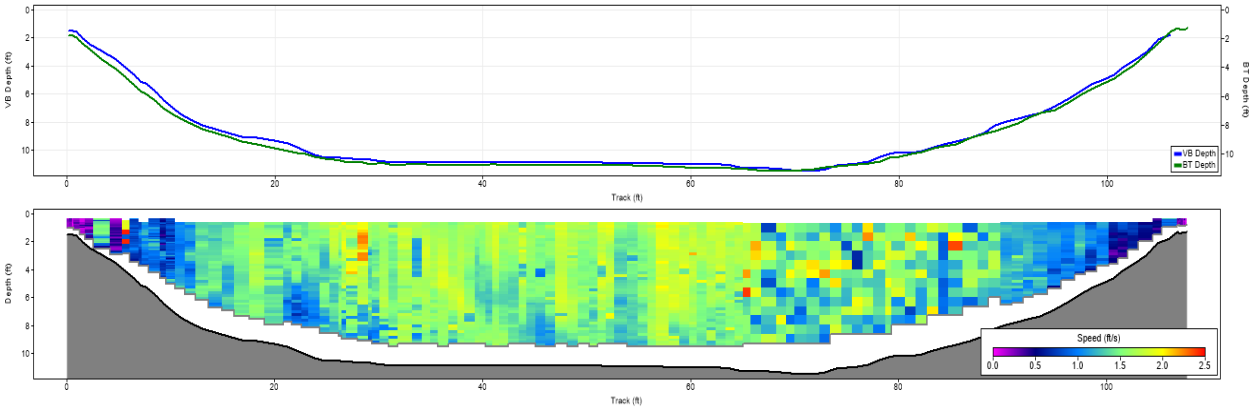


File	File Reference	Direction	Left Bank Distance ft	Right Bank Distance ft	Start Date	Start Time	Duration minutes	Track Length ft	DMG ft	Transect Width ft	Transect Area ft²	Mean River Velocity ft/s	Boat Speed ft/s	Left Q cfs	Right Q cfs	Total Q cfs
20190612113009r.rivr	3009	right bank to left bank	3.0	3.0	6/12/2019	11:30:05 AM	0:03:12	124.9	103.2	109.2	936.0	1.328	0.650	0.53	0.62	1243.3
20190612115620r.rivr	5620	left bank to right bank	3.0	3.0	6/12/2019	11:56:14 AM	0:02:46	109.9	102.0	108.0	933.3	1.316	0.662	0.14	0.51	1228.4
20190612120921r.rivr	0921	left bank to right bank	3.0	3.0	6/12/2019	12:09:15 PM	0:02:12	114.9	95.5	101.5	906.2	1.36	0.870	0.06	0.00	1232.8
						Mean	0:02:43	116.54	100.23	106.23	925.18	1.335	0.728	0.24	0.38	1,234.84
						Std Dev	0:00:25	6.22	3.37	3.369	13.47	0.019	0.101	0.21	0.27	6.23
						COV	0	0.053	0.034	0.032	0.015	0.014	0.139	0.848	0.716	0.01

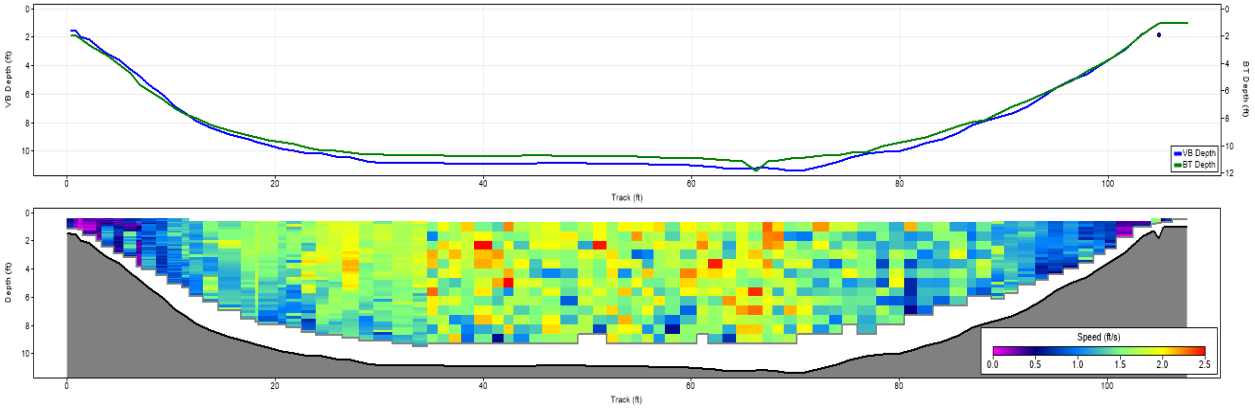
File Reference: 3009



File Reference: 5620



File Reference: 0921



Appendix E. Agency Correspondence

From: **Gunderman, Brian (DNR)** <GundermanB@michigan.gov>
Date: Thu, Jul 11, 2019 at 11:18 AM
Subject: RE: Constantine Hydropower Project: Power Canal Fisheries Assessment
To: Dennis McCauley <dmccauley@glec.com>
Cc: Diana, Matthew (DNR) <DianaM@michigan.gov>, Thiamkeelakul, Kesiree (DNR) <ThiamkeelakulK@michigan.gov>
Kruger, Kyle (DNR) <KRUGERK@michigan.gov>

Hi Dennis,

Thank you for providing the map and report! It is not necessary to conduct electrofishing or netting in the power canal. The stranded fish survey and the electrofishing in the impoundment are sufficient to determine which species are likely to be present in the power canal.

Brian Gunderman
Southern Lake Michigan Unit Manager
Michigan Department of Natural Resources – Fisheries Division
621 N. 10th Street
Plainwell, MI 49080
Phone: (269)204-7009
Fax: (269)685-1362

From: Dennis McCauley <dmccauley@glec.com>
Sent: Wednesday, July 10, 2019 3:11 PM
To: Gunderman, Brian (DNR) <GundermanB@michigan.gov>
Cc: Quiggle, Robert <Robert.Quiggle@hdrinc.com>
Subject: Constantine Hydropower Project: Power Canal Fisheries Assessment

Hello Brian: Thank you for speaking with me today regarding the level of effort necessary to assess the fisheries in the AEP Constantine Hydroelectric Power Canal project (FERC No.: 10661). Great Lakes Environmental Center, Inc. (GLEC) is tasked with assisting HDR Engineering and AEP with the completion of the fisheries tasks outlined for the project relicensing studies. We have determined that the only way to effectively fish the power canal would be electrofishing but that would require us to crane the equipment into the canal. We would welcome your input into this. We completed electrofishing in the impoundment and the by-pass channel (June 2019). I have attached a map showing the electrofishing locations. In that effort we collected 36 species of fish.

In April of this year, another contractor completed a stranded fish and mussel assessment within the power canal (report attached) and they observed 21 species of fish, which, with the exception of the greenside darter, rainbow darter, johnny darter brook silverside, common shiner and stonecat, overlapped with the species collected in the impoundment and by-pass channel. That report also shows good pictures of the de-watered power canal for your reference.

I'll look forward to hearing back form you regarding WDNRs expectations for fishing the Power Canal. If you have an questions, or require additional information, please let me know. Thank you. Dennis

–
Dennis J. McCauley
President/Senior Environmental Scientist
Great Lakes Environmental Center, Inc.
Phone: 231/941-2230
Cell: [redacted]
FAX: 231/941-2240
www.glec.com

Appendix F. Mussel Survey

FRESHWATER MUSSEL SURVEY FOR THE CONSTANTINE HYDROELECTRIC PROJECT **(FERC No. 10661)**

Prepared for:

1304 Buckley Road, Suite 202
Syracuse, New York 13212-4311

and

Indiana Michigan Power Company (I&M)
a unit of

American Electric Power

ES Project No.: 12072
Date: 4/14/2020

Prepared by:

EnviroScience
Excellence In Any Environment

5070 Stow Rd.
Stow, OH 44224
800-940-4025
www.EnviroScienceInc.com

Freshwater Mussel Survey for the
Constantine Hydroelectric project
(FERC No. 10661)

Document Date: 4/14/2020
ES Project No.: 12072

Prepared for:

Mr. Robert Quiggle
Regulatory and Environmental Section Manager
HDR

Authorization for Release

The analyses, opinions, and conclusions in this document are based entirely on EnviroScience's unbiased, professional judgement. EnviroScience's compensation is not in any way contingent on any action or event resulting from this study.

The undersigned attest, to the best of their knowledge, that this document and the information contained herein is accurate and conforms to EnviroScience's internal Quality Assurance standards.

Philip Mathias
Malacologist | Field Supervisor

Ryan Schwegman
Marine Services Practice Area Manager

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ACKNOWLEDGEMENTS

Funding for the project was provided by American Electric Power and Indiana Michigan Power Company (I&M) through a contract with HDR, Inc. Mr. Robert Quiggle was the point of contact for HDR, Inc. Mr. Jonathan Magalski was the project manager and environmental coordinator for American Electric Power (AEP). Mr. Dustin Zirkle (AEP) was the Diving Program Manager and Ryan Stough (AEP / I&M) was the onsite dive inspector. The EnviroScience, Inc. staff who completed the work and reporting include the following. The project manager was Mr. Ryan Schwegman. Mr. Philip Mathias was the field supervisor, malacologist, and authored the mussel survey report. Mr. Patrick Evankovich served as the designated dive supervisor. EnviroScience divers participating on the survey were Mr. Layne Levine, Mr. Matthew Villanueva, and Mr. Jeremy Zucker. Technical review was completed by Mr. Schwegman, and Ms. Kristen Schmidt. Mr. Greg Zimmerman assisted with project coordination and reviewed the report for quality control. Mr. Gregory Hocevar created GIS mapping.

1.0 INTRODUCTION

Indiana Michigan Power Company (I&M), a unit of American Electric Power (AEP), is the Licensee, owner, and operator of the run-of-river, 1,200-kilowatt (kW) Constantine Hydroelectric Project (FERC Project No. 10661) (Project), located on the St. Joseph River in the Village of Constantine in St. Joseph County, Michigan (Latitude 41.847265, Longitude -85.668484; Township 7S, Range 12W, Section 23). The Project is in the process of Federal Energy Regulatory Commission (FERC) relicensing, and as part of the Proposed Study Plan (PSP), prepared by AEP and HDR, Inc. (HDR), a mussel survey was proposed. HDR requested that EnviroScience provide a proposal to complete the mussel survey task of the PSP. The results of the mussel survey would help determine the effects of project operation on mussel habitat.

The existing license for the Project was issued by FERC for a 30-year term, with an effective date of October 20, 1993 and expiration date of September 30, 2023. The I&M is pursuing a new license for the Project pursuant to the FERC's Integrated Licensing Process (ILP) described in 18 Code of Federal Regulations (CFR) Part 5. The I&M filed a Pre-Application Document and associated Notice of Intent with the Commission on June 4, 2018 to initiate the ILP. Pursuant to the FERC's regulations in 18 CFR §5.11, I&M developed a Proposed Study Plan (PSP) for the Project that was filed with the FERC on November 16, 2018. The I&M held a PSP Meeting on December 11, 2018 for the purpose of clarifying the PSP, explaining any initial information gathering needs, and addressing any outstanding issues associated with the PSP. I&M filed the Revised Study Plan (RSP) per the FERC Study Plan Determination (SPD) dated April 9, 2019, which approved eight studies, including a mussel survey.

1.1 BACKGROUND

Continued Project operation could affect (negatively or positively) freshwater mussel resources within and/or adjacent to the Project area, which includes the Project reservoir, bypassed reach, and immediately downstream of the U.S. Route (US) 131 Business Route Bridge (Figure 1; HDR, 2018). Of the 44 mussel species found in Michigan, 19 (43%) are listed as either endangered or threatened pursuant to the Endangered Species Act of the State of Michigan, Part 365 of PA 451 1994, Michigan Natural Resources and Environmental Protection Act (MDNR, 2009). To adhere to the FERC relicensing requirements, the mussel survey was performed to describe potential Project effects to mussels.

The St. Joseph River at this location has a drainage area of 4,740 square kilometers (km^2; 1,830 square miles [mi^2]), and drains into Lake Michigan in Berrien County, Michigan. The Project location is surrounded by residential, commercial, forest, and park/lawn land use types. The 2019 Michigan Mussel Survey Protocol (Protocol) classified the Project reach of the St. Joseph River as a "Group 2 Stream" (Hanshue et al., 2019). Group 2 Streams are defined as streams where state threatened and/or endangered mussels are known or are expected to occur and historically supported federally listed mussel species.

This study was conducted in accordance with the PSP, SPD, and the Protocol. The results of the survey will aid in determining any potential effects (positive or negative) from continued operation imposed on the mussel community within the Project area. Study results may be utilized to develop protection, mitigation, and enhancement (PM&E) measures warranted under a new FERC license.

2.0 METHODS

Survey methods were developed to provide adequate data in order to assess potential effects that this Project may have on the existing mussel community. No instream work stream is anticipated as a result of Project relicensing; therefore, no new direct impacts are anticipated. The survey methods were coordinated between AEP, I&M, HDR, EnviroScience, and MDNR. The PSP called for qualitative surveys at four locations: two locations within the reservoir, one location in the bypass reach, and one location downstream of the Project's powerhouse. The bypass reach had been recently dredged; therefore, any mussel community (if present) was not likely representative of existing conditions. An alternative location downstream of the bypass each was selected and approved by MDNR, AEP, I&M, and HDR. The Sites surveyed are listed below and depicted in Figure 2.

- Site 1 was upstream of the dam within the reservoir at Latitude 41.849041, Longitude -85.667659.
- Site 2 was downstream of the dam at the confluence of the Fawn River with St. Joseph River. Per the SPD recommendations, one survey site was to be upstream of the Fawn River confluence and the other site in the bypassed reach downstream of the confluence. Due to safety considerations (turbulent river conditions precluding safe diving conditions), accessibility, and cursory review of available mussel habitat in the area upstream of the Fawn River confluence, this area was precluded from the survey. A location near to the confluence was surveyed and was deemed more appropriate based on the survey objectives. Three sub-reaches were evaluated:
    - Sub-reach 1 at Latitude 41.849041, Longitude -85.667659
    - Sub-reach 2 at Latitude 41.844611, Longitude -85.668393
    - Sub-reach 3 at Latitude 41.843837, Longitude -85.668561
- Site 3 was downstream of the bypass reach. Three sub-reaches were evaluated:
    - Sub-reach 1 at Latitude 41.842541, Longitude -85.672059
    - Sub-reach 2 at Latitude 41.842327, Longitude -85.671905
    - Sub-reach 3 at Latitude 41.842018, Longitude -85.671337
- Site 4 was upstream of the dam within the reservoir at Latitude 41.847958, Longitude -85.669281

Final approval of survey methods from MDNR was required due to the possibility of state threatened and endangered species presence in the Project area. The mussel survey study plan was approved by MDNR on July 10, 2019 per the issuance of a Project Scientific Collection Permit. The approved survey methods and Project Scientific Collection Permit are provided in Appendix A.

2.1 MUSSEL SURVEY

Mussel surveys were performed following the semi-quantitative guidelines described in Section V of the Protocol (Hanshue et al., 2019). Visual-tactile timed search methods were used to determine mussel presence. The objective of the surveys was to collect enough data to generate species richness curves.

General habitat data, including substrate composition using the Wentworth Scale (% observed of silt, sand, gravel, etc.), were reported by divers prior to initiating searches to allow the team malacologist to assess the suitability of mussel habitat. Overall, 30 sub-reach searches were surveyed at each site, and each sub-reach was searched for 10 minutes for a total of five work-

person-hours per site. Searching entailed divers sweeping away silt and debris and probing the substrate to detect burrowed mussels. Diving utilized surface-supplied air and tethered hardhat diving methods. Surface-supplied air diving facilitated a high level of safety and data collection oversight using two-way communication with top-side support.

The survey team also recorded general site observations and water chemistry each day of the survey. Habitat information such as water depth, habitat type (e.g., riffle, run, pool), cover type (e.g., woody debris), stream width, and qualitative water velocity were noted. Water chemistry parameters (Dissolved Oxygen [% and mg/L], Specific Conductivity [µS/cm], pH, and flow [ft/s)]) were collected morning, mid-day, and in the evening with a Yellow Springs Instruments (YSI) Professional Plus multiparameter instrument that was calibrated the evening prior to use.

2.2 MUSSEL HANDLING

All live mussels were identified, counted, and sexed (dimorphic species only) during the survey. Dead shells were scored as either fresh dead (lustrous nacre, dead <1yr), weathered dead (dull or chalky nacre, dead one to many years), or subfossil (heavily weathered and fragmented, dead many years to many decades) and noted as present. Live mussels were kept cool and moist in shade and were not out of the water for more than five minutes during processing. All live mussels were returned to the area of their collection. Shell lengths of each live mussel were recorded to represent population age structure. Digital images of each species (one of their valves and a closeup of each species dorsal view [umbo]) were taken with a metered scale. Taxonomy nomenclature followed Williams et al. (2017).

2.3 QUALITY CONTROL PROCEDURES

Several measures of quality control were implemented to ensure thorough mussel collection, consistent habitat assessment by divers, and accurate species identification by malacologists. The field staff working on this Project were highly experience in performing freshwater mussel surveys. The field supervisor (Mr. Philip Mathias) has extensive experience (more than 10 years) identifying and handling mussels and directly supervised and actively participated in all survey operations for this project. A copy of Mr. Mathias' scientific collector permits is included in Appendix A. EnviroScience divers were all individually trained and experienced (more than 50 hours) in mussel sampling using both visual and tactile means.

3.0 RESULTS

The EnviroScience field team conducted the survey between August 20 and August 21, 2019. River conditions were appropriate for mussel surveys with an average water temperature of 25 degrees Celsius (77 degrees Fahrenheit) and excellent water clarity. Water visibility averaged 182 centimeters (cm) (72 inches [in]) upstream of the dam and 305cm (120in) below the dam in the flowing habitat areas.

3.1 MUSSEL SURVEY RESULTS

No evidence (live or recently dead) of federally listed threatened or endangered species was observed. The state endangered Lilliput (*Toxolasma parvum*) was found alive in Site 2 sub-reach 2 and the state threatened Purple Wartyback (*Cyclonaias tuberculata*) was found as dead shell in Site 2 sub-reach1 (Table 1). Mussels were generally common, but not densely aggregated in the surveyed reaches. Habitat suitability did not appear to be a limiting factor for mussel colonization, nor did Project operation appear to be negatively effecting mussel distribution.

Overall, a total of 394 mussels representing 12 live species were detected and an additional four species were detected as shells only (Table 1). All live mussels were collected below the dam. The Plain Pocketbook (*Lampsilis cardium*) was the dominant species (total number [n] 111) representing 27.5% of all individuals collected). The Ellipse (*Venustaconcha ellipsiformis*; n=82) and Mucket (*Actinonaias ligamentina*; n=74) were subdominant representing 20.8% and 18.8% of all individuals collected, respectively. The Ellipse is designated as a state special concern species; no legal protection is afforded to special concern species in Michigan. One additional special concern species was collected (Elktoe [*Alasmidonta marginata*]). A summary of mussels observed by site and sub-reach is provided in Table 2. Water chemistry data can be found in Table 3. Mussel shell lengths are presented as histograms in Appendix B. Digital images of representative specimens and general site photos can be found in Appendix C.

Species Richness curves for the two sites where live mussels were detected are provided in Appendix D. Species richness data collected from Site 2 indicated an additional 300 individuals would be required to detect an additional species. Species richness data from Site 3 indicated another 127 individuals would be needed to detect an additional species.

3.1.1 Above the Dam/Sites 1 and 4

No live mussels were found above the dam. Divers collected weathered dead shell of individuals in the reaches surveyed upstream of the dam, and no evidence of living mussels was detected. The three species observed as dead shell were Paper Pondshell (*Utterbackia imbecillis*), Giant Floater (*Pyganodon grandis*), and Spike (*Eurynia dilatata*) (Table 2).

Habitat conditions were not ideal for mussel colonization upstream of the dam. Generally, suitable mussel habitat is that where heterogeneous substrate is present in moderately flowing conditions, and the substrate is free of silt. Mussel habitat (substrate) closer to the dam (upstream survey extent; Sites 1 and 4) varied from that in the downstream survey extent. The upstream portion was dominated by fine substrates of silt, mud, clay, and woody debris. There was noticeable anoxia (lack of dissolved oxygen) in the substrates throughout the upstream portion as decomposition gas coupled with blackened substrates were prevalent.

3.1.2 Below the Dam Sites 2 and 3

Mussels were more common along the right descending bank in the downstream sites and appeared concentrated to the thalweg of the river. Mussel distribution in riverine systems often corresponds with the channel of flow and thalweg. Total abundance within Site 2 Sub-reach 1, Sub-reach 2, and Sub-reach 3 was 29, 39, and 102, respectively (Table 2). Catch-per-unit-effort (CPUE) was highest at Site 2 Sub-reach 3 (20.4 mussels per hour). Site 3 overall had the most mussels observed and abundance was 33, 75, and 116, in Sub-reach 1, Sub-reach 2, and Sub-reach 3, respectively.

Below the dam had ideal substrate to support a diverse mussel community. Substrates were 75% gravel and 25% sand below the dam (Site 2 sub-reaches), while further downstream of the dam (Site 3 sub-reaches) was 50% sand and 50% gravel.

4.0 DISCUSSION

Many factors influence mussel community persistence in the St. Joseph River, and some may be directly and indirectly related to Project operation. The information available regarding specific and cumulative impacts to mussels from hydroelectric dams is relatively understudied and difficult to conclude as a sole contributing factor to decline or loss of species. Direct impacts affecting

mussel persistence include the loss of riverine mussel habitat through the construction and operation of dams. Dams are one of the "single most important factors" to the decline in North American mussel fauna (Haag, 2012). Conversely, Layzer and Scott (2006) identified the tailwaters of dams as beneficial to mussel communities citing increased aeration in tailwaters provides suitable habitat conditions and promotes mussel colonization.

Direct effects from high-volume discharges and abrupt shifts in operation (e.g., reducing or increasing operation capacity resulting in altered river flows downstream) may result in fluctuating water levels and instable riverbed substrates. Inconsistent and variable water velocity can expose boulders, bedrock, and result in depositional shifting sand, which is inhospitable to most freshwater mussels (Neck and Howells, 1994). Similarly, dam operation can change patterns of sedimentation, scour, and alter the ability of particulate matter (food source for mussels) to be transported throughout the stream (Baxter, 1977; Petts, 1980; Ward & Stanford, 1987; Ligon et al., 1995).

Indirect effects of continued operation on mussel life history, reproduction, and habitat may be the most influential to mussel community persistence. Disruptions in mussel reproductivity and shifts in habitat are often attributed to acute or chronic declines in an assemblage over time. For example, because mussels temporarily parasitize and require a fish host, dams can limit fish passage and consequently mussel dispersal (Watters, 1996). As river habitat fluctuates, fish species composition can also shift influencing host availability for the resident mussel community. Often dam tailwaters exhibit fluctuating water temperatures during discharge or release, which can affect spawning and recruitment success of resident mussels.

Mussel assemblage in the Project study area was similar to historic records near the area as presented in Table 4. Nineteen (19) species have been documented in this portion of the St. Joseph River and 12 were observed live in this study. Species observed in this study and not documented downstream by Wesley and Duffy (1999) included the Mapleleaf (*Quadrula quadrula*), Lilliput, and Paper Pondshell. Conversely, species observed pre-1999 and not recorded in this study included Cylindrical Papershell (*Anodontoides ferrussacianus*), Purple Wartyback (*Cyclonaias tuberculata*), Ohio Pigtoe (*Pleuorbema cordatum*), and Rainbow (*Villosa iris*). An undetectable, and not very diverse, mussel community may occupy the region upstream of the dam. Only six species were reported by Wesley and Diff (1999) near Three Rivers, Michigan. A study performed near the dam head race in 2019, associated with a separate project, collected 11 species. Species collected in that survey were like those observed at Sites 2 and 3 in this study, except for Round Pigtoe (live; *Pleurobema sintoxia*) and live Purple Wartyback.

Based on the mussel distribution and habitat conditions observed in this survey, it is likely that Project operation in this part of the St. Joseph River supports the theory presented in Layzer and Scott (2006). Habitat appears to be the limiting factor for mussel colonization at Sites 1 and 4. A small disconnected concentration of mussels was observed downstream where suitable habitat was more prevalent. Reproductivity and recolonization through recruitment may be limited due to fish passage or slowed but some continuity of stable substrate exists despite fluctuating tailwaters. Recommendations for developing PM&E measures were not part of this scope.

5.0 CONCLUSIONS

No federally listed mussel species were detected within the Project area. An undetectable mussel community may occupy the region upstream of the dam, and mussel scarcity is likely to due to a

lack of habitat and unstable conditions in Sites 1 and 4. There appears to be a stable, recruiting mussel community below the dam that has likely persisted for several years based on the diversity and abundances observed in this survey and historical records. The mussels observed would likely not be affected by continued operation assuming relicensing would not alter the existing hydraulics. The results from this survey can be used to assist the FERC as well as MDNR as they evaluate the relicensing of continued operations at I&M Constantine Hydroelectric Project and implementation of any PM&E measures for the Project.

6.0 LITERATURE CITED

Baxter, R. M. (1977). The environmental effects of dams and impoundments. Annual Review of Ecology and Systematics. 8:255-283

Cardno. (2019). Stranded Fish and Mussel Survey Report for Constantine Dam Head Race, St. Joseph River Drawdown. Prepared for American Electric Power.

Fisher, B.E. (1998). Freshwater mussel survey of the Fawn River watershed in the vicinity of the Fawn River State Fish Hatchery. Indiana Department of Natural Resources, Division of Fish and Wildlife, Indianapolis, Indiana.

Haag, W. (2012). North American Freshwater Mussels. *In North American Freshwater Mussels: Natural History, Ecology, and Conservation.* Cambridge: Cambridge University Press.

Hanshue, S., Rathbun, J., Badra, P., Bettaso, J., Hosler, B., Pruden, J., & Grabarkiewicz, J. (2019). Michigan Freshwater Mussel Survey Protocols and Relocation Procedures.

HDR. (2018). Proposed Study Plan, Constantine Hydroelectric Project (FERC No. 10661). Prepared for Indiana Michigan Power Company, an AEP Company. November 16, 2018.

Horvath, et al. (1994). Zebra mussel dispersal in the St. Joseph River basin (Indiana-Michigan): lakes as sources for downstream dispersal. University of Notre Dame, Notre Dame, Indiana.

Layzer J.B. and E.W. Scott. (2006). Restoration and Colonization of Freshwater Mussels and Fish in a Southeastern United States Tailwater. River Research and Applications. 22: 475–491

Ligon F.K., W.E. Dietrich and W.J. Trush. (1995) Downstream ecological effects of dams. Bioscience 45, 183–92.

MDNR (Michigan Department of Natural Resources). (2009). Endangered and Threatened Species. http://www.state.mi.us/orr/emi/admincode.asp?AdminCode=Single&Admin_Num=29901021&Dpt= NE&RngHigh=.

Neck, R.W. (1994). Status survey of Texas heelsplitter , *Potamilus amphicaenus* (Frierson, 1898). Unpublished report, Texas Parks and Wildlife Department, Resource Protection Division and Inland Fisher Division, Austin 47 pp.

Petts, G.E. (1980). Long-term consequences of upstream impoundments. Environmental Conservation &:325-332.

Sherman, R.A. (1997). The freshwater mussels (Bivalvia: Unionidae) of the St. Joseph and Kalamazoo rivers, Michigan. University of Michigan, Museum of Zoology/Mollusk Division, Ann Arbor, Michigan.

Van der Schalie, H. (1930). The clamming industry of the St. Joseph River. Michigan Department of Natural Resources, Fisheries Division, Fisheries Research Report 38, Ann Arbor, Michigan.

Ward, J.V and J.A. Stanford. (1987). The ecology of regulated streams; past accomplishments and directions for future research. Pages 391-409 in J.F. Craig and J.B. Kemper, editors. Regulated streams. Plenum Press, New York

Watters, G.T. (1996). Small dams as barriers to freshwater mussels (Bivalvia, Unionoida) and their hosts. Biological Conservation 75:79-85

Wesley, J.K. and J.E. Duffy. (1999). St. Joseph River Assessment. Michigan Department of Natural Resources Fisheries Division. Online [URL]: https://quod.lib.umich.edu/cache/4/9/6/4968779.0001.001/00000001.tif.251.pdf#page=241;zoom=75 (Accessed October 18, 2017).

Williams, J.D., A.E. Bogan, R.S. Butler, K.S. Cummings, J.T. Garner et al. (2017). A revised checklist of the freshwater mussels (Mollusca: Bivalvia: Unionida) of the United States and Canada. Freshwater Mollusk Biology and Conservation 20(2): 33-58.

Tables

Table 1. Status, Numbers, Relative Abundance, and Minimum, Maximum, and Mean Shell Length of the Total Freshwater Mussels collected from the Constantine Hydroelectric Project (FERC NO. 10661) Relicensing Studies: Mussel Survey. Constantine, St. Joseph County, Michigan, 2019.

				Condition[2]				Shell Length (mm)			Sex (No. Live)	
Species	Common Name	Federal Status[1]	MI Status[1]	Live	FD	D	Rel. Ab. (%)	Min.	Max.	Mean	Female	Male
Actinonaias ligamentina	Mucket			74		1	18.8%	85.0	147.0	114.1		
Alasmidonta marginata	Elktoe		SC	30			7.6%	34.0	82.0	64.8		
Cyclonaias pustulosa	Pimpleback			20			5.1%	51.0	84.0	66.2		
Cyclonaias tuberculata	Purple Wartyback		T			1						
Eurynia dilatata	Spike			10		2	2.5%	70.0	122.0	90.8		
Fusconaia flava	Wabash Pigtoe			3			0.8%	38.0	92.0	70.0		
Lampsilis cardium	Plain Pocketbook			111		1	28.2%	47.0	122.0	91.0	40	71
Lampsilis siliquoidea	Fatmucket					1						
Lasmigona costata	Flutedshell		SC	19		1	4.8%	80.0	137.0	108.8		
Pleurobema sintoxia	Round Pigtoe		SC			1						
Pyganodon grandis	Giant Floater					6						
Quadrula quadrula	Mapleleaf			2			0.5%	80.0	83.0	81.5		
Strophitus undulatus	Creeper			32			8.1%	40.0	98.0	81.0		
Toxolasma parvum	Lilliput		E	1			0.3%		26.0			
Utterbackia imbecillis	Paper Pondshell		SC	10		5	2.5%	35.0	87.0	59.5		
Venustaconcha ellipsiformis	Ellipse		SC	82		1	20.8%	40.0	77.0	61.0		
Total				394		20	100.0%					
No. of Species				12		10						

[1] E = Endangered; SC = Special Concern; T = Threatened

[2] FD=fresh dead shell, D=includes weathered dead and subfossil shells

Table 2. Michigan Status, Numbers, Relative Abundance, Minimum, Maximum, and Mean Shell Length, Sex of Live Sexually Dimorphic Species for Each Site and Subreach that Freshwater Mussels were collected from the Constantine Hydroelectric Project (FERC NO. 10661) Relicensing Studies: Mussel Survey. Constantine, St. Joseph County, Michigan, 2019.

						Length (mm)			Sex (No. Live)	
Site	Scientific Name	Common Name	MI Status[1]	Live	WD	Min.	Max.	Mean	Female	Male
Site 1, Upstream of Dam (41.849041, -85.667659)										
	Pyganodon grandis	Giant Floater			5	73.0	132.0	92.4		
	Utterbackia imbecillis	Paper Pondshell	SC		4	71.0	87.0	82.0		
	Total			0	9					
	CPUE			0.0						
	No. Species			0	2					
Site 4, Upstream of Dam (41.847958, -85.669281)										
	Eurynia dilatata	Spike			1	85	85	85.0		
	Pyganodon grandis	Giant Floater			1	125	125	125.0		
	Utterbackia imbecillis	Paper Pondshell	SC		1	76	76	76.0		
	Totals			0	3					
	CPUE			0.0						
	No. Species			0	3					
Site 2, SubReach 1, Below Dam (41.845369, -85.668526)										
	Actinonaias ligamentina	Mucket		5		105	129	118.2		
	Cyclonaias pustulosa	Pimpleback		1			77			
	Cyclonaias tuberculata	Purple Wartyback	T		1		77			
	Eurynia dilatata	Spike		1			120			
	Fusconaia flava	Wabash Pigtoe		1			38			
	Lampsilis cardium	Plain Pocketbook		11		83	109	97.0	5	6
	Lampsilis siliquoidea	Fatmucket			1		122			
	Lasmigona costata	Flutedshell	SC	3	1	92	134	116.8		
	Pleurobema sintoxia	Round Pigtoe	SC		1		82			
	Quadrula quadrula	Mapleleaf		2		80	83	81.5		
	Strophitus undulatus	Creeper		2		68	94	81.0		
	Utterbackia imbecillis	Paper Pondshell	SC	2		46	58	52.0		
	Venustaconcha ellipsiformis	Ellipse	SC	1	1	61	61	61.0		
	Total			29	5					
	CPUE			5.8						
	No. Species			10	5					
Site 2, SubReach 2, Below Dam (41.844611, -85.668393)										
	Actinonaias ligamentina	Mucket		8	1	85	147	112.4		
	Alasmidonta marginata	Elktoe	SC	3		66	77	70.7		

Table 2. Michigan Status, Numbers, Relative Abundance, Minimum, Maximum, and Mean Shell Length, Sex of Live Sexually Dimorphic Species for Each Site and Subreach that Freshwater Mussels were collected from the Constantine Hydroelectric Project (FERC NO. 10661) Relicensing Studies: Mussel Survey. Constantine, St. Joseph County, Michigan, 2019.

						Length (mm)			Sex (No. Live)	
Site	Scientific Name	Common Name	MI Status[1]	Live	WD	Min.	Max.	Mean	Female	Male
Site 2, SubReach 2, Below Dam (41.844611, -85.668393) (Cont'd)										
	Cyclonaias pustulosa	Pimpleback		4		56	80	68.0		
	Eurynia dilatata	Spike			1					
	Lampsilis cardium	Plain Pocketbook		14	1	79	112	96.0	7	7
	Lasmigona costata	Flutedshell	SC	3		102	118	110.7		
	Strophitus undulatus	Creeper		1		98	98	98.0		
	Toxolasma parvum	Lilliput	E	1		26	26	26.0		
	Utterbackia imbecillis	Paper Pondshell	SC	1		64	64	64.0		
	Venustaconcha ellipsiformis	Ellipse	SC	4		60	64	63.0		
	Total			39	3					
	CPUE			7.8						
	No. Species:			9	3					
Site 2, SubReach 3, Below Dam (41.843837, -85.668561)										
	Actinonaias ligamentina	Mucket		34		93	129	110.97		
	Cyclonaias pustulosa	Pimpleback		6		61	72	65.167		
	Eurynia dilatata	Spike		3		70	122	88.667		
	Lampsilis cardium	Plain Pocketbook		40		66	122	95.5	9	31
	Lasmigona costata	Flutedshell	SC	4		94	113	108		
	Strophitus undulatus	Creeper		5		78	91	86.6		
	Venustaconcha ellipsiformis	Ellipse	SC	10		54	67	61.2		
	Total			102	0					
	CPUE			20.4						
	No. Species			7	0					
Site 3, SubReach 1, Below Dam (41.842541, -85.672059)										
	Actinonaias ligamentina	Mucket		3		99	109	103.33		
	Alasmidonta marginata	Elktoe	SC	1		60	60	60		
	Cyclonaias pustulosa	Pimpleback		2		54	59	56.5		
	Eurynia dilatata	Spike		1		95	95	95		
	Fusconaia flava	Wabash Pigtoe		1		92	92	92		
	Lampsilis cardium	Plain Pocketbook		13		73	111	90.538	4	9
	Lasmigona costata	Flutedshell	SC	2		81	122	101.5		
	Strophitus undulatus	Creeper		2		76	87	81.5		
	Utterbackia imbecillis	Paper Pondshell	SC	2		35	60	47.5		

Table 2. Michigan Status, Numbers, Relative Abundance, Minimum, Maximum, and Mean Shell Length, Sex of Live Sexually Dimorphic Species for Each Site and Subreach that Freshwater Mussels were collected from the Constantine Hydroelectric Project (FERC NO. 10661) Relicensing Studies: Mussel Survey. Constantine, St. Joseph County, Michigan, 2019.

						Length (mm)			Sex (No. Live)	
Site	Scientific Name	Common Name	MI Status[1]	Live	WD	Min.	Max.	Mean	Female	Male
Site 3, SubReach 1, Below Dam (41.842541, -85.672059) (Cont'd)										
	Venustaconcha ellipsiformis	Ellipse	SC	6		55	65	61		
	Totals			33	0					
	CPUE			6.6						
	No. Species			10	0					
Site 3, SubReach 2, Below Dam (41.842327, -85.671905)										
	Actinonaias ligamentina	Mucket		5		104	147	121		
	Alasmidonta marginata	Elktoe	SC	6		57	75	64.833		
	Cyclonaias pustulosa	Pimpleback		4		51	84	66		
	Eurynia dilatata	Spike		1		82	82	82		
	Fusconaia flava	Wabash Pigtoe		1		80	80	80		
	Lampsilis cardium	Plain Pocketbook		25		47	101	80.04	12	13
	Lasmigona costata	Flutedshell	SC	4		82	137	106.75		
	Strophitus undulatus	Creeper		6		75	94	84.5		
	Utterbackia imbecillis	Paper Pondshell	SC	2		44	50	47		
	Venustaconcha ellipsiformis	Ellipse	SC	21		50	77	62.714		
	Totals			75	0					
	CPUE			15.0						
	No. Species			10	0					
Site 3, SubReach 3, Below Dam (41.842018, -85.671337)										
	Actinonaias ligamentina	Mucket		19		100	141	120		
	Alasmidonta marginata	Elktoe	SC	20		34	82	64.2		
	Cyclonaias pustulosa	Pimpleback		3		63	72	69		
	Eurynia dilatata	Spike		4		75	115	88.75		
	Lampsilis cardium	Plain Pocketbook		8		52	125	86.875	3	5
	Lasmigona costata	Flutedshell	SC	3		80	130	105		
	Strophitus undulatus	Creeper		16		40	93	76.813		
	Utterbackia imbecillis	Paper Pondshell	SC	3		35	54	44		
	Venustaconcha ellipsiformis	Ellipse	SC	40		40	71	59.875		
	Totals			116	0					
	CPUE			23.2						
	No. Species			9	0					

[1] E = Endangered; SC = Special Concern; T = Threatened

CPUE = Catch per Unit Effort (number live per hour)

Table 3. Data Collected from the YSI Above (Sites 1 and 4) and Below (Sites 2 & 3) the Dam for the Constantine Hydroelectric Project for FERC Relicensing. St. Joseph River, St. Joseph County, Michigan, 2019.

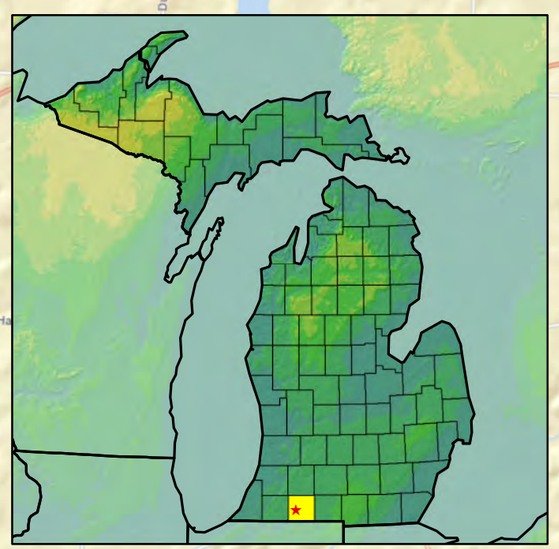
Site	Latitude	Longitude	Date	Time (24h)	Temp (°C)	Pressure (mmHg)	DO (%)	DO (mg/L)	Spec. Conductivity (µS/cm)	pH	Flow
Sites 1 & 4	41.847631	-85.669427	8/21/2019	7:15	24.3	740	79	6.6	0.493	9.38	0.1 ft/s
Sites 1 & 4	41.847631	-85.669427	8/21/2019	16:40	25.2	739.1	112	9.2	0.492	8.65	0.1 ft/s
Site 2	41.844625	-85.668431	8/21/2019	9:03	23.4	741.2	63	5.3	0.530	8.87	0.5 ft/s
Site 3	41.842536	-85.672006	8/21/2019	13:08	24.7	739.4	83	6.9	0.495	8.71	0.5 ft/s

Table 4. Live Mussel Records from within the Vicinity of the Constantine Hydroelectric Project, Constantine, Michigan

		EnviroScience (2019)	Cardno (2019)	Wesley & Duffy (1999)	
Scientific Name	Common Name	This Study Constantine, MI	Dam Head Race Constantine, MI	Upstream Three Rivers, MI	Downstream Mottville, MI
Actinonaias ligamentina	Mucket	X	X		X
Alasmidonta marginata	Elktoe	X	X	X	X
Anodontoides ferussacianus	Cylindircal Papershell				X
Cyclonaiaspustulosa	Pimpleback	X	X		
Cyclonaias tuberculata	Purple Wartyback		X		X
Eurynia [Elliptio] dilatata	Spike	X	X	X	X
Fusconaia flava	Wabash Pigtoe	X	X	X	X
Lampsilis cardium	Plain Pocketbook	X	X		X
Lampsilis siliquoidea	Fatmucket				
Lasmigona costata	Flutedshell	X	X		X
Pleurobema sintoxia	Round Pigtoe		X		
Pleurobema cordatum	Ohio Pigtoe				X
Pyganodon grandis	Giant Floater			X	
Quadrula quadrula	Mapleleaf	X			
Strophitus undulatus	Creeper	X	X	X	X
Toxolasma parvum	Lilliput	X			
Utterbackia imbecillis	Paper Pondshell	X	X		
Venustaconcha ellipsiformis	Ellipse	X		X	X
Villosa iris	Rainbow				X
Total Species		12	11	6	12

X denotes species observed; Additional information for Constantine was from Cardno (2019), while the data from Three Rivers and Mottville, Michigan was been documented in several reports (Van der Schalie 1930, Horvath et al. 1994, Sherman 1997, and Fisher 1998) and is summarized in Wesley and Duffy (1999). Species nomenclature follow Williams et al. (2017).

Figures



CONSTANTINE DAM
41.847241
-85.668505

St Joseph River

Figure 1. Project Location Map for the Constantine Hydroelectric Project (FERC NO. 10661).

Project Boundary

0 2,500 5,000 10,000 Feet

0 750 1,500 3,000 Meters

EnviroScience
Excellence In Any Environment

Date: 4/3/2020 Path: C:\Users\Gregory Hocevar\Desktop\12072_HDR_GIS\Map1_Overview.mxd

Basemap courtesy of National Geographic Society (2013).

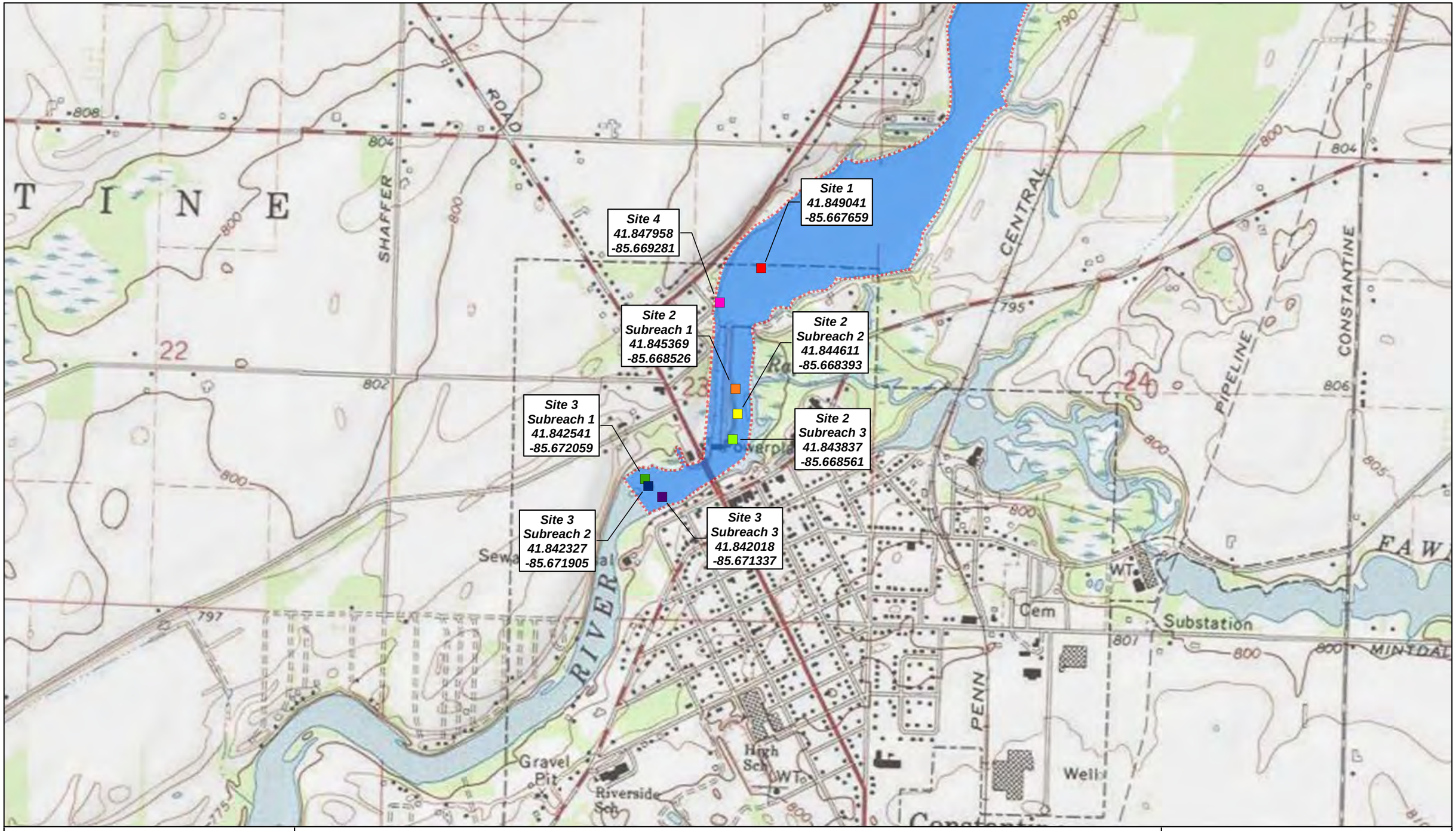


Figure 2. USGS Topographic Map of the Project Area and Site Locations in the St. Joseph River for the Constantine Hydroelectric Project (FERC NO. 10661)
Relicensing Studies: Mussel Survey.
Constantine, St. Joseph County, Michigan, 2019.

EnviroScience
Excellence In Any Environment

Date: 4/6/2020 Path: C:\Users\Gregory Hocevar\Desktop\12072_HDR_GIS\Map2_Topo.mxd

Basemap courtesy of National Geographic Society (2013).

Figure 2. Number of Live Mussels Observed at Each Site and SubReach in the St. Joseph River for the Constantine Hydroelectric Project FERC Relicensing.
Constantine, St. Joseph County, MI, 2019.

Survey Area Reach (20m x 50m)

Project Boundary

0 250 500 1,000 Feet

0 75 150 300 Meters

EnviroScience
Excellence In Any Environment

Date: 4/6/2020 Path: C:\Users\Gregory Hocevar\Desktop\12072_HDR_GIS\Map3_Site.mxd

Appendix A

Agency Correspondence and MDNR Scientific Collecting Permits

PERMIT PROPOSAL:

CONSTANTINE HYDROELECTRIC PROJECT (FERC NO. 10661)

Relicensing Studies: Mussel Survey

Prepared for:

HDR

1304 Buckley Road, Suite 202
Syracuse, New York 13212-4311

and

Indiana Michigan Power Company (I&M), a unit of

American Electric Power (AEP)

ES Project No.: 12072
Date: 6/4/2019

Prepared by:

EnviroScience
Excellence In Any Environment

5070 Stow Rd.
Stow, OH 44224
800-940-4025
www.EnviroScienceInc.com

1.0 INTRODUCTION

Indiana Michigan Power Company (I&M), a unit of American Electric Power (AEP), is the Licensee, owner, and operator of the run-of-river, 1,200-kilowatt (kW) Constantine Hydroelectric Project (Project) (FERC Project No. 10661), located on the St. Joseph River in the Village of Constantine in St. Joseph County, Michigan (41.847265, -85.668484) and is in the process of FERC relicensing. A mussel survey was proposed as part of the Proposed Study Plan (PSP) prepared by AEP and HDR. Subsequently, HDR requested that EnviroScience provide a proposal to complete the mussel survey task. The results of the mussel survey would help to determine the effects of project operation on habitat for the mussels.

2.0 SCOPE OF WORK

MUSSEL SURVEY

Chapter 10 of the Proposed Study Plan outlines the general goals and requirements for the mussel survey. EnviroScience proposes the following methods to assess the mussel assemblage at the Constantine Hydroelectric Project:

- No impacts to the stream will occur, therefore no relocation will be necessary.
- The work will be semi-quantitative in nature following Section V of the Michigan Freshwater Mussel Survey Protocols and Relocation Procedures (Hanshue et al. 2018; the Protocol).
- The field survey will be completed between June 1st and October 15th.
- Methods will utilize a quantitative “timed search survey” as defined by the Protocol to develop species richness curves for each location.
- These surveys will be completed at four locations (two in the reservoir, one in the bypass reach, one downstream of the dam) with suitable habitat for mussels.
    - A minimum of 30 sub-reach searches will be completed at each site. Each sub-reach search will be 10 minutes in length for a total of 5-hrs of search time, per site.
    - Additional time searches will be completed, if required to provide ample data to develop a species richness curve.
- Due to the anticipated depths within many sections of the project area, diving is anticipated. All diving and underwater operations will comply with the AEP Corporate Underwater Diving Policy (12/04/2018 Rev. #2) or the most recent standard.
- Mussels will be processed per the PSP and and Section V of the protocol Protocol and carefully returned to the location of their collection.
- Habitat and qualitative flow data will also be collected at each site per the PSP, as well as water quality at the beginning and end of each day.

REPORTING

A mussel survey study report will be completed following the reporting guidelines in the Protocol and provided for HDR to include in their final report or EnviroScience will provide HDR the report language in an MS Word template file with appendices and attachments. The report will include the project elements requested in the PSP as well as representative photos and GIS-based mapping of mussel resources. Data will be submitted to the MDNR as required by the terms of the scientific collector’s permits and Protocol.

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES
LANSING

GRETCHEN WHITMER
GOVERNOR

DANIEL EICHINGER
DIRECTOR

Date Issued: 6/12/2019

SCIENTIFIC COLLECTOR'S PERMIT
Mollusk

Under the provisions of Part 487, Act 451, P.A. 1994, as amended, being section 324.48735, permission is hereby granted to:

Name: Philip Thomas Mathias Driver's License No.: ST472685 OH

Address: EnviroScience, Inc.
5070 Stow Rd
Stow, MI 44224

to take, catch, or kill and possess the aquatic species from the waters and land within the jurisdiction of this state, as specified below in the special provisions section. This permit limits the take of aquatic species to the **minimum** number needed.

Prior to field activities occurring on any stream, public lake or public lands under this permit, the permittee **must notify** the local fish biologist or Fisheries Division supervisor of the Management Unit where collections will occur. This contact must be made at least 48 hours prior to commencing field work and during normal business hours Monday-Friday between 8 a.m. and 5 p.m. If a set work schedule has been established for the field season, providing a copy to the unit may alleviate the need for additional contacts with a single unit. It is also strongly recommended that the permittee notify the District Law Supervisor for the county where the permit is being used. Failure to notify the law supervisor may result in the disruption of field work. Both of these contacts can be initiated by calling the appropriate operational service center (map and phone numbers provided).

Any survey or sampling gear that is authorized by this permit and left on public lands or waters of the state unattended by the permittee must be clearly marked with either the permittee's name or organized affiliation. Failure to properly attach and display ownership, may result in unattended gear being removed by the DNR.

SPECIAL PROVISIONS: Permittees are authorized for general survey purposes to collect, identify, enumerate and release freshwater mussels at the collection area listed below. The permittee is to collect, handle, process and release mussels in accordance with the Michigan Freshwater Mussel Survey Protocol and Relocation Procedures (Hanshue et. al 2018). All activities authorized under this permit are to be non-lethal and the lethal collection or permanent removal of live mussels from the wild is prohibited. Additionally, if the permittee encounters any mussel listed in Michigan as special concern, threatened, or endangered, it is to be immediately released upon identification with as little further handling as possible.

All equipment coming in contact with water including: boat hulls, boat trailers, buckets, waders, nets, etc. must be visually inspected and cleaned by hand picking any attached plants, sediments, or other debris. This should be done immediately upon leaving the water body being worked on.

Due to the high number of mussel species in Michigan listed as state threatened or endangered it is suggested that the permittees preemptively check with the state T&E permit coordinator, Casey Reitz, about whether any additional permitting is necessary or desired for this particular study. Casey can be reached at 517-284-6210 reitzc@michigan.gov

Permitted collection area: In the upstream and downstream vicinity of the Constantine Hydroelectric Project on the St. Joseph River in St. Joseph County within the Lake Michigan Basin.

Permitted collection gear: by hand; scuba;

A copy of all reports and scientific papers using organisms collected with this permit shall be provided to DNR, Fisheries Division in addition to a Collector's Report form.

GENERAL PROVISIONS: This permit must be in permittee's possession during collection and must be made available upon request of any Department representative. Collection is limited to species not threatened or endangered. This permit is not transferable. This permit does not provide any authorization to circumvent any federal, state, or local laws and ordinances, including, but not limited to restricted entrance to refuges or other areas closed to the public without written permission of the land administrator. For a complete list of provisions, see Guidelines for Holders of Cultural or Scientific Collector's Permits.

In addition to this permit, separate DNR Public Land Use permits are required from:

1) **Parks and Recreation Division for activities in State Parks and Recreation Areas and at the state boat launches;**
2) **Wildlife Division for activities in State Game Areas; and**
3) **Forest Resources Division for activities in State Forests**

Public Land Use Permit applications can be obtained online at:
http://www.michigan.gov/dnr/0,16077,7-153-30301_31154_35728---,00.html

Permittees are also advised to contact the US Forest Service and National Park Service about any permit requirements for activities occurring in Michigan's National Forests and National Parks, respectively.

Any violation of the conditions of this permit may result in revocation of this permit and misdemeanor penalties of imprisonment for not more than 90 days or a fine of not more than $500 or all of the above. Unless revoked, this permit **expires on 12/31/2019**.

By _____ for
James L. Dexter, Chief
Fisheries Division

cc: Fisheries Division
Southern Lake Michigan Management Unit
Threatened and Endangered Species Unit, Wildlife Division

STATE OF MICHIGAN

DEPARTMENT OF NATURAL RESOURCES

LANSING

GRETCHEN WHITMER
GOVERNOR

DANIEL EICHINGER
DIRECTOR

AMENDMENT TO
SCIENTIFIC COLLECTOR'S PERMIT
Mollusk

Amendment Issued: 6/25/2019
Date Permit Issued: 6/12/2019

Under the provisions of Part 487, Act 451, P.A. 1994, as amended, being section 324.48735, permission is hereby granted to:

Name: Philip Thomas Mathias Driver's License No.: ST472685 OH

Address: EnviroScience, Inc.
5070 Stow Rd
Stow, **OH** 44224

to take, catch, or kill and possess the aquatic species from the waters and land within the jurisdiction of this state, as specified below in the special provisions section. This permit limits the take of aquatic species to the **minimum** number needed.

Prior to field activities occurring on any stream, public lake or public lands under this permit, the permittee **must notify** the local fish biologist or Fisheries Division supervisor of the Management Unit where collections will occur. This contact must be made at least 48 hours prior to commencing field work and during normal business hours Monday-Friday between 8 a.m. and 5 p.m. If a set work schedule has been established for the field season, providing a copy to the unit may alleviate the need for additional contacts with a single unit. It is also strongly recommended that the permittee notify the District Law Supervisor for the county where the permit is being used. Failure to notify the law supervisor may result in the disruption of field work. Both of these contacts can be initiated by calling the appropriate operational service center (map and phone numbers provided).

Any survey or sampling gear that is authorized by this permit and left on public lands or waters of the state unattended by the permittee must be clearly marked with either the permittee's name or organized affiliation. Failure to properly attach and display ownership, may result in unattended gear being removed by the DNR.

SPECIAL PROVISIONS: Permittees are authorized for general survey purposes to collect, identify, enumerate and release freshwater mussels at the collection area listed below. The permittee is to collect, handle, process and release mussels in accordance with the Michigan Freshwater Mussel Survey Protocol and Relocation Procedures (Hanshue et. al 2018). All activities authorized under this permit are to be non-lethal and the lethal collection or permanent removal of live mussels from the wild is prohibited. Additionally, if the permittee encounters any mussel listed in Michigan as special concern, threatened, or endangered, it is to be immediately released upon identification with as little further handling as possible.

All equipment coming in contact with water including: boat hulls, boat trailers, buckets, waders, nets, etc. must be visually inspected and cleaned by hand picking any attached plants, sediments, or other debris. This should be done immediately upon leaving the water body being worked on.

Due to the high number of mussel species in Michigan listed as state threatened or endangered it is suggested that the permittee preemptively check with the state T&E permit coordinator, Casey Reitz, about whether any additional permitting is necessary or desired for this particular study. Casey can be reached at 517-284-6210 reitzc@michigan.gov

Permitted collection area: In the upstream and downstream vicinity of the Constantine Hydroelectric Project on the St. Joseph River in St. Joseph County within the Lake Michigan Basin.

Permitted collection gear: by hand; scuba;

A copy of all reports and scientific papers using organisms collected with this permit shall be provided to DNR, Fisheries Division in addition to a Collector's Report form.

GENERAL PROVISIONS: This permit must be in permittee's possession during collection and must be made available upon request of any Department representative. Collection is limited to species not threatened or endangered. This permit is not transferable. This permit does not provide any authorization to circumvent any federal, state, or local laws and ordinances, including, but not limited to restricted entrance to refuges or other areas closed to the public without written permission of the land administrator. For a complete list of provisions, see Guidelines for Holders of Cultural or Scientific Collector's Permits.

In addition to this permit, separate DNR Public Land Use permits are required from:

1) **Parks and Recreation Division for activities in State Parks and Recreation Areas and at the state boat launches;**
2) **Wildlife Division for activities in State Game Areas; and**
3) **Forest Resources Division for activities in State Forests**

Public Land Use Permit applications can be obtained online at:
http://www.michigan.gov/dnr/0,16077,7-153-30301_31154_35728---,00.html

Permittees are also advised to contact the US Forest Service and National Park Service about any permit requirements for activities occurring in Michigan's National Forests and National Parks, respectively.

Any violation of the conditions of this permit may result in revocation of this permit and misdemeanor penalties of imprisonment for not more than 90 days or a fine of not more than $500 or all of the above. Unless revoked, this permit **expires on 12/31/2019**.

By _____
James L. Dexter, Chief
Fisheries Division

cc: Fisheries Division
Southern Lake Michigan Management Unit
Threatened and Endangered Species Unit, Wildlife Division

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES
LANSING

GRETCHEN WHITMER
GOVERNOR

DANIEL EICHINGER
DIRECTOR

July 10, 2019

Mr. Phillip Mathias
EnviroScience, Inc.
5070 Stow Rd.
Stow, OH 44224

Dear Mr. Mathias:

This letter is an official attachment to your Threatened and Endangered Species Permit **(TE 182).** Your permit is issued in the *Consultant* category only. Your permit expires on **March 31, 2022**. Renewal information will be sent in December of 2021.

Authorization:
To conduct the scientific activities listed under special conditions on the threatened/endangered species listed below. All activities are subject to the standard permit conditions within this letter.

- This permit authorizes capture, temporary possession and relocation of state listed Threatened or Endangered species of **Mussels** in St. Joseph County.
- Propagation of brood stock and release of mussels to same watersheds is permitted.
- Relocation efforts must comply with the Michigan DNR Standards for Freshwater Mussel Protocol.
- Any salvageable mussel shells may be placed into an appropriate archiving facility at the University of Michigan Museum of Zoology or other appropriate institution.
- Subpermittees: None

Mollusks

- Requires a scientific collector permit from the DNR's Fish Division. Permitted is the collection and temporary holding of mussels. Sampling must be done in a manner that minimizes the amount of time taken from the water and risk to the mussels. The consultant must have written approval from the Fisheries Division Management Unit Supervisor for each project prior to surveying and moving mussels from the project site. The consultant must complete reports for each project within 60 days and submit them to the Fisheries Division Management Unit Supervisor and Scott Hanshue with the DNR's Fisheries Division. The consultant must follow the most recent Michigan Freshwater Mussel Survey Protocols and Relocation Procedures document, including guidelines for monitoring and reporting.

Standard Permit Conditions

A. All specimens authorized for collection under this Permit shall be deposited in the collection of an approved public educational or research institution prior to Permit expiration.

B. None of the specimens collected shall become part of a private collection or private property.
C. This permit does not allow or grant the right of trespass. Projects shall not take place on any private or public lands without permission from the owner or administrator of such lands.
D. This permit does not provide authorization to circumvent any federal, state, or local laws and ordinances.
E. Additionally, federal permits may be required for activities affecting federally listed threatened or endangered species and/or migratory birds. Contact the U. S. Fish and Wildlife Service at 2651 Coolidge Road, East Lansing, MI 48823.
F. The activities covered under this Permit are not transferable to another person unless specifically authorized.
G. Unless otherwise noted, within 10 days of the expiration of this Permit, the holder is required to file a report detailing the locations of any threatened and endangered species encountered and the number and disposition of specimens handled. Annual reports for multi-year permits are due at the end of each calendar year.
H. A person conducting any activities authorized by this permit shall carry a copy of this permit and shall produce a copy of this permit upon request of a Department of Natural Resources employee or law enforcement officer.

All permits require and annual report unless indicated otherwise. You can use the enclosed report form and submit forms via email to reitzc@michigan.gov. In addition, please report any new occurrences of threatened and endangered species as soon as possible instead of waiting until the end of the year. This will allow new data to be incorporated into the Michigan Natural Features Inventory database sooner, thus ensuring greater protection for these species and their habitats.

Thank you for helping protect our threatened and endangered species. Feel free to contact me with any questions or concerns.

Sincerely,

Casey M Reitz

Casey M. Reitz, Permit Specialist
DNR-Wildlife Division
Phone: 517-284-6210
Fax: 517-335-6604
reitzc@michigan.gov
www.michigan.gov/wildlifepermits

Michigan Department of Natural Resources – Wildlife Division

APPLICATION FOR A THREATENED/ENDANGERED SPECIES PERMIT

By the authority of Part 365, Endangered Species Protection, of the Natural Resource and Environmental Protection Act, Act 451 of 1994, and the rules established thereunder, submittal is required to be considered for a permit.

INSTRUCTIONS: Please type or print all information except the signature and mail with attachments to the Wildlife Division. Federal permits may be required for federally listed or migratory species.

APPLICANT INFORMATION AND PERMIT TYPE

☒ New Permit ☐ Renewal Permit — If Renewal, Permit Number: _____

☒ Consultant (provide credentials) ☐ Education or Scientific ☐ Development ☐ Live Animal Programs/Salvage

Name of Applicant (Last, First, Middle)	Applicant's Title (If applicable)
Mathias, Philip, Thomas	Malacologist
Name of Organization	**Subpermittee**
EnviroScience, Inc.	
Address	
5070 Stow Rd	
City, State, ZIP Code	
Stow, OH 44224	
Telephone	**E-Mail Address**
330-688-0111	pmathias@enviroscienceinc.com

SPECIES INFORMATION

Species (Scientific or common names)
T&E mussels. See attached species list.

Location (Be specific. Include Michigan county(ies))
St. Joseph County: above and below the dam located here: 41.847265, -85.668484

Time period requested (Usually one calendar year)
06/01/2019 to 10/15/2019

Number of plants and/or animals to be handled, collected, relocated, etc.
As encountered as this is a preliminary survey

Name and location of public institution where authorized specimens will be placed
Mussels will be returned to their point of collection.

Purpose of project and justification for study, collection, or relocating species (Attach applicable proposals or plans)

Indiana Michigan Power Company (I&M), a unit of American Electric Power (AEP), is the Licensee, owner, and operator of the run-of-river, 1,200-kilowatt (kW) Constantine Hydroelectric Project (Project) (FERC Project No. 10661), located on the St. Joseph River in the Village of Constantine in St. Joseph County, Michigan and is in the process of FERC relicensing. A mussel survey was proposed as part of the Proposed Study Plan (PSP) prepared by AEP and HDR. The results of the mussel survey would help to determine the effects of project operation on habitat for the mussels.

Proposed methods to mitigate impacts of projects (Attached applicable proposals or plans)

Methods will follow "Hanshue, S., J. Rathbun, P. Badra, J. Bettaso, B. Hosler, J. Pruden, and J. Grabarkiewicz. 2018. Michigan Freshwater Mussel Survey Protocols and Relocation Procedures." Further methods are described in the attached survey proposal.

Signature of Applicant	Date
Philip T Mathias	06/04/2019

Mail completed application and attachments to:

Wildlife Division
Department of Natural Resources
PO Box 30444
Lansing, MI 48909-7944

Permit #: TE 182
Issued: 7/10/19
Expired: 3/31/22

PR2013 (Rev. 11/15/2018)

Michigan Department of Natural Resources – Wildlife

THREATENED / ENDANGERED SPECIES REPORT

This information is required by the authority of Part 365, Endangered Species Protection, of the Natural Resources and Environmental Protection Act, Act 451 of 1994, and the Rules established thereunder.

REQUIREMENTS: As a holder of a Threatened/Endangered Species Permit, you are required to complete this report **even if you did not** collect, observe, or relocate any listed species. Failure to report may result in loss of permit renewal. Where applicable, copies of complete specimen labels or reports may be substituted in lieu of completing this form if you provide information on the form that is not included on the label or in the report.

INSTRUCTIONS: Complete one form for each site and for each species at a site. Mail all report information to the Michigan DNR, Wildlife Division, (address on Page 2), **within 10 days of the permit expiration date or by December 31,** for each year of a multi-year permit.

PERMITTEE INFORMATION

Permittee's Name (Last, First, Middle)	Name of Organization or Business (if applicable)	
Address	Permit Number	
City, State, ZIP	Telephone ( )	Email

SPECIES INFORMATION

☐ I did not collect, observe, or relocate any threatened or endangered species during the period covered by my permit. (Sign and date page 2.)

☐ I collected, observed, or relocated the species listed below.

Species: (Scientific and common names)

OBSERVATION DATE	LOCATION (Legal description or UTM coordinates)			
	County	Town	Range	Section 1/4

Detailed Directions to Site: Include directions from nearest town or road. Draw or attach a map indicating the exact location of the observation, collection, and/or relocation site (photocopies of USGS topographic maps preferred).

PR2013-4 (Rev 11/03/2009)

POPULATION DATA

Number of Individuals:	Observed	Collected	Captured/Relocated
Phenology (plants):	Percent Flowering	Percent Fruiting	Apparent Vigor
Animal Population Age Structure:	Number of Adults	Number of Juveniles	
Evidence of Reproduction:			

RELOCATION DATA (IF APPLICABLE)

Survival of Relocated Specimens:	Number Relocated	Number Surviving	Percent Surviving

HABITAT DATA

Extent of Habitat:	No. of Acres, Sq., Meters, etc.	☐ Acres ☐ Sq. Meters	Percent Occupied by Species
Associated Species: (List 6 plant species in order of dominance, beginning with overstory if present.)			
Microhabitat Description: (soils, topography, etc.)			

CONSERVATION DATA

OVERALL SITE QUALITY:	☐ Excellent	☐ Good	☐ Fair	☐ Poor
Threats or Need for Protection: (Immediate? Long Term?)				
Other Information Needs: (Survey, Monitoring, etc.)				
Institution Where Specimens Were Deposited: (If collected or salvaged)		Voucher/Collection Number:		
Comments, Additional Information and Recommendations: (Attach sheets, reports, or photographs as appropriate)				

Permittee's Signature _____ Date _____

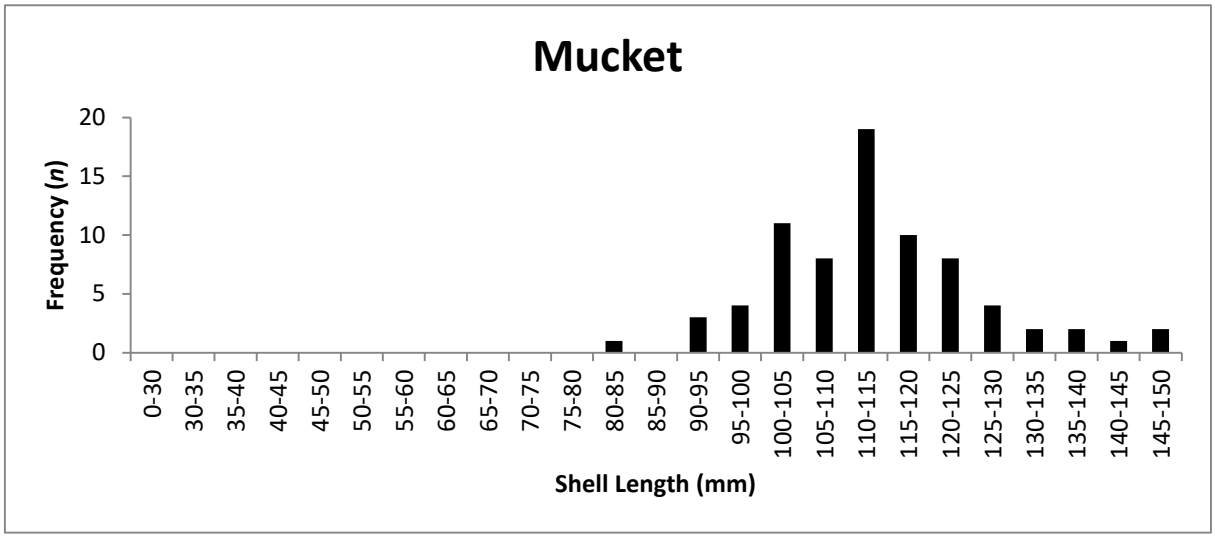
Mail completed application with attachments to :

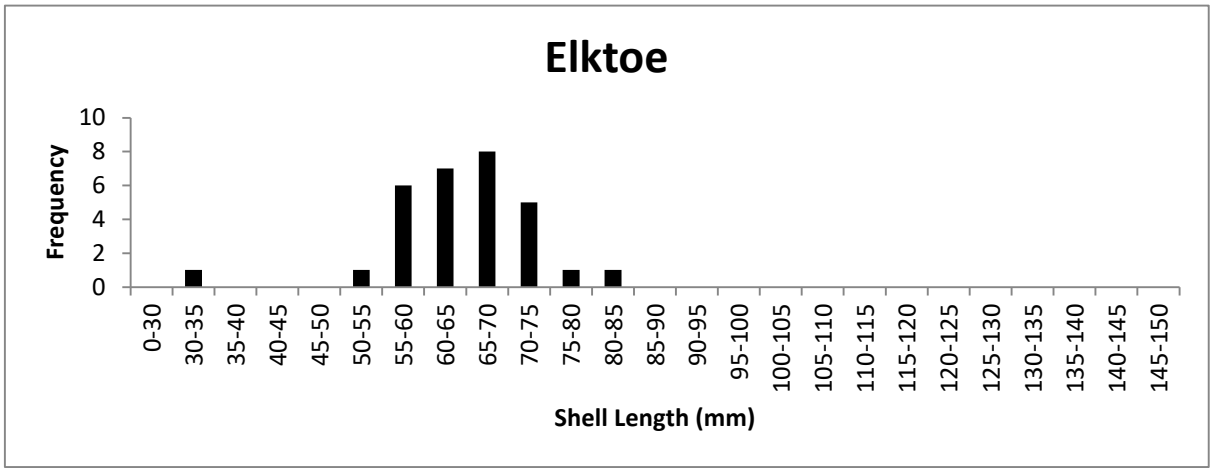
WILDLIFE DIVISION – PERMIT SPECIALSIT
MICHIGAN DEPARTMENT OF NATURAL RESOURCES
PO BOX 30444, LANSING MI 48909-7944
FAX: 517-335-6604 or reitzc@michigan.gov

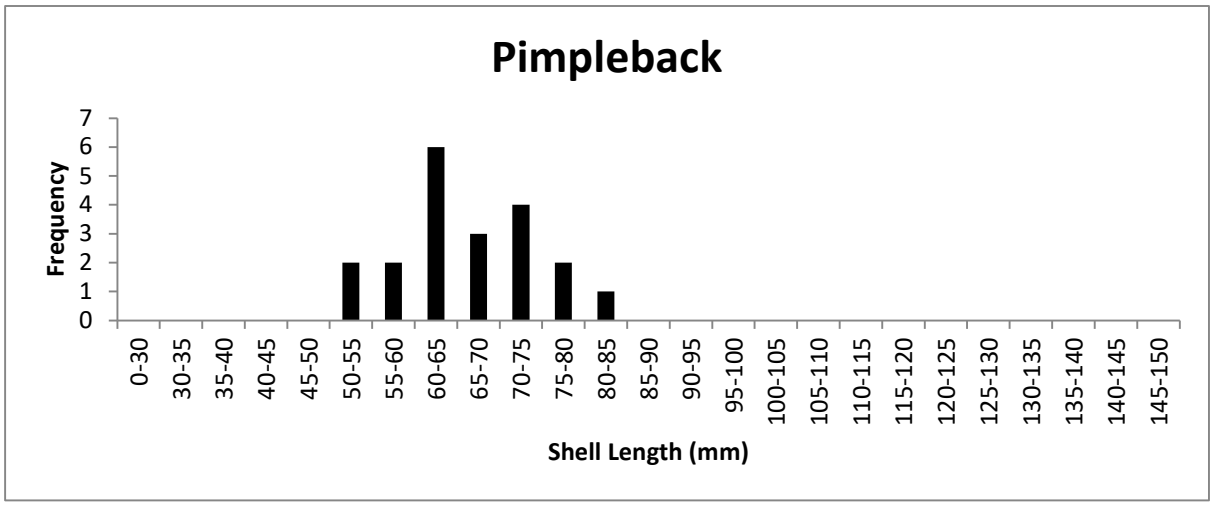
Appendix B

Shell Length Histograms

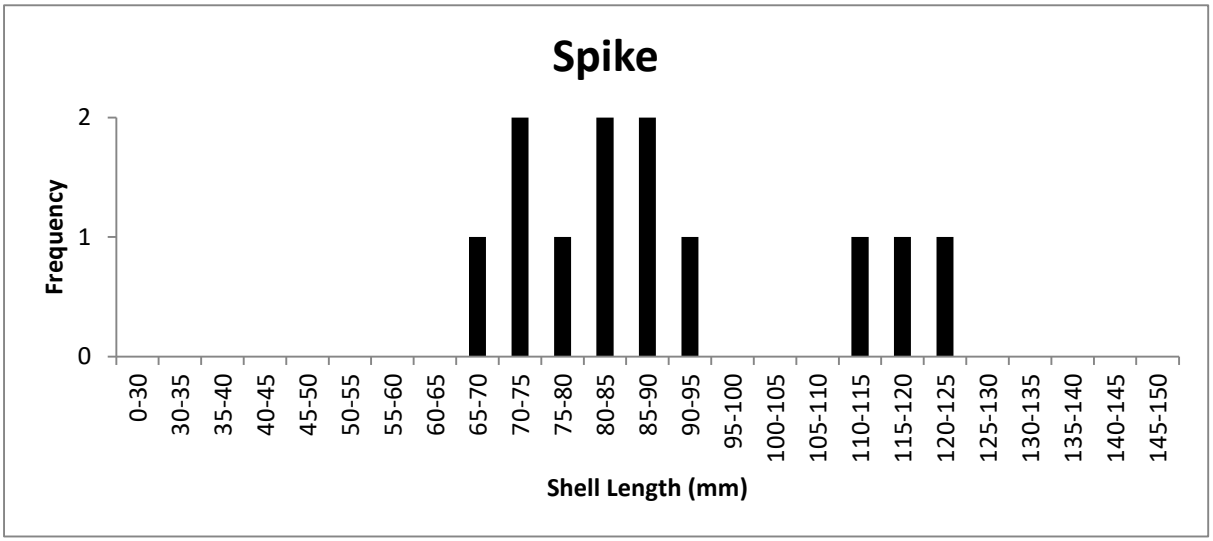
Appedix B. Length Frequency Histograms of Live Mussels (>*n* =3) Collected from the Constantine Hydroelectric Project (FERC NO. 10661) Relicensing Studies: Mussel Survey. Constantine, St. Joseph County, Michigan, 2019.

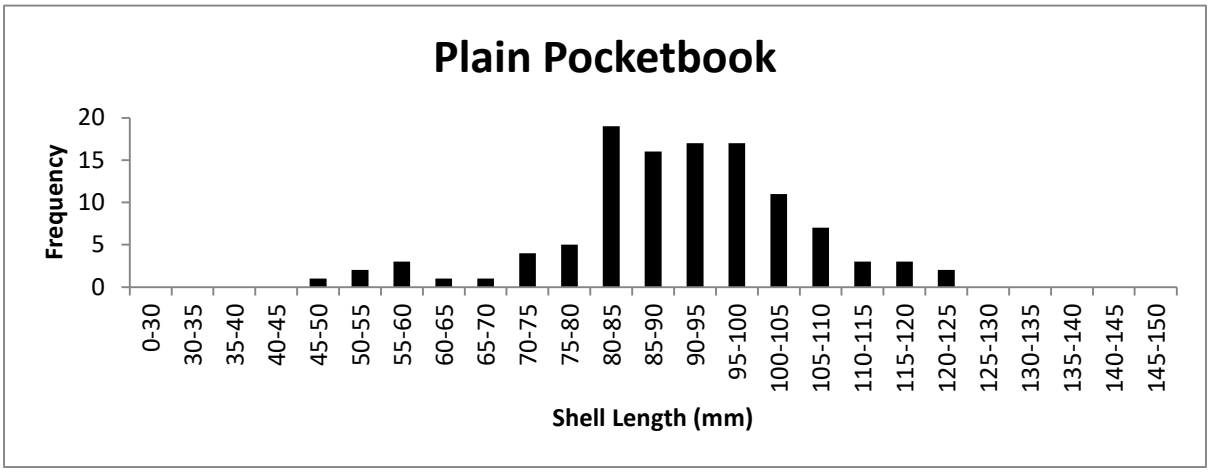


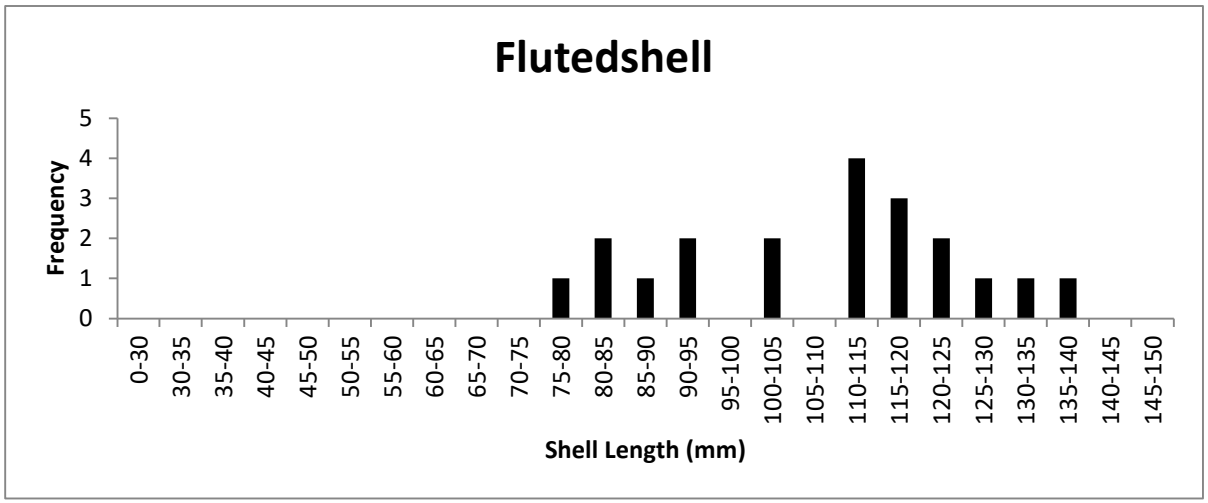




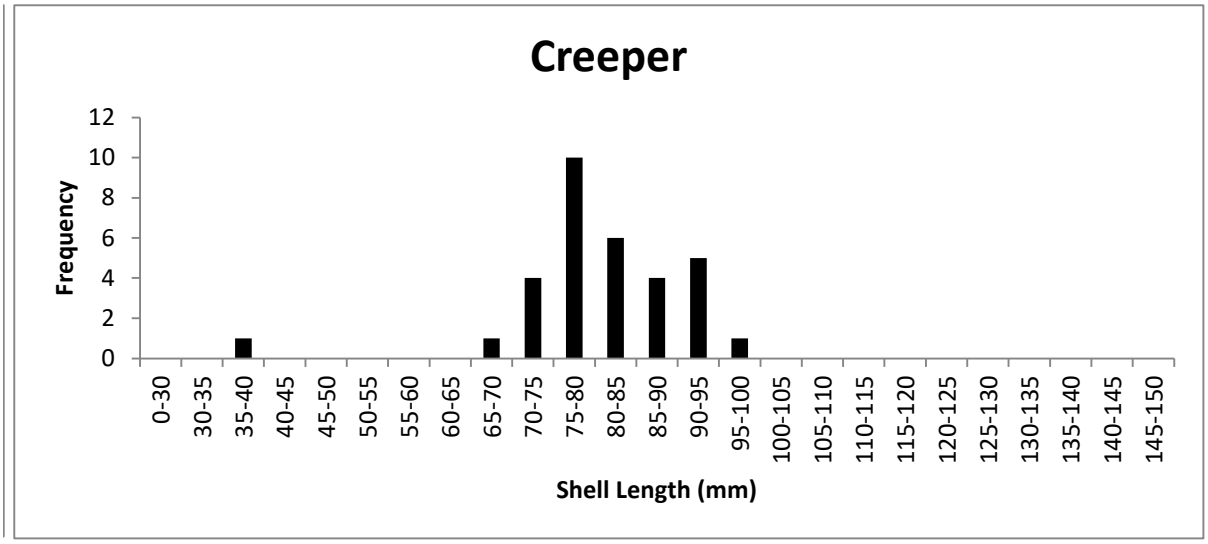
Appedix B. Length Frequency Histograms of Live Mussels (>*n* =3) Collected from the Constantine Hydroelectric Project (FERC NO. 10661) Relicensing Studies: Mussel Survey. Constantine, St. Joseph County, Michigan, 2019.

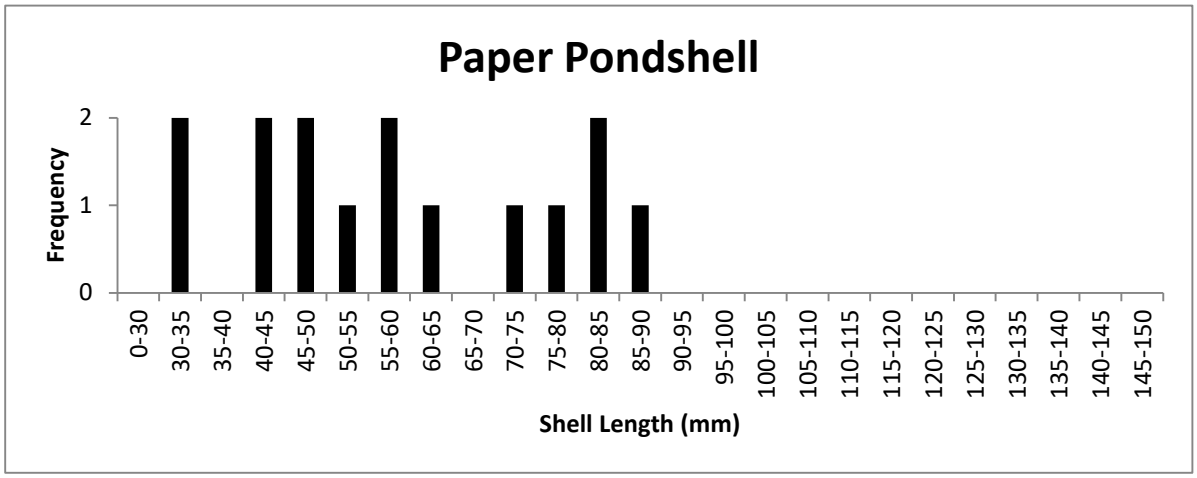


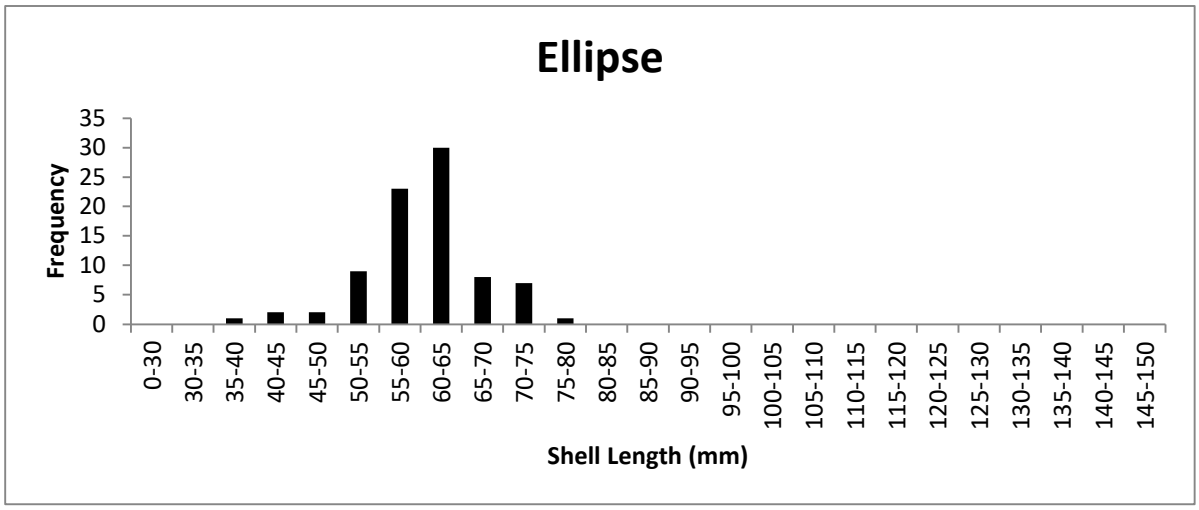




Appedix B. Length Frequency Histograms of Live Mussels (>*n* =3) Collected from the Constantine Hydroelectric Project (FERC NO. 10661) Relicensing Studies: Mussel Survey. Constantine, St. Joseph County, Michigan, 2019.







Appendix C

Digital Image Log

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019

Digital Images 1 and 2. Mucket (*Actinonaias ligamentina*); right valve (top), umbo (bottom)

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019

Digital Images 3 and 4. Elktoe (*Alasmidonta marginata*); right valve (top), umbo (bottom)

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019

Digital Images 5 and 6. Pimpleback (*Cyclonaias [Quadrula] pustulosa*); right valve (top), umbo (bottom)

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019

Digital Images 7 and 8. Purple Wartyback (*Cyclonaias tuberculata*); right valve (top), umbo (bottom)

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019

Digital Images 9 and 10. Spike (*Eurynia dilatata*); right valve (top), umbo (bottom)

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019

Digital Images 11 and 12. Wabash Pigtoe (*Fusconaia flava*); right valve (top), umbo (bottom)

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019

Digital Images 13 and 14. Plain Pocketbook Female (*Lampsilis cardium*); right valve (top), umbo (bottom)

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019

Digital Images 15 and 16. Plain Pocketbook Male (*Lampsilis cardium*); right valve (top), umbo (bottom)

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019

Digital Images 17 and 18. Fatmucket (*Lampsilis siliquoidea*); right valve (top), umbo (bottom)

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019

Digital Images 19 and 20. Flutedshell (*Lasmigona costata*); right valve (top), umbo (bottom)

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019

Digital Images 21 and 22. Round Pigtoe (*Pleurobema sintoxia*); right valve (top), umbo (bottom)

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019

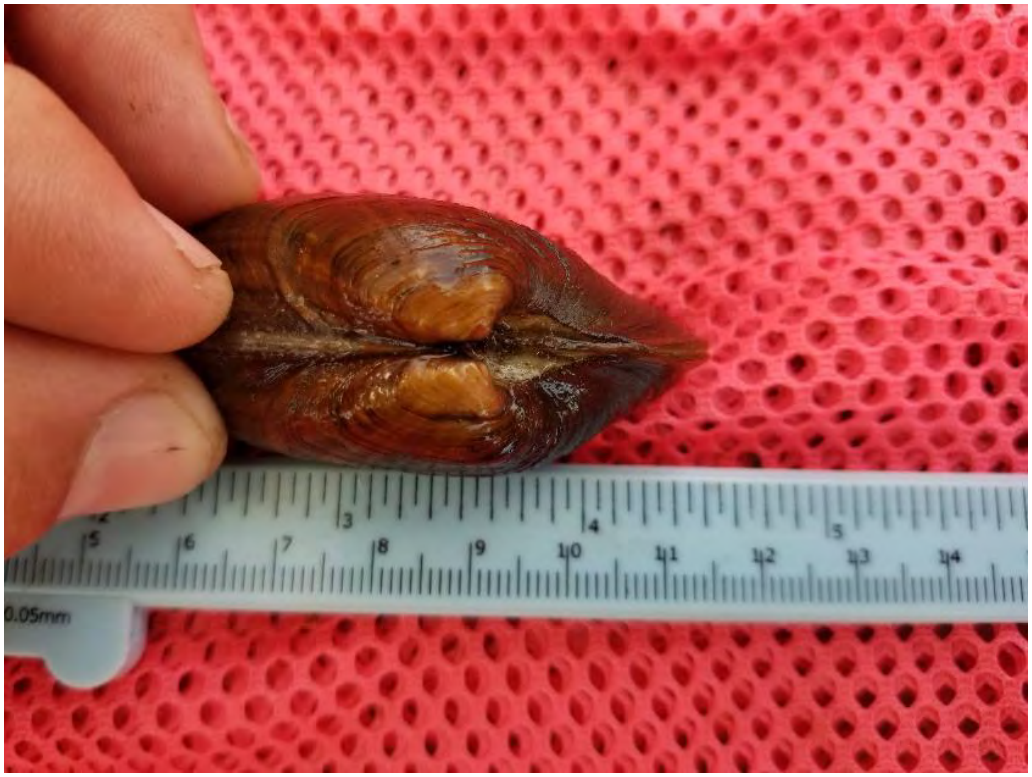
Digital Images 23 and 24. Giant Floater (*Pyganodon grandis*); right valve (top), umbo (bottom)

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019

Digital Images 25 and 26. Mapleleaf (*Quadrula quadrula*); right valve (top), umbo (bottom)

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019

Digital Images 27 and 28. Creeper (*Strophitus undulatus*); right valve (top), umbo (bottom)



Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019

Digital Images 29 and 30. Lilliput (*Toxolasma parvum*); right valve (top), umbo (bottom)

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019

Digital Images 31 and 32. Paper Pondshell (*Utterbackia imbecillis*); right valve (top), umbo (bottom)

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019

Digital Images 33 and 34. Ellipse (*Venustaconcha ellipsiformis*); right valve (top), umbo (bottom)

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019

Digital Image 35. Site 1, Sub-reach 1 Looking Downstream

Digital Image 36. Site 1, Sub-reach 1 Looking Upstream

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019

Digital Image 37. Site 4, Sub-reach 1 Looking Downstream

Digital Image 38. Site 4, Sub-reach 1 Looking Upstream

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019
Digital Image 39. Substrate near Site 1.

Digital Image 40. Upstream Portion of Site 2 Looking Upstream

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019
Digital Image 41. Upstream Portion of Site 2 Looking Downstream

Digital Image 42. Upstream Portion Site 2, Substrate

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019
Digital Image 43. Downstream Site 2, Looking Downstream

Digital Image 44. Downstream Site 2. Looking Upstream

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019
Digital Image 45. Downstream Portion of Site 2, Substrate

Digital Image 46. Upstream Portion of Site 3, Looking Downstream

Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019
Digital Image 47. Upstream Portion Site 3, Looking Upstream

Digital Image 48. Downstream Portion of Site 3, Looking Downstream

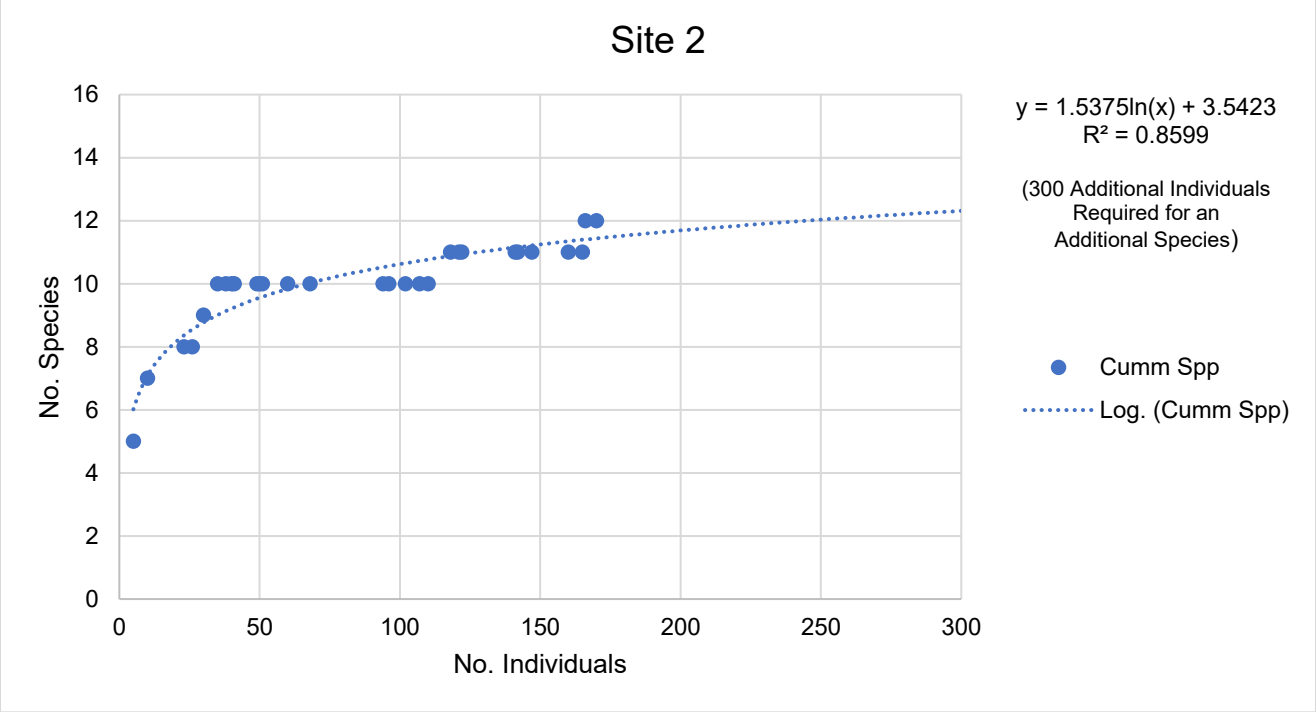
Freshwater Mussel Survey for the Constantine Hydroelectric Project (FERC No. 10661)
HDR, Inc. and American Electric Power
Photographed August 21, 2019
Digital Image 49. Portion of Site 3, Looking Upstream

Digital Image 50. Site 3, Substrate

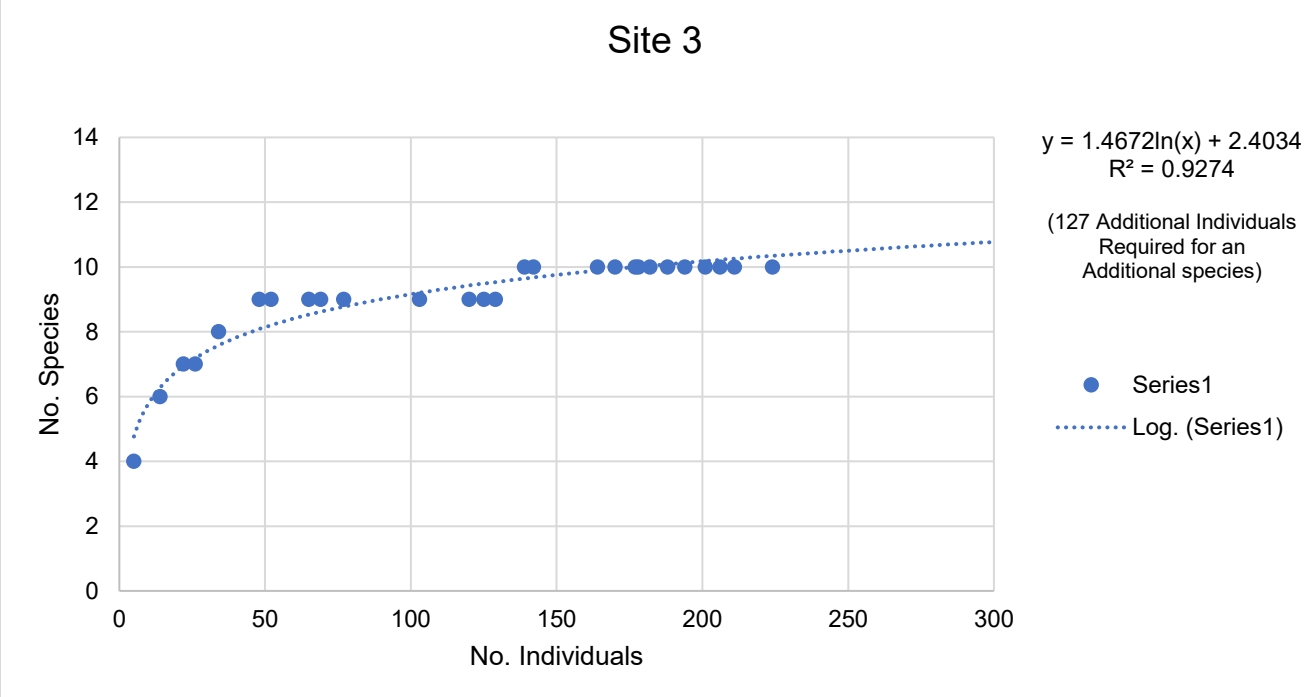
Appendix D

Species Richness Curves

Species richness curve within Site 2 of the Project area, St. Joseph River, Michigan, 2019.



Species richness curve within Site 3 of the Project area, St. Joseph River, Michigan, 2019.



Appendix G. Wetlands Study

Wetlands Study Report

Constantine Project (FERC No. 10661)
March 31, 2020

Contents

Tables

Figures

1. Project Introduction and Background

Indiana Michigan Power Company (I&M), a unit of American Electric Power (AEP), is the Licensee, owner, and operator of the run-of-river, 1.2-megawatt Constantine Hydroelectric Project (Project) (FERC Project No. 10661). The Project located along the St. Joseph River in the Village of Constantine in St. Joseph County, Michigan.

I&M operates and maintains the Project under a license from the Federal Energy Regulatory Commission (FERC or Commission). The Project's existing license expires on September 30, 2023. I&M is pursuing a subsequent license for the Project using the Commission's Integrated Licensing Process (ILP) as defined in 18 Code of Federal Regulations (CFR) Part 5.

In accordance with 18 CFR § 5.15, I&M has conducted studies as provided in the March 15, 2019 Revised Study Plan (RSP) and schedule approved in the Commission's April 9, 2019 Study Plan Determination (SPD) for the Project. This report describes the methods and results of the Wetlands Study conducted in support of preparing an application for a subsequent license for the Project.

The State of Michigan administers Section 404 of the federal Clean Water Act regulating wetlands in most areas of the State through the Michigan Department of Environment, Great Lakes and Energy (EGLE). The U.S. Army Corps of Engineers (USACE) retains jurisdiction over traditionally navigable waters including the Great Lakes and connecting channels and wetlands directly adjacent to these waters. Wetlands are generally defined as those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support vegetation typically adapted for life in saturated soil conditions. The United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) classification system (Cowardin 1979) defines wetlands as:

> …lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification, wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominately hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some point during the growing season of the year.

Existing relevant and reasonably available information pertinent to the scope of the RSP including wetlands and riparian habitat in the Project area was included in the Pre-Application Document (PAD) (I&M 2018) in Section 5.6 Wetlands, Littoral, and Riparian Habitat. Sub-section 5.6.3 Wetland, Riparian Zone, and Littoral Maps, provides a map of wetlands within the Project boundary and a summary table of acreage by USFWS NWI category within the Project boundary. The Project wetland Geographic Information System (GIS) map features were used to calculate total wetland acreage for each wetland feature within the Project boundary. Total wetland acreage within the Project boundary was calculated as 35.8 acres across six NWI categories that fall under the system/class categories palustrine emergent, palustrine forested, and palustrine scrub-shrub wetland habitats (Cowardin 1979). The majority of the

Project wetland area (20.8 acres) is classified as: PF01Ch Palustrine, Forested, Broad Leaved Deciduous, Seasonally Flooded, and Diked/Impounded. The Project wetland map included in the PAD was developed through GIS editing (clipping) of the USFWS NWI wetlands polygon layer against the Constantine Project boundary polygon.

Section 5.6 of the PAD also includes background information on wetland and riparian vegetation. The Project area is in the Beach-Maple Association of the Eastern Deciduous Forest Province (Bailey 1978). Dominant vegetation in the Project area is a mixed hardwood community consisting of oak, ash, beach, hickory, maple, cottonwood, and aspen. Willow species dominate the plant community in the scrub-shrub areas and maple, sycamore, and cottonwood dominate the forested wetlands. Other species of the palustrine forested areas include ash, sumac, walnut, and oaks. Plant species of the aquatic bed community include American white waterlily (*Nymphaea odorata*), Eurasian watermilfoil (*Myriophyllum spicatum*), and crispy pondweed (*Potamogeton crispus*). Green arrow arum (*Peltandra virginica*) is a dominant species in the emergent wetland class. Cattails are a minor component of the wetland plant community in the Constantine reservoir (FERC 1993a).

2. Study Goals and Objectives

In accordance with I&M's RSP and the Commission SPD for the Project, the general goal of the Wetlands Study was to conduct a field survey of wetland and riparian areas within the Project boundary to characterize habitats, vegetation and verify/update existing wetlands map data. The specific goals and objectives of this study were as follows:

- Use NWI and Michigan Department of Environmental Quality (MDEQ) Wetland Maps to identify, display, and describe the current composition of wetland communities within and adjacent to the study area.
- Use the NWI and MDEQ Wetland Maps to develop a GIS database on the extent, classification, and plant community structure of wetland habitats within and adjacent to the study area.
- Confirm NWI wetland classifications of previously documented wetlands based on field observations and assess any necessary map change recommendations.
- Via the GIS data, estimate the total acres of wetlands and cover type habitats that currently exist within the study area.
- Provide the necessary baseline data to support determination of potential Project effects.

Applied methods and variances from the RSP study methods are described in the following sections, along with survey data and discussion of study results.

3. Study Area

The study area for the Wetlands Study is the FERC Project boundary as detailed on the map provided in Appendix C of the PAD. The ArcGIS shapefile P-10661 Project Boundary Data 05-13-2016 (see Figure 1) was used to guide field investigations, conduct GIS analyses, and create map figures for this report.

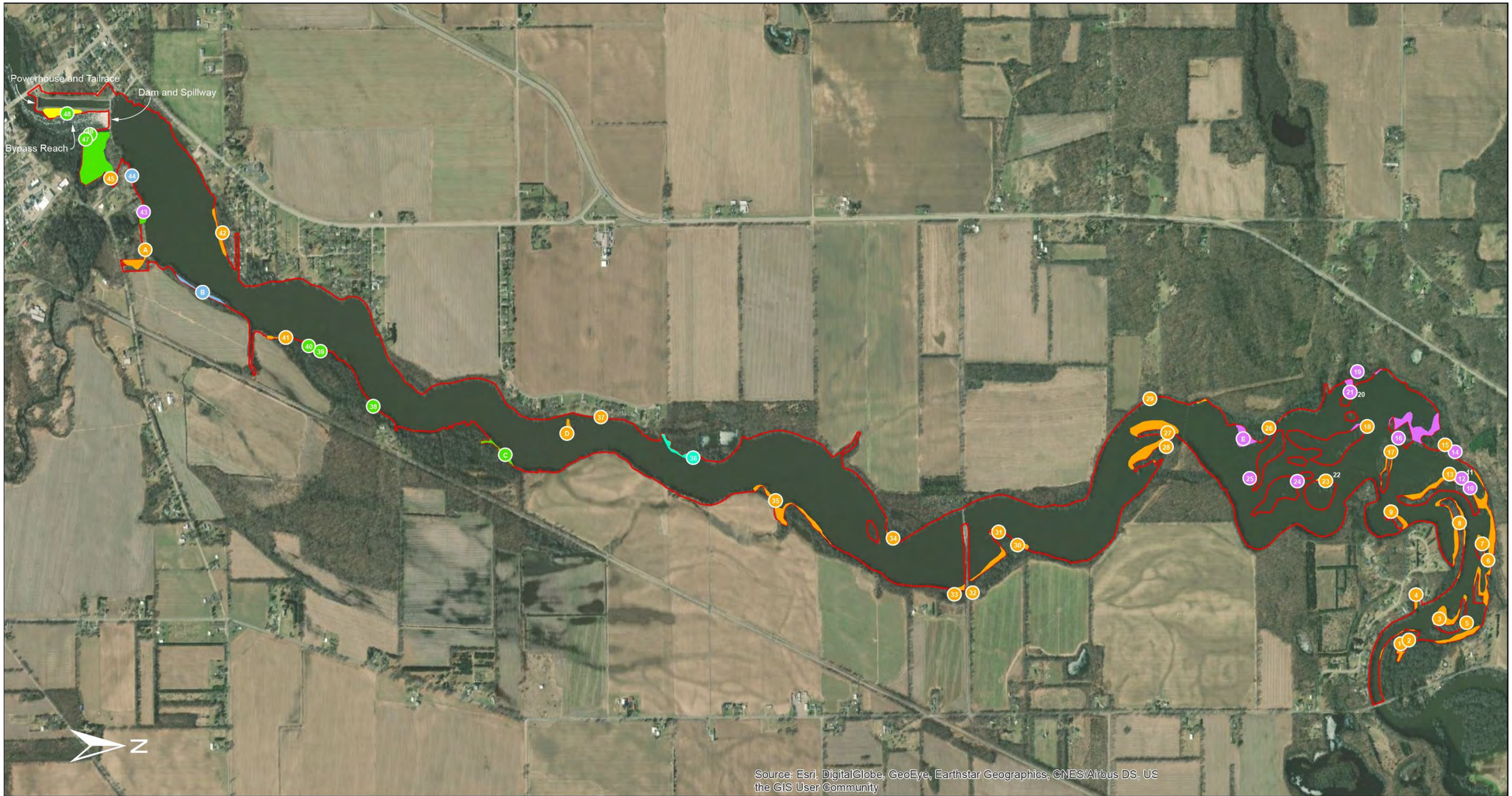


Figure 1. Wetland Survey Map

4. Methodology

The Wetlands Study was conducted pursuant to the approved March 15, 2019 RSP with some modifications. A field survey of wetlands and riparian vegetation was conducted by a certified wetlands biologist on August 14, 15, and 16, 2019. The survey involved verifying and noting any changes to the characteristics and extent of the NWI wetland features within the Project boundary. Field data included habitat descriptions at 48 positions throughout the length of the Project area. Pursuant to the RSP, formal wetland delineations were not conducted. Wetland delineations, according to the 1987 USACE Wetland Delineation Manual, involve collecting soil core samples, identifying and formally mapping wetland vegetation, and documenting hydrologic characteristics. There were only slight variations in observed wetland feature classifications and extents compared to the Project NWI wetlands map. Consistent with the RSP, field measurements (i.e., delineations) to quantify changes to the NWI wetland feature areas were not conducted; changes to NWI map features are noted in the Summary and Discussion and Field Survey Notes sections below. After the field survey, numbered field survey positions and accompanying note attributes were converted into map point features (Figure 1). Survey notes describing wetland and riparian vegetation characteristics are provided in Section 7. Field survey notes with corresponding station numbers are displayed on Figure 1.

Operated as run-of-river, this Project will have little effect on reservoir levels that would, if varied, potentially impact wetlands associated with the Project. The study methods proposed by I&M and outlined below are used commonly during FERC relicensing studies and provided adequate information to assess potential impacts to wetlands related to Project operations.

4.1. Desktop Mapping/Distribution of Wetland and Riparian Vegetation

The RSP called for the development of a GIS base map of wetland cover types in the Project study area using the best available data from state and/or federal agencies (i.e., USFWS, MDEQ). For the Project area, it was determined that the best available map data was the USFWS NWI digital wetland map polygons, available for download as undated ESRI shapefile polygons from the USFWS NWI website. The State of Michigan offers the same NWI wetland layer for download through its GIS Open Data website. The Project study area wetland map was developed through GIS editing (clipping) of the USFWS NWI wetlands polygon layer against the Constantine Project boundary polygon. The resulting shapefile *wetn_mi_20170808_NWI_Wetlands_Clip* – heretofore referred to as *"*Project NWI Wetlands Map" - was utilized to describe wetland area by classification, guide the wetlands and riparian vegetation field survey, and provide a base reference layer for Figure 1. The Project wetland GIS map features were used to calculate total wetland acreage for each wetland feature within the Project boundary and summarized in the PAD in Table 5.6-1 National Wetlands Inventory Classification System and Estimated Acreage. Total wetland acreage within the Project boundary was calculated as 35.8 acres across six NWI categories that fall under the system/class categories palustrine emergent, palustrine forested, and palustrine scrub-shrub wetland habitats (Cowardin 1979). The majority of the Project wetland area (20.8

acres) is classified as: PF01Ch Palustrine, Forested, Broad Leaved Deciduous, Seasonally Flooded, and Diked/Impounded.

Table 1. National Wetlands Inventory Classification System and Estimated Acreage (PAD Table 5.6-1).

Wetland Code	System	Class	Subclass	Regime	Qualifier	Estimated Acres
PEM1C	Palustrine	Emergent	Persistent	Seasonally Flooded	None	1.4
PFO1Ah	Palustrine	Forested	Broad-Leaved Deciduous	Temporary Flooded	Diked/ Impounded	0.5
PFO1C	Palustrine	Forested	Broad-Leaved Deciduous	Seasonally Flooded	Diked/ Impounded	7.6
PFO1Ch	Palustrine	Forested	Broad-Leaved Deciduous	Seasonally Flooded	Diked/ Impounded	20.8
PSS1Ch	Palustrine	Scrub-Shrub	Broad-Leaved Deciduous	Seasonally Flooded	Diked/ Impounded	0.8
PSS1Fh	Palustrine	Scrub-Shrub	Broad-Leaved Deciduous	Semi permanently Flooded	Diked/ Impounded	4.7

4.2.Field Survey Verification of Wetland Maps

On August 14, 15, and 16, 2019, two contractor field biologists surveyed the wetland complexes in the Constantine reservoir, bypass reach and tailrace areas within the Project boundary. The purpose of the survey was to verify the wetland map features in the Project NWI wetland map described in Section 4.1. The survey was conducted by boat and walking near shore areas over the length of the Project. Observations were recorded at 48 stations generally adjacent to or overlying the NWI wetlands features within the Project boundary. Observations of wetland habitats near the Project boundary were recorded at 8 stations (14,24,25,37,38,39,40), not immediately adjacent to or overlying NWI map clipped features and are provided in Figure 1 and the Field Survey Notes section to support overall study findings. The Wetlands Study was coincidental with the Botanical Resources Study, and field survey notes (Section 7) describe the vegetative cover, species composition, and wetland classifications which imply successional stage - including degree of inundation (e.g., seasonally flooded, permanently flooded) for each station, based upon information obtained from this study as well as the annual Constantine Invasive Species Survey conducted by GLEC for I&M (GLEC 2019 Invasive Species Survey). Any changes in wetland type or characteristics to the existing NWI classification were noted when relevant. Coordinate positions were recorded with a Global Positioning System (GPS) device at 40 of the 48 stations and marked on a large-scale field map for the remaining 8 stations. As prescribed by the RSP, delineations/field measurements were not conducted to verify the size or extent of the wetland features. The field notes appear in Section 7 Field Survey Notes.

4.3.Field Survey Data Analysis and Mapping

The field notes and coordinate data from the August survey were reviewed and edited by the field biologist and GIS analyst. A total of 48 ESRI ArcGIS point features were created from GPS coordinates and field map markings that include the confirmed or modified wetland classification attribute (stations

1 through 48). Six of the survey stations had duplicate paired coordinates for essentially duplicate observations as the survey meandered through the northern end of the reservoir (stations 11 and 12; 20 and 21; 22 and 23). Notes for these duplicate locations can serve as an ad hoc quality check as they confirm the same observed wetland classification for each pair. As part of post-survey processing, an additional five observation points were created using ArcGIS aerial imagery base map (stations A through E) to correspond with overlaid NWI polygons that had not been formally field-verified. Wetland classifications were applied to these additional five stations through image analysis and verification by field biologists. The 53 observation survey points were then labeled with numbers and overlaid on an aerial image base map and the existing Project NWI wetlands layer. The NWI wetlands polygons and survey point map layers were color coded with the same classification color theme to visually identify where wetland classifications were confirmed or where updates were made (Figure 1).

5. Study Results

5.1. Wetlands Coverage and Description

The wetlands mapping and field survey exercises determined that the wetland coverages described by the Project NWI wetland map and summarized by classification and acreage in Table 1 generally fit the same description with a few exceptions. The most notable modification was the reclassification of the island between the tailrace and bypass reach from PEM1C Freshwater Emergent Wetland to PFO1C Forested Shrub Wetland, likely an example where a field investigation (i.e., ground-truthing) provided more accurate information than interpreting an image (i.e., remote sensing). This difference is further explained in the survey notes for station 48 and is visually evident in Figure 1. The observed change to the classification of the island at station 48 is the most significant change to the existing NWI wetlands (within the Project boundary) from the survey findings. Allowing for the change to the island classification, the category PEM1C would be removed and the summary of wetlands acreage by classification provided in Table 1 would change to the following in Table 2:

Table 2. National Wetlands Inventory Classification System and Estimated Acreage from August 2019 Survey.

Wetland Code	System	Class	Subclass	Regime	Qualifier	Estimated Acres
PFO1Ah	Palustrine	Forested	Broad-Leaved Deciduous	Temporary Flooded	Diked/ Impounded	0.5
PFO1C	Palustrine	Forested	Broad-Leaved Deciduous	Seasonally Flooded	Diked/ Impounded	9.0
PFO1Ch	Palustrine	Forested	Broad-Leaved Deciduous	Seasonally Flooded	Diked/ Impounded	20.8
PSS1Ch	Palustrine	Scrub-Shrub	Broad-Leaved Deciduous	Seasonally Flooded	Diked/ Impounded	0.8
PSS1Fh	Palustrine	Scrub-Shrub	Broad-Leaved Deciduous	Semi permanently Flooded	Diked/ Impounded	4.7

The wetlands survey did produce some other observed changes to the Project NWI wetlands map coverage data. There are no estimates of changes to acreage by classification types since field measurements (i.e., delineations) were not conducted. It can be stated that the observed changes – other than the island mentioned above – were relatively minor and do not significantly affect the mix of wetland types or introduce new wetland types not already described within the Project boundary. Table 3 provides a summary where station observations differed from the Project NWI wetlands map classification for the station area. Notes for each station are provided in Section 7 Field Survey Notes.

Table 3. Survey Stations with Different Classification versus Underlying NWI Map Data.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
10	PSS1Fh	PFO1Ch
11	PSS1Fh	PFO1Ch
12	PSS1Fh	PFO1Ch
18	PFO1Ch	PSS1Fh
43	PSS1Fh	PFO1Ch
45	PFO1Ch	PFO1C
48	PFO1C	PEM1C

6. Summary and Discussion

Wetlands are generally defined as those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support vegetation typically adapted for life in saturated soil conditions. The Constantine Project area is in the Beach-Maple Association of the Eastern Deciduous Forest Province (Bailey 1978). Dominant vegetation in the Project area is a mixed hardwood community consisting of oak, ash, beach, hickory, maple, cottonwood, and aspen. Plant species of the aquatic wetland community include American white waterlily, Eurasian watermilfoil, and crispy pondweed. Arrow arum is a dominant species in the emergent wetland class. Cattails are a minor component of the wetland plant community in the Constantine reservoir.

The classification of wetlands and the acreages observed in this study vary very little from the results from previous assessments described in the PAD. The most notable change documented was the reclassification of the island between the tailrace and bypass reach from PEM1C Freshwater Emergent Wetland to PFO1C Forested Shrub Wetland. This change was made due to the ground-truthing and identification of a discrepancy in the NWI wetland map.

Total wetland acreage strictly within the Project boundary was estimated to remain at approximately 35.8 acres across five NWI categories that fall under the system/class categories palustrine forested and palustrine scrub-shrub wetland habitats. The majority of the Project wetland area (20.8 acres) is classified as: PF01Ch Palustrine, Forested, Broad Leaved Deciduous, Seasonally Flooded, and Diked/Impounded. These observations are consistent with the information presented in the PAD.

Modifications to existing NWI wetlands map classifications were attributable to invasive species competition; purple loosestrife (*Lythrum salicaria*) overwhelming the scrub-shrub communities in the modified zones. Modifications are described in Section 7 Field Survey Notes for each station. As noted in the RSP and PAD, the Constantine Project is operated as run-of-river and has little effect on reservoir levels that could potentially impact wetlands within the Project boundary.

6.1. Variances from FERC-Approved Study Plan

Actual wetlands survey and study methods applied some interpretations of and minor variances from the method details outlined in Section 11 Wetlands Study of the March 15, 2019 RSP. Section 11 subsections variously describe wetlands of concern and the study area as "wetlands within or adjacent to the Project boundary", "wetlands in the Project boundary", and "wetland cover types in the Project study area". The survey and mapping tasks prescribed in the RSP were followed to address wetlands within the official permit Project boundary, since only areas within the Project boundary are relevant to Project operations and licensing requirements. Wetland areas adjacent to (i.e., outside) the Project boundary were referenced in some areas to support and verify observations, but were not re-classified or studied to update wetland features relating to the Project. The Task 1 Desktop Mapping approach in the RSP suggests source data could include soil maps and maps from NWI and MDEQ. As mentioned in Section 4.1 above, it was determined that the best source data for wetlands in the study area was the USFWS NWI wetlands map already used in the PAD to produce the Project NWI Wetlands map layer.

Soil maps were not used in the wetlands survey or post-survey mapping exercises. Field notes and the Summary and Discussion section above discuss soil regimes in the study area. However, there is no doubt that the soils are hydric and either somewhat "dried" due to low river conditions, or wet depending on the size of the wetland adjacent to the Project boundary or juxtaposition of the riverine habitat.

Task 2 Field Verification of Wetland Maps in the RSP prescribes that any map change recommendations include species composition, successional stage, and extent of shoreline. Where changes to Project NWI wetland features were recommended, field measurements were not taken to verify extent of shoreline where the feature was re-classified.

7. Field Survey Notes

The following section provides the field survey notes recorded at each observation station by the field biologists who conducted the wetlands survey on August 14, 15, and 16, 2019. Each station is labeled on Figure 1 for reference. The station notes describe vegetative cover supporting the classification noted as "Observed Wetlands Class" in the station note header. The "Project NWI Wetlands Map Class" in each note header is the wetland classification of the adjacent or underlying wetland feature in the Project NWI wetland map, also exhibited in Figure 1 for visual comparison. Explanations are provided in each note where the observed wetlands classifications did not agree with the NWI map data or did not correspond to a nearby NWI map feature.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
1	PFO1Ch	PFO1Ch

Overstory of silver maple (*Acer saccharinum*), catalpa, and willow. Ground cover lizard's tail (*Saururus cernuus*), purple loosestrife, pond lily, and buttonbush (*Cephalanthus occidentalis*). Currently inundated 10yR2/1; muck soil.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
2	PFO1Ch	PFO1Ch

Overstory of silver maple, lizard's tail, and pond lily. Currently inundated 10yR2/1; muck soil.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
3	PFO1Ch	PFO1Ch

Overstory of elm, hickory, and silver maple. Ground cover lizard's tail purple loosestrife, Joe-pye weed (*Eutrochium maculatum*), and buttonbush.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
4	PFO1Ch	PFO1Ch

Overstory of willow tree. Understory of small willow, arrowhead, purple loosestrife, goldenrod (*Solidago rugosa*), Joe-pye weed, and buttonbush.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
5	PFO1Ch	PFO1Ch

Overstory of silver maple. Understory of willow, smartweed (*Persicaria amphibia*), button bush, and lizard's tail.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
6	PFO1Ch	PFO1Ch

Overstory of silver maple. Understory of arrowhead and lizard's tail.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
7	PFO1Ch	PFO1Ch

Overstory of willow and silver maple. Understory of lizard's tail, gray dogwood (*Cornus foemina*), purple loosestrife, elm, green ash (*Fraxinus pennsylvanica*), and cardinal flower (*Lobelia cardinalis*).

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
8	PFO1Ch	PFO1Ch

Overstory of silver maple, green ash, and willow. Understory of arrowhead, Joe-pye weed, purple loosestrife, false nettle (*Bohmeria cylindrical*), buttonbush, elm, vervain (*Verbena urticifolia*), and skullcap.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
9	PFO1Ch	PFO1Ch

Overstory of silver maple and elm. Understory of lizard's tail, cardinal flower, arrowhead, black ash (*Fraxinus nigra*) false nettle, small elm, American corn mint (*Mentha canadensis*), smartweed and buttonbush.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
10	PSS1Fh	PFO1Ch

Stations 10- 12 concern three islands closely grouped at the north end of the Project. Observations were taken from the boat only since heavy muck prohibited safe foot travel. This complex of islands exhibited some of the adjacent NWI polygon classification PFO1Ch along the eastern edges with silver maple overstory, but the majority of the island habitats appeared to be more representative of PSS1Fh with arrowhead, lily along the edge, smartweed, lizard's tail, buttonbush, pussy willow (*Salix discolor*), and purple loosestrife. It was evident that emergent purple loosestrife is outcompeting the scrub-shrub community.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
11	PSS1Fh	PFO1Ch

Stations 10- 12 concern three islands closely grouped at the north end of the Project. Observations were taken from the boat only since heavy muck prohibited safe foot travel. This complex of islands exhibited some of the adjacent NWI polygon classification PFO1Ch along the eastern edges with silver maple overstory, but the majority of the island habitats appeared to be more representative of PSS1Fh with arrowhead, lily along the edge, smartweed, lizard's tail, buttonbush, pussy willow, and purple loosestrife. It was evident that emergent purple loosestrife is outcompeting the scrub-shrub community. Station 11 is a duplicate observation location to station 12 (same GPS coordinates).

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
12	PSS1Fh	PFO1Ch

Stations 10- 12 concern three islands closely grouped at the north end of the Project. Observations were taken from the boat only since heavy muck prohibited safe foot travel. This complex of islands exhibited some of the adjacent NWI classification PFO1Ch along the eastern edges with silver maple overstory, but the most of the island areas appeared to be predominantly representative of PSS1Fh with arrowhead, lily along the edges, smartweed, lizard's tail, buttonbush, pussy willow, and purple loosestrife. It was evident that emergent purple loosestrife is outcompeting the scrub-shrub community. Station 12 is a duplicate observation location to station 11 (same GPS coordinates).

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
13	PFO1Ch	PFO1Ch

Overstory of silver maple. Understory of gray dogwood, buttonbush, multiflora rose, arrowhead, lizard's tail, and purple loosestrife on the margins.

Station	Observed Wetlands Class	Project NWI Wetlands Map Class
14	PSS1Fh	NA

Cattail, gray dogwood, curly dock (*Rumex crispus*), swamp loosestrife (*Decodon verticillatus*), buttonbush, cutgrass (*Leersia oryzoides*), elm <4" DBH, and purple loosestrife. Still scrub-shrub. Note: this station position is slightly outside the Project boundary and there is no NWI feature next to this station in either the Project NWI map or surrounding area NWI map, but the observation and classification is consistent with other stations in the general area.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
15	PFO1Ch	NA

Overstory of chinquapin oak (*Quercus muehlenbergii*), swamp white oak (*Quercus bicolor*), silver maple, hickory, and green ash. Understory of small green ash, false nettle, cutgrass, gray dogwood, arrowhead, and buttonbush. Note: this station position is slightly outside the Project boundary and there is no NWI feature next to this station in the Project NWI map, but the station is adjacent to a surrounding area NWI wetland map feature classified PFO1Ch, to the observation is consistent with existing NWI data.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
16	PSS1Fh	PSS1Fh

Overstory of mature silver maple along the eastern edge of the island. Understory of dense purple loosestrife, buttonbush, and pussy willow.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
17	PFO1Ch	PFO1Ch

Overstory of silver maple. Understory of purple loosestrife, arrowhead, cardinal flower, grape, gray dogwood, multiflora rose, cattail, common loosestrife, and buttonbush. Half forested/half emergent.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
18	PFO1Ch	PSS1Fh

The Project NWI map polygon underlying station 18 is classified as PSS1Fh. The field biologist determined that this area was more indicative of wetland classification PF01Ch: Palustrine, Forested, Broad-leaved Deciduous, Seasonally Flooded, Impounded wetland. The vegetative cover description is given as overstory of silver maple and willow. Understory of buttonbush, green ash, arrowhead, purple loosestrife, swamp milkweed (*Asclepias incarnata*), and common cattail (*Typha latifolia*).

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
19	PSS1Fh	PSS1Fh

Wetland area dominated by purple loosestrife with native arrowhead, lizard's tail, buttonbush, and willow being suppressed.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
20	PSS1Fh	PSS1Fh

Overstory of silver maple and willow. Understory of common cattail, arrowhead, gray dogwood, buttonbush, small maple, and small willow being out competed by purple loosestrife. Visited twice - duplicate station position to station 21 (same GPS coordinates).

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
21	PSS1Fh	PSS1Fh

Majority is purple loosestrife outcompeting smartweed (*Persicaria amphibia*), arrowhead, buttonbush, small silver maple, and gray dogwood. Visited twice - duplicate station position to station 20 (same GPS coordinates).

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
22	PFO1Ch	PFO1Ch

Small island. Overstory of silver maple, willow, and elm. Understory of small willow bush, buttonbush, curly dock, arrowhead, American corn mint, and multiflora rose. Purple loosestrife is outcompeting the scrub-shrub component of the wetlands on the east side. Visited twice - duplicate station position to station 23 (same GPS coordinates).

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
23	PFO1Ch	PFO1Ch

Small acreage <1 acre. Overstory of willow and silver maple, surrounded by purple loosestrife, with some cattail, arrowhead, and lily. Purple loosestrife is outcompeting native vegetation. Visited twice - duplicate station position to station 22 (same GPS coordinates).

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
24	PSS1Fh	PSS1Fh

Channel Islands. Purple loosestrife, arrowhead, small willow, smartweed, and swamp loosestrife. Purple loosestrife is outcompeting the scrub-shrub plant community. This station is not immediately adjacent to a Project NWI map feature but is consistent with the underlying wetland feature classification in the general NWI wetland map.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
25	PSS1Fh	PSS1Fh

Channel Islands. Purple loosestrife, arrowhead, small willow, smartweed, and swamp loosestrife. Purple loosestrife is outcompeting the scrub-shrub plant community. This station is not immediately adjacent to a Project NWI map feature but is consistent with the underlying wetland feature classification in the general NWI wetland map.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
26	PFO1Ch	PFO1Ch

Overstory of swamp white oak, basswood, red maple (*Acer rubrum*), small elm. Understory of buttonbush, lizard's tail, small black ash, cutgrass, skunk cabbage (*Symplocarpus foetidus*), and sensitive fern (*Onoclea sensibilis*).

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
27	PFO1Ch	PFO1Ch

Overstory of silver maple, hickory, black oak (*Quercus velutina*) on fringe, and willow, up to 22" DBH. Understory of gray dogwood, cutgrass, buttonbush, and arrowhead.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
28	PFO1Ch	PFO1Ch

Overstory of silver maple, black oak, willow, white oak on the fringe. Small amount of narrowleaf cattail (*Typha angustifolia*). Buttonbush, arrowhead, false nettle, lizard's tail, cutgrass, and small narrowleaf cattail.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
29	PFO1Ch	PFO1Ch

(No field note descriptions for this station)

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
30	PFO1Ch	PFO1Ch

Overstory of silver maple and elm. Understory of cutgrass, arrowhead, elderberry, smartweed, water willow, buttonbush, and false nettle.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
31	PFO1Ch	PFO1Ch

Overstory of silver maple and willow. Understory of arrowhead, purple loosestrife, cutgrass, cardinal flower, and buttonbush.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
32	PFO1Ch	PFO1Ch

Overstory of silver maple, elm, willow, and sycamore. Understory of cottonwood, smartweed, jewelweed (*Impatiens capensis*), red osier dogwood (*Cornus sericea*), buttonbush, gray dogwood, wild tomato (*Solanum habrochaites*), and purple loosestrife.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
33	PFO1Ch	PFO1Ch

(No field note descriptions for this station)

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
34	PFO1Ch	PFO1Ch

Overstory of silver maple, white oak, basswood, and hickory. Understory of black ash, box elder (*Acer negundo*), cardinal flower, false nettle, buttonbush, gray dogwood, cutgrass, arrowhead, lizard's tail, and purple loosestrife.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
35	PFO1Ch	PFO1Ch

Overstory of silver maple and willow. Understory of gray dogwood, buttonbush, swamp loosestrife, arrowhead, lizard's tail, and purple loosestrife.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
36	PFO1C	PFO1C

Scrub-shrub, willow, buttonbush, ash, swamp loosestrife, arrowhead, pickerelweed (*Pontederia cordata*), common cattail, bindweed, peachleaf willow (*Salix amygdaloides*).

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
37	PFO1Ch	NA

Station 37 is a shoreline observation point not adjacent to a Project NWI map or general NWI map feature, but is consistent with the nearest Project NWI map island feature just south of this location.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
38	PFO1C	NA

Overstory of willow, elm, red cedar, and basswood. Understory of buttonbush, lizard's tail, arrowhead, cardinal flower, and cutgrass.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
39	PFO1C	NA

Overstory of silver maple, swamp white oak, and sycamore. Under-story of buttonbush, spicebush *(Lindera benzoin*), false nettle, stag horn fern, arrowhead, and lizard's tail. Station 39 is on the same shoreline about 200 meters north of the nearest Project NWI wetland feature and adjacent to a general NWI wetland feature classified as PFO1Ch, so in this respect does not agree with the NWI map data.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
40	PFO1C	NA

Overstory of swamp white oak and silver maple. Understory of buttonbush, spicebush, cutgrass, water parsnip (*Sium suave*), lizard's tail, and arrowhead. Station 39 is on the same shoreline about 130 meters north of the nearest Project NWI wetland feature and adjacent to a general NWI wetland feature classified as PFO1Ch, so in this respect does not agree with the NWI map data.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
41	PFO1Ch	PFO1Ch

Overstory of chinquapin oak, silver maple, and elm. Understory of buttonbush, sensitive fern, arrowhead, gray dogwood, lizard's tail, and spicebush.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
42	PFO1Ch	PFO1Ch

Overstory of silver maple. Understory of buttonbush, lizard's tail, cardinal flower, and cutgrass.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
43	PSS1Fh	PFO1Ch

A portion of station 43 is not forested due to power line maintenance and residential construction. The field biologist determined that this recent activity combined with general observations makes this area more indicative of a PSS1Fh classification versus the NWI map data PFO1Ch classification. Fringed loosestrife (*Lysimachia ciliata*), purple loosestrife, lizard's tail, buttonbush, and narrowleaf cattail. Vegetative cover at the site was characterized as fringed loosestrife, purple loosestrife, lizard's tail, buttonbush, and narrowleaf cattail, which supports a reclassification to PSS1Fh within the observed area.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
44	PFO1Ah	NA

Overstory of silver maple, mulberry, and American elm (*Ulmus americana*). Understory of lizard's tail, arrowhead, and pickerelweed. Station 44 is not on or adjacent to a Project NWI or general NWI map feature.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
45	PFO1Ch	PFO1C

Station 45 is described as a very narrow strip of muck soil inundated by water. This classification is not consistent with the adjacent significant map feature in both the Project NWI and general NWI maps and nearby stations 46 and 47 classified as PFO1C, suggesting that this is a small distinct area.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
46	PFO1C	PFO1C

Overstory of silver maple, soft maple (*Acer saccharinum*), water willow, and chinquapin oak. Understory of elm saplings, green ash saplings, spicebush, cutgrass, and false nettle.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
47	PFO1C	PFO1C

Downstream from the dam on the junction of Fawn River and St. Joseph River. Overstory of silver maple, chinquapin oak, and elm. Understory of spicebush, green ash saplings, gray dogwood, false nettle, and purple loosestrife.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
48	PFO1C	PEM1C

This is the island in the St. Joseph River downstream of the dam in the tailrace just east of the power canal. The field biologist determined that this feature should be classified as PFO1C (Forested Shrub Wetland) instead of the NWI PEM1C (Freshwater Emergent Wetland) – classification. This change is the most significant modification to the base NWI data from the wetlands survey, eliminating the PEM1C category from the Project NWI wetlands map inventory and adding 1.4 acres to the PFO1C category in the overall wetlands acreage summary table (Table 2). The site was unapproachable to land the boat due to low water and too deep to wade, but was easily observed from the boat. Vegetative cover is described as: overstory of silver maple and cottonwood. Understory of gray dogwood, water willow, arrowhead, and purple loosestrife observed from east shore.

In order to remain consistent with the study approach, an additional five observation check stations (A through E) were created after the field survey in ArcMap by referencing aerial imagery and wetland features in the Project NWI wetlands map that had not been formally field verified. Both field biologists who conducted the wetlands and botanical resources survey confirmed through memory and imagery interpretation that all five added check stations match the underlying NWI classifications.

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
A	PFO1Ch	PFO1Ch

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
B	PFO1Ah	PFO1Ah

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
C	PFO1C	PFO1C

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
D	PFO1Ch	PFO1Ch

Station	Observed Wetlands Classification	Project NWI Wetlands Map Class
E	PSS1Fh	PSS1Fh

8. References

Bailey, RG. 1978. Descriptions of the EcoRegions of the United States. US Department of Agriculture. Forest Service, Intermtn Reg. Ogden, UT. 77pp.

Cowardin, L. M. 1979. Classification of Wetlands and Deepwater Habitats of the United States FWS/OBS-79/31. Washington, DC: U. S. Department of the Interior, U. S. Fish and Wildlife Service. DataUSA.

Federal Energy Regulatory Commission (FERC). 1993a. Environmental Assessment for the Constantine Hydroelectric Project FERC No. 10661. February 24, 1993.

Indiana Michigan Power Company (I&M). 2018. Constantine Hydroelectric Project (FERC No. 10661). Notice of Intent and Pre-Application Document. Federal Energy Regulatory Commission, Washington, D.C. June 4, 2018.

Indiana Michigan Power Company (I&M). 2019. Constantine Hydroelectric Project (FERC No. 10661) Filing of Revised Study Plan for Relicensing Studies. Federal Energy Regulatory Commission, Washington, D.C. March 15, 2019.

Appendix H. Recreation Study

Indiana Michigan Power Company

Constantine Hydroelectric Project (P-10661)

Recreation Study

Prepared for:

Indiana Michigan Power Company

Prepared by:

YOUNG ENERGY SERVICES

2112 Talmage Drive Leland, NC 28451-9340

youngenergyservices.com

January 2020

Table of Contents

BACKGROUND

Indiana Michigan Power Company (I&M), a unit of American Electric Power (AEP), is the Licensee, owner and operator of the run-of-river Constantine Hydroelectric Project (FERC No. 10661) (Project or Constantine Project) located on the St. Joseph River at Constantine, Michigan. The current license for the Project was issued by the Federal Energy Regulatory Commission (FERC or Commission) with an effective date of October 1, 1993. The license term of the Project is thirty years and the expiration date for the license is September 30, 2023. Accordingly, I&M is pursuing a subsequent license for the Project pursuant to the Commission's Integrated Licensing Process (ILP), as described at 18 Code of Federal Regulations (CFR) Part 5.

I&M filed the Notice of Intent (NOI) and Pre-Application Document (PAD) with the Commission on June 4, 2018 to initiate the ILP. The PAD provides a description of the Project and summarizes the existing, relevant, and reasonably available information to assist the Commission, resource agencies, Indian Tribes, non-governmental organizations (NGOs), and other stakeholders in identifying issues, determining information needs, and preparing study requests. In the PAD, I&M stated its intention to conduct a study to assess recreational opportunities and potential improvements at the Project.

The National Environmental Policy Act of 1969 (NEPA), the Commission's regulations, and other applicable statutes require the Commission to independently evaluate the environmental effects of issuing a subsequent license for the Project and to consider reasonable alternatives to relicensing. At this time, the Commission has expressed its intent to prepare an Environmental Assessment (EA) that describes and evaluates the site-specific and cumulative potential effects (if any) of issuing a subsequent license, as well as potential alternatives to relicensing. The EA is supported by a scoping process to identify issues, concerns, and opportunities for resource enhancements associated with the proposed action. Accordingly, the Commission issued Scoping Document 1 (SD1) for the Project on July 25, 2018. SD1 was intended to advise resource agencies, Indian Tribes, NGOs, and other stakeholders as to the proposed scope of the EA and to seek additional information pertinent to the Commission's analysis. One of the resources the FERC determined should be analyzed was the existing public access, recreational facilities, and their ability to meet current and future recreation needs for the Project.

SD1 was followed by Scoping Meetings held August 28 and 29, 2018 in Constantine, Michigan. During these meetings, FERC staff presented information regarding the ILP and details regarding the study scoping process and how to request a relicensing study, including the Commission's study criteria. In addition, FERC staff solicited comments regarding the scope of issues and analyses for the EA. Pursuant to 8 CFR §5.8(d), a public site visit of the Project was

conducted on August 28, 2018. Resource agencies, Indian Tribes, and other interested parties were afforded a 60-day period to request studies and provide comments on the PAD and SD1. The comment period was initiated with the Commission's July 25, 2018 notice and concluded on October 2, 2018.

FERC issued Scoping Document 2 (SD2) on November 13, 2018 to provide information on the proposed action and alternatives, the environmental analysis process FERC staff will follow to prepare the EA, and a revised list of issues to be addressed in the EA. In SD2, FERC again identified the need to assess recreation resources at the Project.

In accordance with 18 CFR §5.11, I&M developed a Proposed Study Plan (PSP) for the Project that was filed with the Commission and made available to stakeholders on November 16, 2018. The purpose of the PSP was to present the studies and study methods proposed by I&M and to address the comments and study requests submitted by resource agencies and other stakeholders. In the PSP, I&M proposed to conduct a Recreation Study to collect information regarding current recreation use levels and the condition of the existing formal and informal recreation facilities in the Project area.

Pursuant to 18 CFR §5.11(e), I&M held a PSP Meeting on December 11, 2018, for the purpose of clarifying the PSP, explaining any initial information gathering needs, and addressing any outstanding issues associated with the PSP. The meeting was held in Lansing, Michigan, and attended by representatives from FERC, the U.S. Fish and Wildlife Service, Michigan Department of Natural Resources, Michigan Department of Environmental Quality, and Young Energy Services (YES). During the PSP Meeting, I&M presented the basis for the studies as described in the PSP.

Resource agencies and stakeholders were afforded 90 days from the date of the PSP filing (i.e., until February 14, 2018) to provide comments on the PSP or to request additional studies. In developing the Revised Study Plan (RSP) for the Project, I&M carefully evaluated and considered agency and stakeholder comments and study requests filed in response to the PAD, SD1, SD2, PSP and discussed during the PSP Meeting. In accordance with 18 CFR § 5.13, I&M filed the RSP with the Commission on March 15, 2019. On April 9, 2019, the Commission issued a Study Plan Determination for the Project. The SPD approved I&M's proposed Recreation Study without modification.

This Recreation Study has been prepared under the requirements of the April 9, 2019 Study Plan Determination by YES, the subcontractor to perform the work.

1.0 STUDY AREA

The study area includes the Project boundary and recreational facilities adjacent to the Project boundary. The Project boundary, as shown on the Exhibit G drawings that are a part of the Project's existing license, extends upstream from just below the faces of the Project powerhouse and spillway located in the Village of Constantine, Michigan off N. Washington Road to Constantine Road in Lockport Township essentially following the limits of the Project reservoir at normal pool elevation 789.2 ft. NGVD. At the normal pool elevation, the reservoir for the Project has a surface area of 608 acres and the associated shoreline encompasses approximately 12 miles. For those recreation facilities provided and maintained by I&M under the requirements of the existing Project license, the Project boundary was extended under Order Approving Revised Exhibit G Drawing issued September 21, 1999 by FERC to include those areas.

Several recreational facilities for the Project have been provided by the Licensee in accordance with Articles 411 and 412 of the existing license as well as Order Approving Recreational Facilities issued July 25, 1995 and Order Approving Building Removal Plan Including Tailwater Fishing Facility issued April 5, 1995. The facilities provided by I&M and identified as Project recreation sites provide the public free access to the Project reservoir as well as to the St. Joseph River below the Project's powerhouse and spillway. Those facilities include: (1) a boat launch on the Project reservoir; (2) a reservoir fishing access site; (3) a tailwater fishing access platform; and (4) a canoe portage around the east abutment of the Project spillway. Exhibits R-1 through R-3 of the Project license (see Appendix E) present as-built drawings of the Project Recreation Facilities. Each of the described facilities is located within the Project boundary and is operated and maintained by I&M.

In addition to the recreational facilities provided by I&M, there are community parks outside of the Project boundary identified as Non-Project recreation sites that provide access to the St. Joseph River below the Project spillway. The community parks that are provided, maintained, and operated by the Village of Constantine (Village) are identified as Shelby Park and Riverview Park. Both are located along the east side of the St. Joseph within the Village and provide public access to the river at no cost.

The American Legion (Post 223) maintains a boat launch upstream of the Project spillway along the western shoreline of the Project reservoir with access directly off U.S. Business Route 131. This location is also identified as a Non-Project recreation site. Use of the facility is limited to American Legion members. Each summer, hydroplane and runabout boat races are held by the U.S. Title Series Championship Racing Association. Boats in the competition are launched from the American Legion site.

Of the 12 miles of Project reservoir shoreline, approximately 2.5% is safely accessible to the general public by land travel without trespassing on private property. The majority of the area abutting the Project reservoir consists of agricultural lands with limited land within the Project boundary. Private development along the reservoir is limited in scope.

2.0 RECREATION STUDY OBJECTIVES AND METHODOLOGIES

The objectives for the Recreation Study include collecting information regarding current recreation use levels and the condition of the existing recreation facilities in the Project area. This information is gathered in order to: (1) characterize current recreation use of the Project area; (2) estimate future demand for public recreation use at the Project; (3) assess the condition of the existing recreation facilities in the Project area and identify any need for improvements; and (4) evaluate potential impacts of the Project on existing Project recreation facilities and improvements. YES staff performing necessary work included Dr. James Lewis, Ph.D. and Frank Simms, PE. Both have extensive experience in recreational studies related to licensing and relicensing of hydroelectric projects and are familiar with the Constantine Project and associated recreation facilities.

2.1 Current Use of Recreation Facilities

Visitor use data at the Project and Non-Project recreation sites was collected by Dr. Lewis and his assistant including in-person surveys, field reconnaissance, and photo documentation. Field reconnaissance and in-person surveys were conducted during the prime recreation season from May 2019 through September 2019. Surveys were performed at the sites in compliance with the Visitor Use Survey Schedule contained in Section 12.6.2 of the RSP which is presented below in Table 2.1.1.

Table 2.1.1: Survey and Reconnaissance Schedule	
May	One weekend day (Memorial Day weekend)
	One randomly selected weekday
June	One weekend day to coincide with the Father's Day boat race
	One randomly selected weekday
July	One weekend day
	One randomly selected weekday
August	One weekend day
	One randomly selected weekend day
September	One weekend day (Labor Day weekend)
	One randomly selected weekday

Regarding the referenced Father's Day boat race, the Michigan Hydroplane Racing Association typically holds an annual boat race on the St. Joseph River at Constantine on or about Father's Day.

During their visits to the recreation sites, Dr. Lewis and his assistant rotated between the recreation sites spending a minimum of half an hour at each conducting interviews, making observations of ongoing activities, and recording the number of vehicles in parking areas associated with each facility. In addition, general information regarding date, time and weather conditions was recorded. Individuals interviewed at the recreation sites were asked to complete a questionnaire designed to collect certain information including:

- General user information
- Resident/visitor
- Purpose and duration of visit
- Distance traveled
- Day use/overnight lodging
- History of visiting the site or area
- Types of recreational activities participated in or planned during visit
- Other recreational sites visited or intended to be visited during their visit
- General satisfaction with recreational opportunities and facilities including recommendations for improvements
- Effects of Project operations on recreation use and access
- Accessibility of facilities

Each of the individuals approached to complete a survey on site were presented the option of completing the survey online. Information on how to access the online questionnaire was provided by Dr. Lewis and his assistant. In addition, the same information in the form of a windshield flyer was placed on each vehicle parked in areas associated with the recreational facilities. A total of fifty flyers were placed on vehicle windshields during the study period. I&M also posted signs at each recreational site directing those desiring to complete a questionnaire online. The questionnaire is contained in Appendix B of this study as is a copy of the referenced windshield flyer.

The actual dates that field reconnaissance took place in 2019 were as follows:

- May 22 and 27 (Memorial Day)
- June 15, 16 (Father's Day) and 28
- July 1 and 21 (Boat Race)
- August 15 and 25
- September 27 and 29

Twenty-one site surveys were completed in the field. In addition, seven surveys were completed online. The results of the surveys are summarized in Appendix D. From the information obtained, individuals utilizing the formal Project and Non-Project recreation facilities are day visitors primarily coming from within 30 miles of the Constantine Project. This is true for holidays, weekend days, and typical weekdays. There were a limited number of individuals who traveled extended distances. For example, one individual that completed a survey was from the Upper Peninsula in Michigan, therefore travelling approximately 600 miles each way to enjoy the recreation opportunities afforded at the Project. Additionally, other individuals surveyed indicated that they had travelled approximately 200 miles and 150 miles respectively.

Based upon the results of the surveys along with observations made in the field, the majority of the individuals utilizing the recreation sites are individual users who are fishing. Many of those fish on the reservoir. They come early in the morning, launch from the Constantine Project boat launch, and spend the day on the reservoir. The Tailwater Fishing Access provided by I&M immediately downstream of the Project powerhouse is also a popular site. There was not a significant amount of canoeing or kayaking observed. Users of the recreation sites are predominantly males with an average age of fifty years according to the survey information collected at the sites and online.

Visitors were typically noted recreating during days Dr. Lewis and his assistant visited the Project. However, there were scheduled field observation days during which no one was observed visiting any of the recreation sites. In a number of those instances, this was due weather conditions such as rain, fog, and/or temperatures. This was the case for Labor Day which started out with light rain and fog.

The Project-related facilities are utilized year-round with most use occurring during the prime recreation months of May through September. Respondents to the surveys noted that most utilized more than one recreation site during their visits. Observations made by Dr. Lewis are included in the Monthly Progress Reports included in Appendix F.

In 2019, two boat races were held at the American Legion site. The Father's Day race referenced earlier took place that weekend. Attendance was sparse due to weather conditions. On July 21st, the U.S. Title Series Boat Races occurred attracting a large number of boat racing fans. Weather conditions were favorable, and the event was well-attended.

The boat races at the Project typically attract a large number of visitors to the Constantine area. Many of the visitors are local residents but, as evidenced by the various out-of-state license plates, there are a significant number of individuals who travel extensively to enjoy the races. During the races in July, license plates from the below listed states were noticed:

- Florida (5)
- New York (1)
- Indiana (3)

- Iowa (10)
- Illinois (6)
- Connecticut (1)
- Ohio (1)
- Wisconsin (1)
- South Carolina (1)

In addition to the number of license plates from states outside of Michigan listed above, thirty vehicles with license plates from Michigan were observed.

On February 19, 2015 I&M filed the "Licensed Hydropower Development Recreation Report – FERC Form 80" (FERC Form 80 Report) for the Constantine Hydroelectric Project. The report presented detailed information regarding the usage of the Project recreation facilities provided and operated by I&M including capacity utilization. From that report, the following estimates of capacity utilization are provided:

- Boat Launch Areas 48%
- Portages 5%
- Tailwater Fishing 44%
- Reservoir Fishing 9%
- Picnic Areas 6%

Estimates of capacity utilization for the boat launch areas represent an average of the Project reservoir boat launch and American Legion boat launch. The individual capacity utilization for the Project boat launch was estimated at 46% while capacity utilization estimates for the American Legion boat launch were approximately 50%.

The conclusion of the FERC Form 80 Report was that the use of each of the individual Project recreation sites was relatively low with less than 20,000 recreation days per year and that the existing Project facilities provide sufficient access.

The results of the site surveys along with the observations made during field visits completed for this study appear to verify the findings of the FERC Form 80 Report. Activity observed at the Project facilities demonstrate that Project recreation facilities provide sufficient access to the Project reservoir and the St. Joseph River.

Usage of the Non-Project recreation facilities provided by the Village of Constantine noted during the field surveys show that those facilities also provide adequate access to the public for recreation purposes. During the site surveys at no time was full use of the facilities observed. As with the Project facilities, the Non-Project facilities had little to no usage during the visits by YES staff. Comments provided for the surveys, both in the field and online, note public satisfaction with the Project and Non-Project facilities.

The very low usage of the canoe portage for the Project identified in the FERC Form 80 Report was verified not only by field observations and survey results but also through conversation with the operators of Liquid Therapy Canoe and Kayak Rental located in nearby Three Rivers, Michigan (Liquid Therapy). Liquid Therapy rents an average of 10 canoes/kayaks daily during the recreation season. The public boat launch adjacent to the facilities owned by Liquid Therapy provides access to the St. Joseph River just upstream of the Project boundary for the Constantine Project. The facilities available to the public at that location include a concrete ramp and ample parking. The travel time from the canoe and kayak livery to the spillway powerhouse for the Constantine Project is approximately four hours. The operators for Liquid Theory note that most rentals from their livery travel approximately two hours to the take-out provided by St. Joseph County at Withers Road, which is near the mid-point for the Constantine Project reservoir. The access at Withers Road consists of wooden steps that allow canoeists/kayakers to get out of the water to the parking area along the road.

Those who do elect to continue further downstream take their canoes or kayaks out of the water at the boat launch provided by I&M on the reservoir at the Constantine Project. This is also true for canoeists or kayakers other than those who rent from Liquid Therapy. The overall result is that canoeing/kayaking beyond the spillway for the Constantine Project is very infrequent; thus the portage is not utilized extensively.

2.2 Future Use of Recreation Facilities

As part of the development of the St. Joseph County, Michigan Parks and Recreation Five-Year Plan 2019-2023 (PRFYP), input was obtained from the general public regarding main recreation interests of those visiting parks in St. Joseph County. On the top of the list was running/walking/hiking followed by canoeing/kayaking. Within the Michigan Statewide Comprehensive Outdoor Recreation Plan 2018-2022 (SCORP), those same recreational preferences are also high on the list of top outdoor recreation activities.

According to the St. Joseph County PRFYP, St. Joseph County (County) has more navigable waterways than any other county in the State of Michigan. The goal of St. Joseph County Parks and Recreation is to highlight those natural resources as a means of attracting people to the County along with promoting and funding development of water-based recreation with facilities that complement canoe trails with access points. The State of Michigan in its 2018-2022 SCORP also emphasizes the importance of water based-recreation by pointing out the need to ensure access to water-based recreation through the development of water trails and increasing access for canoes, kayaking, and fishing.

The above described goals are further emphasized by the 2015 completion of the Water Trail Master Plan for St. Joseph County. Through a public input process and extensive resource inventory study, specific needs to meet those goals were identified and include:

- Appropriate distribution of access points

- Hierarchy of services and quality of access
- Water trail route priorities and types
- Consistent signage and promotion

Regarding the appropriate distribution of access points, it is stated within the Water Trail Master Plan that there should be a second access point one to two hours downstream of any canoe/kayak put-in. In addition, reference is made to a maximum spacing of four hours between sites having amenities such as restrooms and parking. When including the access at Withers Road, the current distribution of access points from the boat ramp in Three Rivers through the Constantine Project meets the described goals.

In 2016, The Village of Constantine prepared its five-year Parks and Recreation Plan. In that plan, the Village identifies the need for restroom facilities at I&Ms Tailwater Fishing Access. The need for restroom facilities at the Tailwater Fishing Access was stated numerous times by those interviewed. As with the master plans described for St. Joseph County and the State of Michigan, the importance of water-based recreation in the area is emphasized. As part of its plans, the Village identifies the desire to extend the existing boardwalk at Riverview Park onto I&M property upstream of the park and containing the portage around the spillway for the Constantine Project. It is stated in the plan that the Village understands that such an extension would require an agreement with I&M to utilize the property.

Although the recreation facilities at and near the Constantine Project are utilized by individuals from various locations outside the Village of Constantine and St. Joseph County, it is clear that the majority of the use comes from local residents. It is also clearly understood that participation in outdoor recreation activities has grown over the past few years and is anticipated to continue to grow. Most of that growth would be expected to be related to population growth for the Village and County.

According to census information, populations for the Village and County have been stagnant if not somewhat negative over the last 10 years. The population for St. Joseph County for the period of 2010 through 2017 is estimated to have decreased from 61,283 to 60,819 (approximately -0.8%) while the Village of Constantine's population is estimated to have gone down from 2,076 in 2010 2,047 in 2016 (approx. -1.4%). Large gains in growth are not currently anticipated for the future. The completion of the U.S. Route 131 bypass, which redirected traffic from going through the Village of Constantine, has apparently contributed to recreationists bypassing the Village. This is according to comments provided during the field observations. With these considerations, it is believed that the existing Project and Non-Project recreation sites referenced in this study should meet the recreation needs for the Project now and into the future.

As noted earlier, private development along the Project reservoir is limited. Therefore, private use does not contribute significantly to recreation activity at the Project and is not expected to do so in the future.

2.3 Recreation Facility Inventory and Condition Assessments

Field inventories and condition assessments were made of recreation facilities within and adjacent to the Project boundary in accordance with Section 12.6.1 of the Revised Study Plan for the Constantine Hydroelectric Project filed March 15, 2019 by I&M and approved by in the SPD for the Constantine Project issued by FERC on April 9, 2019. This includes those Project Recreation Facilities provided and maintained by I&M and the Non-Project Recreation Facilities provided by others. Information recorded includes:

- A description of the type and location of existing recreation facilities.
- The type of recreation provided.
- Length and footing materials of any trails.
- Existing facilities, signage, and sanitation.
- The type of vehicular access and parking (if any).
- Suitability of facilities to provide recreational opportunities and access for persons with disabilities.
- Photographic documentation of recreation facilities.
- Qualitative assessments of the condition of the recreation facilities.

The type, location, and condition of the existing recreation facilities were noted during the field reconnaissance that occurred on July 16 and 17, 2019 as well as during the days that survey information was gathered as described in Section 2.1 of this study. Qualitative assessments made of the Project recreation amenities were recorded on the Facilities and Condition Forms provided in Appendix C of this report.

Utilizing the Facilities and Condition Form, the recreation amenities were rated using the following criteria: (N) Needs replacement; (R) Needs repair; (M) Needs maintenance; and (G) Good condition. In each case, an explanation of the rating was provided. Field personnel for the qualitative assessments made included Dr. Lewis and Mr. Simms, who are familiar with the Project recreation facilities. Photographs of the recreation facilities taken during the field reconnaissance are contained in Appendix C of this report as well as in the monthly progress reports provided in Appendix F.

The following subsection summarizes the recreation amenities inventory and condition assessments for the Project Recreation Facilities.

2.3.1 Project Recreation Facilities

2.3.1.1 Tailwater Fishing Access

The tailwater fishing platform is located immediately downstream of the Project powerhouse along the west shoreline of the St. Joseph River. It is a wooden structure that is ramped to allow access for the general public as well as individuals with special needs. Handrails are provided along the access ramps which have a maximum slope of less than five percent.

Approximately 45 lineal feet of the platform is available for fishing. Handrails are provided at two heights. Four sections of the handrails have a height of 42 inches to support individuals who stand and fish. Three sections have a height of 34 inches to allow individuals to fish while sitting including while in a wheelchair. The elevation of the wood deck from which fishing takes place is approximately 4.75 feet above the normal tailwater elevation of 771.5 feet NGVD. Between each handrail section, a vertical clear space of 6.5 inches is provided so that fish caught can be brought to the individual catching the fish without having to raise it above the handrail.

Near the tailwater fishing platform is a paved parking area that can accommodate eight vehicles. The parking area is within the Village of Constantine's Rotary Park maintained by the Village. Individuals parking in the provided area need to traverse a distance of approximately 200 feet to the fishing platform on a paved sidewalk along U.S Business Route 131 which connects to a 42 inch-wide paved asphalt walkway. The asphalt walkway has a maximum slope of five percent. Exhibits R-2 and R-3 of the Project License are provided in Appendix E and present details related to the tailwater fishing platform.

The Tailwater Fishing Platform is in good condition. The platform appears to be sound and requiring just normal maintenance. The associated grounds are well maintained with the grass mowed and nearly no litter. During the July 16 and 17 site visit, it was noticed that the light on the powerhouse just above the platform was damaged and not working. It should be replaced or repaired. In addition, the asphalt ramp to the platform should be resurfaced and the contact point at the platform repaired to eliminate the gap between the surface of the paved path and the platform.

There are no trash receptacles. They were provided earlier when the platform was constructed. However, the trash receptacles actually attracted more household trash and litter than the current situation. Individuals surveyed about the lack of trash receptacles stated that they understood the reasons for not providing them and believed that the cleanliness of the site improved after they were removed.

Signage providing direction to the parking area needs to be improved. Individuals traveling north on U.S. Business Route 131 cannot see the directional sign to the parking area since it is obscured by the information sign placed in front of it by the Village. Signs required by the FERC giving notice to the Project number and where additional information regarding recreation opportunities may be found are prominently displayed and visible to the public. The safety sign

at the head of the asphalt ramp to the platform has aged and is faded. Replacement of that sign is suggested.

The surface of the parking area at Rotary Park is in good condition as is the surrounding grounds. However, there is no sign designating a parking space for handicap use. A designated parking slot should be provided and signed appropriately. One item raised by the public utilizing the tailwater fishing platform is the lack of sanitary facilities. The nearest public facility is the porta-john provided by I&M approximately one-third of a mile from the tailwater fishing platform at I&M's reservoir boat launch.

2.3.1.2 Reservoir Boat Launch

The reservoir boat launch provided, operated, and maintained by I&M is located adjacent to the west abutment for the Project spillway at the intersection of Garden Street and Race Street in the Village of Constantine. Facilities provided include: (1) 15 foot-wide concrete boat ramp with a slope of 13%; (2) paved parking providing spaces for 10 vehicles as well as four spaces for vehicles with trailers; (3) floating platform approximately 24.25 feet long and 12.33 feet wide allowing for access to boats utilizing the adjacent boat ramp and for reservoir fishing; (4) ramp/access bridge from the parking area to the floating platform having a maximum slope of 8%; and (5) ADA-accessible portable porta-john. The deck for the floating platform is 22 inches above the surface elevation for the Project reservoir. To allow access to boats utilizing the boat ramp, the adjacent side of the platform is open. The remaining three sides of the floating platform have handrails that are set at different heights and separated by 9-inch gaps to allow for fishing by those with special needs as well as others. Details for the boat launch are shown in Exhibits R-1 and R-2 provided in Appendix E.

The boat launch provided by I&M on the Project reservoir is in good condition requiring normal maintenance and some minor repairs. The grounds and parking area are well maintained. During the July 16 and 17 inventory, it was noted that sections of the privacy fencing adjacent to the entrance to the parking area have failed or were in need of repair or replacement. Since that time, the fencing has been replaced. Within the parking area, there are no parking spaces designated for handicap use only. Such designation should be provided adjacent to the boat ramp.

Other maintenance that should be considered includes trimming vegetation that was impeding access to the bridge connecting the parking area to the floating platform adjacent to the boat ramp. Vegetation blocking view of the safety warning site adjacent to the boat ramp was also observed. On the floating platform, one section of handrail (third from the upstream end) was loose and needed to be tightened. In addition, the bumpers along the open portion of the floating platform need to be replaced since some sections are gone while those remaining are in poor condition. One survey respondent suggested that bank fishing opportunities be expanded at the boat launch area. The amount of property owned by I&M along the reservoir constrains the length of shoreline available for bank fishing. Therefore, this is not a recommendation of this study.

2.3.1.3 Reservoir Fishing Access and Canoe Portage

Located at the east abutment area for the Project spillway is a take-out for individuals canoeing or kayaking the Project reservoir. From the take-out, recreationists can proceed to the canoe portage steps that provide a route for portaging down the east abutment. Parallel to the steps is a wood trough that those handling kayaks or canoes can use to assist with traversing the abutment embankment. The steps are constructed of a wood frame with compacted stone fill. There are a total of 19 steps each having a width of six feet, a depth of 2.5 feet, and a height of five inches. At the end of the steps is a trail with a crushed stone surface averaging 1.5 feet in width that follows along the St. Joseph River and leads to the portage put-in located approximately 300 feet downstream of the Project spillway. The total length of the portage from take-out to put-in is 560 feet.

Adjacent to the portage take-out, the abutment embankment is open to the public allowing for bank fishing at the reservoir. In this area, an ADA-accessible porta-john and picnic table is provided. There is no parking area available at the portage/reservoir bank fishing site. Individuals can park vehicles in the vicinity of the intersection of nearby Hull Street and Wells Street. A locked gate closes the area off to vehicle access but does allow for the public to access the area by foot. Approximately three vehicles can utilize the available street parking area. The distance from the street parking area to the bank fishing area is approximately 600 feet.

The canoe portage is in poor condition and needs repairs as well as improved maintenance. A portion of the take-out for the canoe portage along the Project reservoir is covered by vegetation which needs to be cleared to allow unobstructed removal of canoes and kayaks from the reservoir. There is no signage upstream of the portage take-out directing individuals to where they can get of the reservoir surface to bypass the Project spillway. In addition, once out of the water there is no signage provided to direct recreationists to the portage trail. Therefore, signage improvements are recommended.

Along the spillway abutment area, a handicap accessible picnic table and porta-john are provided. The grounds in this area are well-maintained and kept clear of debris and litter. An informational sign regarding the Project facilities and capabilities is provided at the upper end of the stairs leading down the embankment to the portage path. The sign has faded and needs updating or replacement.

The stairs leading down the embankment are in good condition but do require some minor repair. In particular, the compacted stone fill has settled and needs to be replenished to bring the steps up to original level. The trail below the steps is in very poor condition and needs significant work.

Comments received regarding the canoe portage highlight concerns that the portage trail is very close to the river and individuals utilizing the portage for canoeing or kayaking can enter the established safety zone downstream of the Project spillway. Signs stating that the portage put-

in is approximately 300 feet downstream of the spillway and that entering the river closer than that point presents a safety hazard could be beneficial.

Vegetation overhanging the trail should be removed in order to allow unimpeded access along the trail. Additionally, the trail should be widened, and a crushed stone walking surface considered. At the put-in downstream of the Project spillway, improvements should be made to provide those utilizing the put-in a stable area to put their canoes/kayaks into the St. Joseph River to continue downstream. A sign noting the location of the put-in should also be provided.

2.3.2 Non-Project Recreation Facilities

2.3.2.1 Riverview Park

Riverview Park is a community park located along the east side of the St. Joseph River extending downstream of the Project spillway from the canoe portage put-in. There are two distinct areas at Riverview Park which are connected by a raised boardwalk constructed of wood. The most upstream area includes: (1) parking for six vehicles of which one is designated for handicap use; (2) a covered picnic area; (3) a playground; (4) park benches; and (5) a porta-john. Parking is also available along E. Water Street. Facilities provided at the most downstream area include: (1) a concrete single lane boat launch; (2) a floating platform to allow access to boats utilizing the adjacent boat ramp as well as for fishing; (3) tables with seats that are ADA acceptable; and (4) parking for six to eight vehicles as well as three to four vehicles with trailers.

Riverview Park is a well-maintained recreation site. The grounds are well-kept with no noticeable litter, grasses cut, and facilities maintained in good condition. High water in 2018 caused significant damage to the boardwalk connecting both areas of the park, making it impossible to utilize. The Village is planning to repair and replace the damaged portions of the boardwalk as funds become available. Use of the other facilities provided at Riverview Park is not impeded by not having the boardwalk available. The floating access platform adjacent to the boat ramp does tend to move slightly. The Village may want to consider improving the security of the platform. Improvements to the banks at the boat launch were made after the July 16 and 17 inventories and condition assessments.

2.3.2.2 Shelby Park

At the northeast corner of the intersection of N. Washington Street and E. Water Street in the Village of Constantine is Shelby Park, a community park approximately one acre in area and abutting the shoreline for the St. Joseph River directly across from the powerhouse for the Constantine Hydroelectric Project. Facilities at the park consist primarily of paved walkways, benches, a covered gazebo sitting area, and tables with attached seating. The tables and seats are accessible to those with special needs.

Along the St. Joseph River, handrails are provided to allow fishing from a concrete platform approximately 135 feet in length. The handrail sections are set at different heights and separated allowing visitors including those with special needs to sit while fishing.

The facilities at Shelby Park are in very good condition. One feature noticed at Shelby Park and the other Village parks is the provision of signs identifying different types of trees.

2.3.2.3 Rotary Park

As described previously for the Tailwater Fishing Access provided by I&M, Rotary Park is a community park that provides parking for that facility. At one time, the park had a playground area that was removed. There are no other facilities at Rotary Park.

As with the other Village parks, the condition of Rotary Park is very good. As noted for I&M's Tailwater Fishing Access, one of the parking spaces should be designated as available for handicap use only and appropriate signage provided. Rotary Park could also be considered as a potential location for a porta-john or other sanitary facility to accommodate individuals utilizing the Tailwater Fishing Access if deemed necessary.

2.3.2.4 American Legion Boat Launch

Approximately one-quarter mile upstream of the Project spillway along the western shoreline of the Project reservoir is a boat launch which is owned and operated by American Legion Post 223. Individuals utilizing the boat launch, consisting of a concrete boat ramp and movable access platform, include members of the Legion and guests. There is also a clubhouse for members. The shoreline is open to the reservoir allowing for fishing by members. The American Legion Boat Launch is used as the access point for boats participating in the hydroplane and runabout boat races held annually at the American Legion. There is extensive parking provided for members and guests during races.

The facilities at the American Legion Boat Launch are kept in very good condition.

2.4 Potential Impacts of the Project on Existing Project Recreation Facilities and Improvements

The results of the Recreation Study indicate that the existing recreation facilities, both Project and Non-Project, meet the current and foreseeable future recreation needs of the public. The facilities are mostly well maintained and are in line with the goals and objectives of the recreation plans for the State of Michigan, St. Joseph County, and the Village of Constantine. Therefore, other than improvements to the canoe portage trail as discussed in Section 2.3.1.3 and maintenance of the existing recreation facilities, there are no changes and/or additions suggested. There are no anticipated changes to Project operations or facilities that would have impacts on existing Project recreation facilities and proposed improvements.

In the 2016 Village of Constantine Parks & Recreation Plan, the Village identifies the goal and objective to extend the existing boardwalk at the east end of Riverview Park. The extension would be constructed on property owned by I&M and could potentially connect with the existing canoe portage trail. The extension of the boardwalk should not be a requirement of the new license for the Constantine Hydroelectric Project. However, I&M may want to consider a cooperative effort with the Village of Constantine if approached in the future.

Under the requirements of the current license for the Project, I&M was required to file in accordance with 18 C.F.R. § 8.11 a recreation report every six years that provided an update on recreation facilities at that project and an assessment of whether the existing facilities would meet the recreation needs of the Project for the following six years. The report was to be prepared in consultation with the appropriate agencies, local governments, and non-governmental organizations (NGOs). The FERC order issued December 12, 2018 eliminated the need for the preparation and filing of the recreation report required under 18 C.F.R. § 18.11 for the Constantine Project. Recreation needs at hydroelectric projects change over time since they are subject to changes in population, the types of recreation desired, along with other reasons. The reports were an effective tool in being able to determine the need for improvements to recreation facilities at Projects as well as the elimination of facilities that were no longer effective in meeting the recreation needs for the Project area. They also provided a mechanism for Project licensees to keep in touch with the recreation needs by consulting with the appropriate agencies, local governments, and NGOs. I&M has a good working relationship with the Village of Constantine and St. Joseph County. That working relationship should be maintained including keeping all parties apprised of changes in recreation needs at the Constantine Hydroelectric Project in the absence of the previously required recreation reports.

3.0 SUMMARY

The existing recreation facilities, both Project and Non-Project, are well maintained and utilized by the public. Overall, the public is pleased with the recreation facilities provided by I&M, St. Joseph County, and the Village of Constantine. The cooperative effort of I&M and local governments has resulted in recreation facilities that not only meet the goals and objectives of the relevant recreation plans but contribute to the economies of the area. This is evidenced by individuals from outside of St. Joseph County visiting to boat on the Constantine Project Reservoir, canoe/kayak the St. Joseph River, and fish the river and reservoir. According to the comments received, the existing facilities contribute to the enjoyment of all participating in those activities.

The primary recreation activities for the Constantine Project observed are fishing by boat, bank fishing, fishing from the Tailwater Fishing Access platform located at the face of the

powerhouse, and pleasure boating. Results from the site and online surveys, provided below in Table 3.1, substantiate those observations.

Table 3.1: Activities Participated in by Survey Respondents

	Bank Fishing	Boat Fishing	Pleasure Boating	Canoe/ Kayak	Picnic	Swim	Sight-Seeing	Hunt	View Wildlife	Other
Number	5	5	6	1	0	0	1	0	0	0
Percent	27.8	27.8	33.3	5.6	0	0	5.6	0	0	0

Those surveyed indicated that the overall experience had recreating at the Constantine Project was totally acceptable. Table 3.2 presents the results of the surveys relative to rating the overall experience of the respondents.

Table 3.2: Overall Experience of Survey Respondents

	Totally Unacceptable	Unacceptable	Neutral	Acceptable	Totally Acceptable
Safety (Number/Percent)			1 (4.8%)		20 (95.2%)
Enjoyment (Number/Percent)				1 (4.8%)	20 (95.2%)
Crowding (Number/Percent)	1			2 (10.5%)	17 (89.5%)
Overall Experience (Number/Percent)				1 (5.9%)	16 (94.1%)

Based upon the results of the observations made by this study, there are no additions or reductions to Project recreation facilities recommended. For each of the existing Project recreation sites, suggested improvements are noted in Section 2.3.1. These primarily reflect the need for signage improvements, identifying slots at the parking areas as being for use by handicapped individuals only, and improvements to vegetation management. Of the Project recreation sites, the canoe portage below the Project spillway requires the most work. As noted in Section 2.3.1, the portage trail in particular needs to be improved including signage, the walking surface, and trail width.

4.0 REFERENCES

Edgewater Resources. St. Joseph County, Michigan Water Trail Master Plan. St. Joseph County Parks and Recreation. February 26, 2015.

FERC 1993. *Order Issuing License (Minor).* Federal Energy Regulatory Commission. October 20, 1993.

FERC 1995. *Order Approving Recreational Facilities.* Federal Energy Regulatory Commission. July 25, 1995.

FERC 1995[2]. *Order Approving Building Removal Plan Including Tailwater Fishing Facility.* Federal Energy Regulatory Commission. August 5, 1995.

FERC 1999. *Order Approving Revised Exhibit G Drawing.* Federal Energy Regulatory Commission. September 21, 1999.

FERC 2018. *Transcript for August 28, 2018 Scoping Meeting.* Federal Energy Regulatory Commission. August 28, 2018.

FERC 2018[2]. . *Transcript for August 29, 2018 Scoping Meeting.* Federal Energy Regulatory Commission. August 29, 2018.

FERC 2019. *Study Plan Determination for Constantine Hydroelectric Project.* Federal Energy Regulatory Commission. April 9, 2019.

Indiana Michigan Power Company (I&M). 2018. Pre-Application Document for Constantine Hydroelectric Project FERC No. 10661. June 4, 2018.

MDNR. Michigan Department of Natural Resources. Comments on FERC Scoping Document. October 2, 2018.

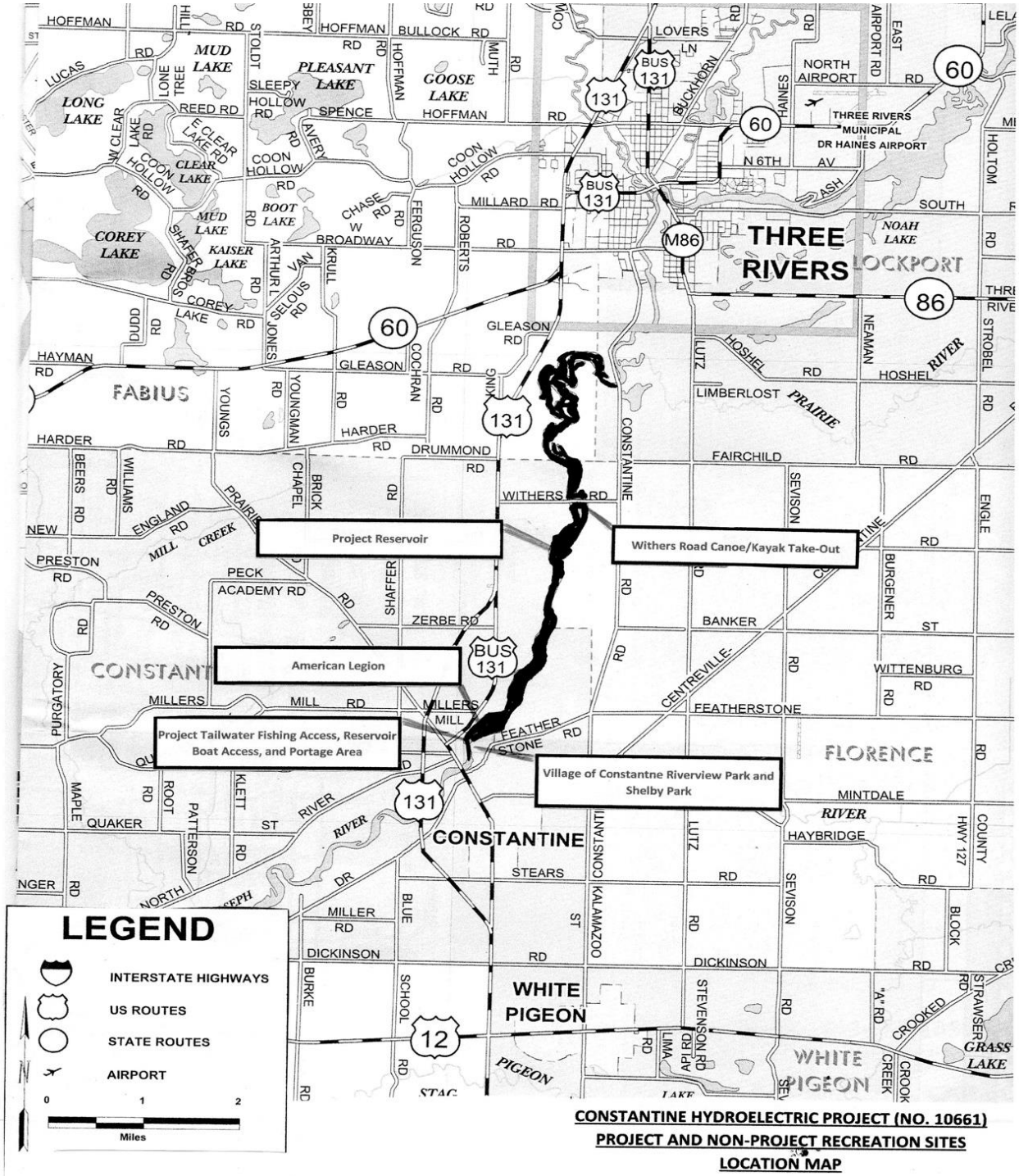
PRFYP. Parks and Recreation Five-Year Plan 2019-2023. St. Joseph County Parks and Recreation Commission.

SCORP. Michigan Statewide Comprehensive Outdoor Recreation Plan 2018 – 2022. Michigan Department of Natural Resources. August 31, 2017.

USEPA. United States Environmental Protection Agency. EPA's Detailed Comments: Constantine Hydroelectric Project Scoping/Early Coordination (pre-EA). September 28, 2018.

Village of Constantine Parks and Recreation Board. Village of Constantine Park & Recreation Plan. January 2016.

Young Energy Services, LLC, et al. Indiana Michigan Power Company Constantine Hydroelectric Project (P-10661) Licensed Hydropower Development Recreation Report FERC Form 80. February 2015.



CONSTANTINE HYDROELECTRIC PROJECT (NO. 10661)
PROJECT AND NON-PROJECT RECREATION SITES
LOCATION MAP

Location Map of Recreation Areas in Vicinity of Constantine Hydroelectric Project

(Note: Map from Constantine Hydroelectric Project Pre-Application Document – Figure 5.8.11)

CONSTANTINE HYDROELECTRIC PROJECT (FERC NO. 10661)
RECREATION STUDY

Appendix –A: Facility Inventory and Condition Assessment Form

Content:

- **Blank Recreation Facility Inventory and Condition Assessment Form**

RECREATION FACILITY INVENTORY AND CONDITION ASSESSMENT
Constantine Hydroelectric Project (FERC No. 10661)

Location:	
Date:	**Surveyor:**
Photo Number(s):	

Type of Amenity	#	ADA	Condition	Notes
Boat Launch Ramp/Lane			N / R / M / G	
Fishing Platform			N / R / M / G	
Portage (put-in/take-out)			N / R / M / G	
Portage Trail/Walking Trail (include length and footing materials)			N / R / M / G	
Picnic Table			N / R / M / G	
Restroom			N / R / M / G	
Trash Receptacles			N / R / M / G	
Other			N / R / M / G	

PARKING	Total Spaces: _____ Standard: _____ ADA: _____ Double (trailer): _____ Other: _____	Condition
	Surface Type: *Asphalt* *Concrete* *Gravel* *Other:*_____	N / R / M / G

Signs	#	Size	Material	Condition	Comments
FERC Project			wood / metal / other	N / R / M / G	
Facility ID			wood / metal / other	N / R / M / G	
Regulations			wood / metal / other	N / R / M / G	
Directional			wood / metal / other	N / R / M / G	
Interpretive			wood / metal / other	N / R / M / G	

N - Needs replacement (broken or missing components, or non-functional)
R - Needs repair (structural damage or otherwise in obvious disrepair)
M - Needs maintenance (ongoing maintenance issue, primarily cleaning)
G - Good condition (functional and well-maintained)
If a facility is given a rating of "N", "R", or "M", provide specific details.

ADDITIONAL COMMENTS/NOTES:
Note the age of the facilities (if known) as well as any signs of overuse.

Page 1 of 1

CONSTANTINE HYDROELECTRIC PROJECT (FERC NO. 10661)
RECREATION STUDY

Appendix – B: Recreation Site Survey Questionnaire

Content:

- **Blank Recreation Site Survey Questionnaire (Pages 1 through 4)**
- **Windshield Flyer**

ON-SITE/IN-PERSON RECREATION INTERVIEW
Constantine Hydroelectric Project (FERC No. 10661)
Recreation Site Survey Questionnaire

Indiana Michigan Power Company (I&M) is the licensee, owner, and operator of the 1.2 megawatt (MW) Constantine Hydroelectric Project (Project or Constantine Project) which is licensed by the Federal Energy Regulatory Commission (FERC). The three FERC-approved recreation facilities associated with the Project are located immediately upstream and downstream of the Project. The current operating license for the Project was issued on October 20, 1993, and expires on September 30, 2023. I&M must file its application with FERC for a new license no later than September 30, 2021. As part of the relicensing process, I&M is conducting studies on environmental resources to enable FERC to prepare an environmental document. The purpose of this survey is to collect information about use of the Project's three FERC-approved recreation facilities.

Interview Location:	**Constantine Boat Launch☐ Constantine Tailwater Fishing Access☐ Constantine Portage and Reservoir Fishing Access☐ Riverview Park☐ Riverview Park Boat Launch☐ Shelby Park☐ American Legion Boat Launch☐ Other☐**
Home Zip Code: _____	**Date:** _____
Age: _____	**Time:** _____
Are you: **Male ☐** **Female ☐**	**Prefer not to answer ☐**
Interviewer:	

Q-1. Regarding the Constantine Project area, do you consider yourself: **(Please circle one)**

1. A regular visitor to this area (*3 or more times per year*)
2. An occasional visitor (*1-2 times per year*)
3. An infrequent visitor (*Less than 1 time per year*)
4. This is my first visit

Q-2. On this trip to the Constantine Project area, when did you arrive?

Arrival Date **Arrival Time**

____/____/____ _____AM/PM

When do you expect to leave the Constantine Project area?

Departure Date **Departure Time**

____/____/____ _____AM/PM

Q-3. During the last 12 months (including this trip), which month(s) did you visit the Constantine Project area? **(Please select all that apply)**

Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐

Q-4. Which of the following recreation areas at or near the Constantine Project did you visit for recreation during the past 12 months? **(Please select all that apply)**

- ☐ Constantine Boat Launch
- ☐ Constantine Tailwater Fishing Access
- ☐ Constantine Portage and Reservoir Fishing Access
- ☐ Riverview Park
- ☐ Riverview Park Boat Launch
- ☐ Shelby Park
- ☐ American Legion Boat Launch
- ☐ None of the above
- ☐ Other (Please list)

_____

_____

Q-5. About how many miles did you travel to get to the Constantine Project area?

A. _____miles

Q-6. Are you staying overnight in the Constantine Project area (not including at your own home) on this trip?

1. Yes 2. No

Q-7. If you answered yes to **Q-6**, at what type of accommodations will you be staying? **(Please select one)**

1. RV/Auto/Tent Campground
2. Motel/hotel
3. Bed and Breakfast
4. Vacation or rental home
5. Other (Please specify: _____)

Q-8. How many people (including you) are in your group?

A. _____people

Q-9. Which of the following best describes your group during this trip?

1. Individual
2. Adult group (over 21)
3. Youth group (under 21)
4. Family (with children)
5. Mixed group (families and friends of various ages)

Q-10. On this trip to the Constantine Project area, in which of the following activities have you or do you expect to participate? **(Please select all that apply)**

1. Bank fishing	5. Picnicking	8. Hunting
2. Boat fishing	6. Swimming	9. Wildlife viewing

3. Pleasure boating	7. Sight-seeing	10. Other (please describe)
4. Canoeing/kayaking		

Q-11. Of the activities you circled in Q-10 above, what is the primary activity that you participated in, or expect to participate in, on this visit? (Please write in the corresponding number **from above**)

A. Primary activity # _____

Q-12. If you specified that boating or fishing is the primary activity you participated in please rate the following:

	Totally Unacceptable	Unacceptable	Neutral	Acceptable	Totally Acceptable
Safety	1	2	3	4	5
Enjoyment	1	2	3	4	5
Crowding	1	2	3	4	5
Overall Experience	1	2	3	4	5

Q-13. If you participated in recreational activities in the Constantine Project area today or in the past, please rate the following:

	Constantine Boat Launch	Constantine Tailrace Fishing Access	Constantine Portage and Reservoir Fishing Access	Riverview Park
Accessibility				
Parking				
Crowding				
Safety				
Condition of Recreation Facilities				
Available Facilities				
Overall Experience				

	Riverview Park Boat Launch	Shelby Park	American Legion Boat Launch	Other
Accessibility				
Parking				
Crowding				
Safety				
Condition of Recreation Facilities				
Available Facilities				
Overall Experience				

Q-14. Please tell us what type(s) of recreation enhancements you believe are needed and at what specific location(s) at the Constantine Project.

1. Type of recreation enhancement:_____

   Location(s):_____

   _____

2. Type of recreation enhancement:_____

   Location(s):_____

Q-15. Please share any other comments that you have regarding recreation near the Constantine Project:_____

Thank you for completing the Recreation Survey!

Web Survey – Windshield Flyer

The following information was provided to those not completing the Recreation Site Survey Questionnaire in the field:

"I & M (Indiana Michigan Power) is conducting a Recreation Study as part of the relicensing of the Constantine Hydroelectric Project FERC No. 10661

Please participate in the Recreation Study by visiting the website below to take a brief online survey intended to gather information about recreational use at the Constantine Hydroelectric Project.

You can follow either link to get to the survey:

www.aephydro.com/HydroPlant/Constantine (click on The Recreation Survey Link

Or go straight to this link:

https://hdrinc.co1.qualtrics.com/jfe/form/SV_by1FPypkLuQRT9z

Thank you!"

CONSTANTINE HYDROELECTRIC PROJECT (NO. 10661)
RECREATION STUDY

Appendix – C: Recreation Facility Inventories and Condition Assessments

Content:

- **Reservoir Boat Launch (Project Recreation Site)**
- **Tailwater Fishing Access (Project Recreation Site)**
- **Reservoir Fishing Access and Canoe Portage (Project Recreation Site)**
- **Riverview Park Playground Area and Boat Launch (Non-Project Recreation Site)**
- **Shelby Park (Non-Project Recreation Site)**
- **American Legion (Non-Project Recreation Site)**
- **Withers Road Canoe/Kayak Take-Out (Informal Recreation Site)**

CONSTANTINE HYDROELECTRIC PROJECT NO. 10661
RESERVOIR BOAT LAUNCH
(PROJECT RECREATION SITE)

RECREATION FACILITY INVENTORY AND CONDITION ASSESSMENT
Constantine Hydroelectric Project (FERC No. 10661)

Location:	**Reservoir Boat Launch (41.84742; -85.66965)**
Date: **July 16 & 17, 2019**	**Surveyor:** **F. Simms/J. Lewis**
Photo Number(s):	**Photos Attached**

Type of Amenity	#	ADA	Condition	Notes
Boat Launch Ramp/Lane	1	**Yes**	N / R / M / G	Notes Attached
Fishing Platform	1	**Yes**	N / R / M / G	.Notes Attached
Portage (put-in/take-out)			N / R / M / G	
Portage Trail/Walking Trail (include length and footing materials)			N / R / M / G	
Picnic Table			N / R / M / G	
Restroom	1	**Yes**	N / R / M / G	Notes Attached
Trash Receptacles	1		N / R / M / G	
Other			N / R / M / G	

PARKING	Total Spaces: _14____ Standard: _10____ ADA: _____ Double (trailer): __4___ Other: _____	**Condition**
	Surface Type: *Asphalt* *Concrete* *Gravel* *Other:*_____	N / R / M / G

Signs	#	Size	Material	Condition	Comments
FERC Project	1		wood / metal / other	N / R / M / G	
Facility ID			wood / metal / other	N / R / M / G	
Regulations	1		wood / metal / other	N / R / M / G	Obscured by vegetation.
Directional	1		wood / metal / other	N / R / M / G	
Interpretive			wood / metal / other	N / R / M / G	

N - Needs replacement (broken or missing components, or non-functional)
R - Needs repair (structural damage or otherwise in obvious disrepair)
M - Needs maintenance (ongoing maintenance issue, primarily cleaning)
G - Good condition (functional and well-maintained)
If a facility is given a rating of "N", "R", or "M", provide specific details.

ADDITIONAL COMMENTS/NOTES:
Note the age of the facilities (if known) as well as any signs of overuse.

Estimated age of facilities: 22 years

Notes from Constantine Project Boat Launch
Inventory and Condition Assessment - July 16 and 17, 2019

- Parking area asphalt paved and in good condition. Some maintenance needed to eliminate potholes.
- Parking is provided for ten vehicles and four vehicles with trailers. There is no designated handicap parking.
- FERC information sign located at gated entrance.
- No sign directing users directly to entrance. One directional sign located along U.S. Business Route 131 which can be seen by traffic heading north.
- Warning signs located at entrance to boat ramp obscured by vegetative growth.
- ADA rated sanitary facility provided at parking area.
- Sections of wood privacy fence at parking entrance missing and/or collapsing (Repairs made since inventory completed).
- Boat ramp, single lane, constructed of concrete.
- Boat barrier located upstream of project spillway and headrace in good condition.
- Floating platform adjacent to boat ramp and associated access bridging from parking area in good condition. Both the floating platform and access bridging allow for handicap access. The wood surface of the floating platform was noticed to be somewhat slippery due to early morning dew.
- Access along access bridging partially blocked by overgrowth of vegetation.
- A number of the boat bumpers along the floating platform are either missing or in poor condition and should be replaced.
- One handrail section along the floating platform is loose and needs to be repaired.
- Security lights provided for the parking area and boat ramp.
- Overall, the boat launch area is maintained in good condition.
- In conversation with owner of property located directly across from entrance to boat launch area, he stated that there have been very little if any disturbances by anyone utilizing the facilities.

Bridge to Floating Platform (41.84752, -85.66959)

Boat Ramp, Bridging, and Floating Platform (41.84749, -85.66968)

Boat Barrier Upstream of Spillway and Headgates (41.847538, -85.669586)

FERC Sign at Boat Launch (41.847439,-85.670059)

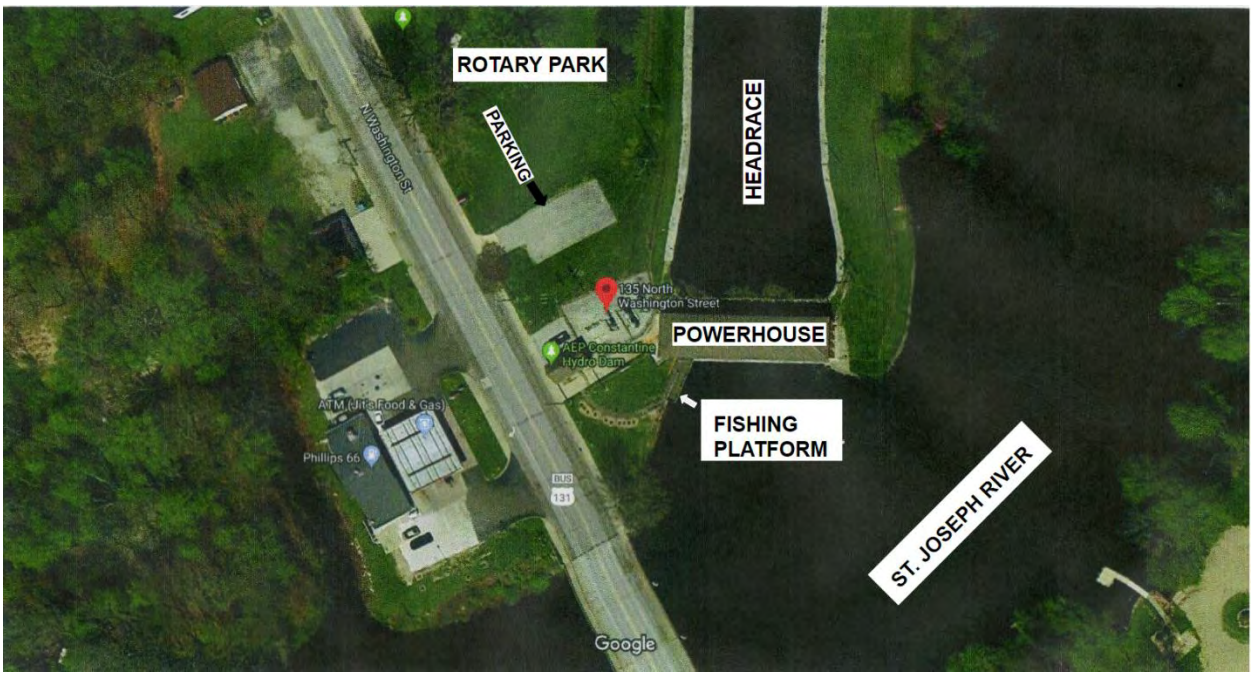
Collapsed Section of Privacy Fence at Entrance to Parking Area (41.84751, -85.66998)

Replaced Section of Fencing at Parking Area Entrance

ADA Sanitary Facility at Boat Launch Parking Area (41.84745, -85.66971)

Warning Sign at Boat Ramp - Obscured by Vegetation (41.84741, -85.66976)

Looking North on U.S. Business Route 131 at Directional Sign to Boat Access
(41.8454, -85.67132)



CONSTANTINE HYDROELECTRIC PROJECT NO. 10661
TAILWATER FISHING ACCESS
(PROJECT RECREATION SITE)

RECREATION FACILITY INVENTORY AND CONDITION ASSESSMENT
Constantine Hydroelectric Project (FERC No.10661)

Location:	**Tailwater Fishing Access (41.84359; -85.66949)**
Date:	**July 16 & 17, 2019** **Surveyor:** **F. Simms/J. Lewis**
Photo Number(s):	**Photos Attached**

Type of Amenity	#	ADA	Condition	Notes
Boat Launch Ramp/Lane			N / R / M / G	
Fishing Platform	1	**Yes**	N / R / M / G	Notes Attached
Portage (put-in/take-out)			N / R / M / G	
Portage Trail/Walking Trail (include length and footing materials)			N / R / M / G	
Picnic Table			N / R / M / G	
Restroom			N / R / M / G	
Trash Receptacles			N / R / M / G	
Other			N / R / M / G	

PARKING	Total Spaces: ___8__ Standard: __8___ ADA: _____ Double (trailer): _____ Other: _____	**Condition**
	Surface Type: *Asphalt* *Concrete* *Gravel* *Other:*_____	N / R / M / G

Signs	#	Size	Material	Condition	Comments
FERC Project	2		wood / metal / other	N / R / M / G	
Facility ID	1		wood / metal / other	N / R / M / G	
Regulations	1		wood / metal / other	N / R / M / G	Fading – Hard to Read
Directional	2		wood / metal / other	N / R / M / G	Sign on Bus. Rt. 131-N Obscured
Interpretive			wood / metal / other	N / R / M / G	

N - Needs replacement (broken or missing components, or non-functional)
R - Needs repair (structural damage or otherwise in obvious disrepair)
M - Needs maintenance (ongoing maintenance issue, primarily cleaning)
G - Good condition (functional and well-maintained)
If a facility is given a rating of "N", "R", or "M", provide specific details.

ADDITIONAL COMMENTS/NOTES:
Note the age of the facilities (if known) as well as any signs of overuse.

- Estimated age of facilities 22 years.
- Parking spaces provided at Village of Constantine Rotary Park adjacent to Tailwater Fishing Platform area.

Notes from Constantine Project Tailwater Fishing Access Inventory and Condition Assessment - July 16 and 17, 2019

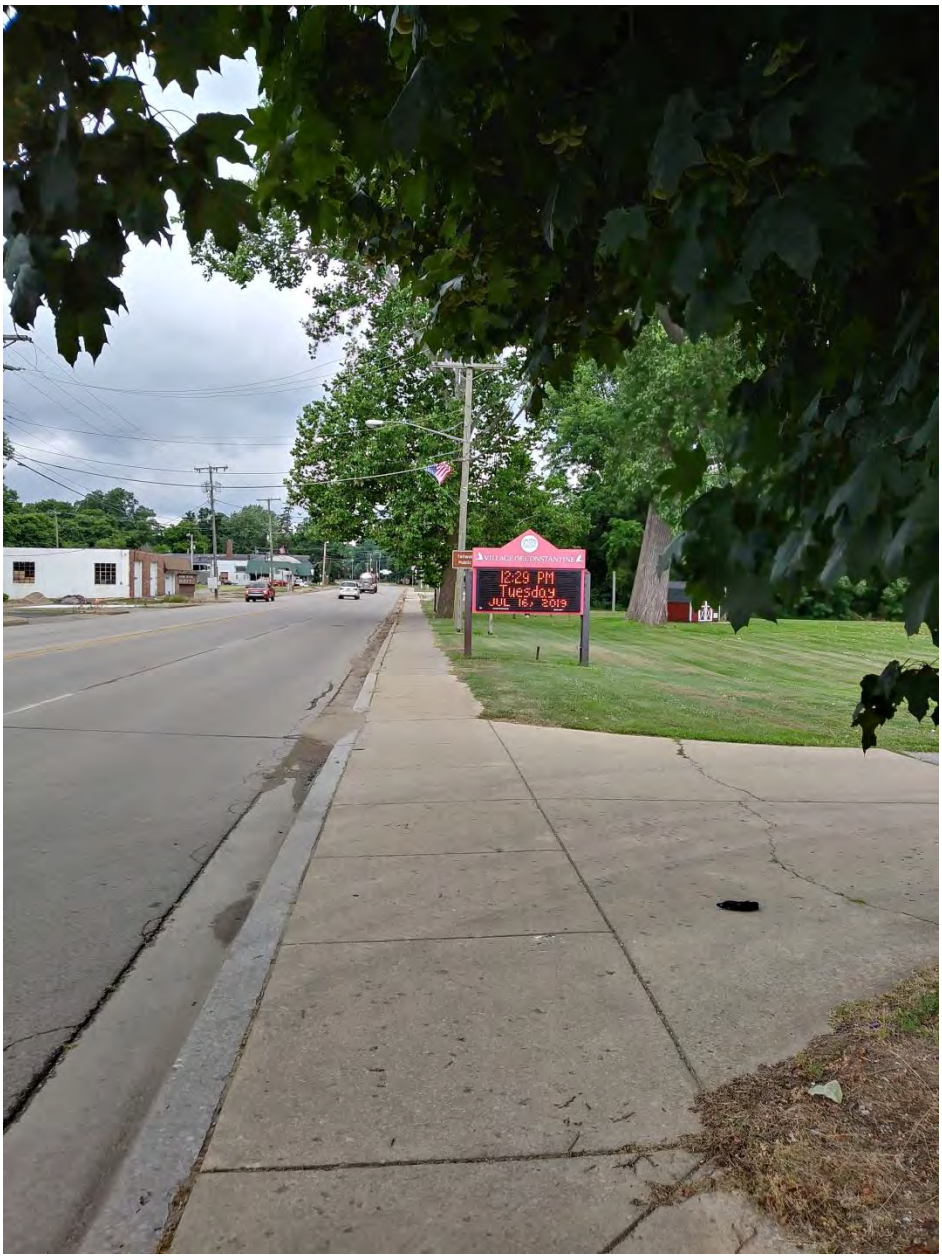
- Parking area at Rotary Park is asphalt paved and provides parking for eight vehicles. The parking lot is in good condition and well maintained. There is no designated handicap parking.
- The view of the sign located along northbound Business Route 131 cannot be seen by traffic due to Village of Constantine information sign blocking the line of sight. The directional sign along southbound Business Route 131 is visible and in good shape.
- Parking available for I&M employees only adjacent to former plant operator building at entrance gate to substation. FERC information sign provided at substation fence visible from parking area. FERC information sign also provided so as to be seen from tailwater fishing access platform.
- Walking distance from Rotary Park to tailwater access platform measured at approximately 200 lineal feet along sidewalk adjacent to U.S. Business Route 131. ADA curb cuts provided at driveways.
- Walkway from sidewalk to tailwater fishing access structure asphalt paved. Slope and width of pathway allow for handicap access. The walkway is in good shape but needs maintenance particularly at point where asphalt meets the wood access platform.
- No sanitary facility provided.
- Directional sign to tailwater access platform in good shape and easy to see. However, safety warning sign at the head of the asphalt walkway has faded and needs to be replaced.
- Wooden site identification sign in poor shape but readable.
- Light and window above tailwater fishing platform broken. Apparently the result of vandalism.
- No trash receptacle provided.
- The tailwater fishing platform is of wood construction and is in good condition. Handrails, platform slopes, and railings along river downstream of powerhouse allow for handicap access.
- Overall, the tailwater fishing access is in good condition and well maintained.

Downstream Face of Constantine Project Powerhouse Showing Tailwater Fishing Access Platform (41.843357,-85.669823)

Tailwater Fishing Access – Parking Area at Village Rotary Park (41.84372, -85.67007)

FERC Information Sign Along Substation Fence as Seen from Rotary Park Parking Area (41.8438, -85.66999)

FERC Information Sign as Seen From Tailwater Fishing Access (41.8436, -85.66962)



Village Information Sign Along U.S. Business Route 131 – North Blocking Directional Sign for Tailwater Access Parking (41.8438, -85.67017)

Tailwater Park Identification Sign (41.84349, -85.66992)

Asphalt Walkway Meets Tailwater Fishing Platform (41.84353, -85.66986)

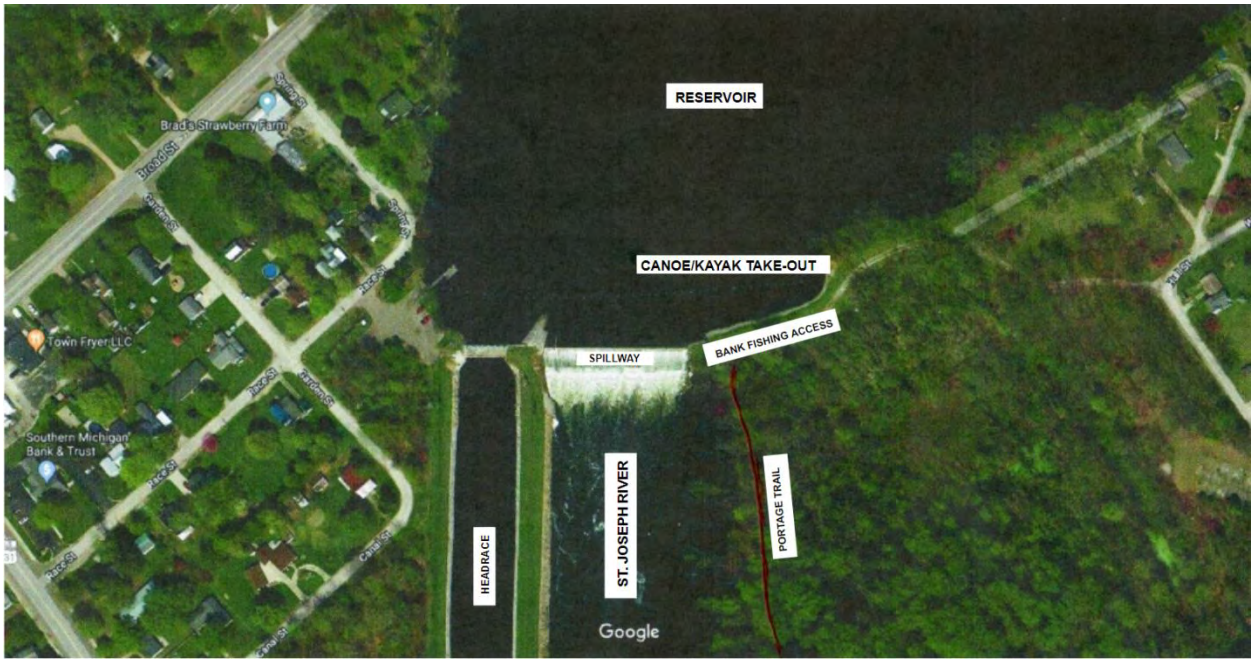
Paved Walkway to Tailwater Fishing Platform (41.84355, -85.66992)

Sidewalk from Rotary Park to Tailwater Fishing Access (41.84372, -85.67003)

Tailwater Fishing Access Platform (41.84366, -85.66955)

Broken Light and Window at Powerhouse Above Tailwater Fishing Access Platform
(41.8436, -85.6696)

Warning Sign at Head of Paved Access to Tailwater Fishing Access Platform
(41.84352, -85.66973)



CONSTANTINE HYDROELECTRIC PROJECT NO. 10661
RESERVOIR FISHING ACCESS AND CANOE PORTAGE
(PROJECT RECREATION SITE)

RECREATION FACILITY INVENTORY AND CONDITION ASSESSMENT
Constantine Hydroelectric Project (FERC No.10661)

Location:	**Reservoir Fishing Access & Portage (41.847431; -85.66949)**
Date:	**July 16 & 17, 2019** **Surveyor:** **F. Simms/J. Lewis**
Photo Number(s):	**Photos Attached**

Type of Amenity	#	ADA	Condition	Notes
Boat Launch Ramp/Lane			N / R / M / G	
Fishing Platform			N / R / M / G	
Portage (put-in/take-out)	1 ea.	**No**	N / R / M / G	Notes Attached
Portage Trail/Walking Trail (include length and footing materials)	1	**No**	N / R / M / G	Notes Attached – Length = 560 L.F.
Picnic Table	1	**Yes**	N / R / M / G	
Restroom	1	**Yes**	N / R / M / G	
Trash Receptacles			N / R / M / G	
Other			N / R / M / G	

PARKING	Total Spaces: _____ Standard: _____ ADA: _____ Double (trailer): _____ Other: _____	**Condition**
	Surface Type: *Asphalt* *Concrete* *Gravel* *Other:*_____	N / R / M / G

Signs	#	Size	Material	Condition	Comments
FERC Project			wood / metal / other	N / R / M / G	
Facility ID			wood / metal / other	N / R / M / G	
Regulations			wood / metal / other	N / R / M / G	
Directional			wood / metal / other	N / R / M / G	
Interpretive	1		wood / metal / other	N / R / M / G	Notes Attached

N - Needs replacement (broken or missing components, or non-functional)
R - Needs repair (structural damage or otherwise in obvious disrepair)
M - Needs maintenance (ongoing maintenance issue, primarily cleaning)
G - Good condition (functional and well-maintained)
If a facility is given a rating of "N", "R", or "M", provide specific details.

ADDITIONAL COMMENTS/NOTES:
Note the age of the facilities (if known) as well as any signs of overuse.

Estimated age of facilities 22 years

Notes from Constantine Project Canoe Portage and Fishing Access Area Inventory and Condition Assessment - July 16 and 17, 2019

- Take-out at reservoir, located immediately upstream of the spillway boat barrier, is in poor condition. Vegetation blocks access. Gravel surfaces below and above water need to be re-established.
- Signs providing direction for following the portage not provided. No sign observed providing identification of canoe take-out at reservoir.
- ADA sanitary facility provided near the take-out as is an ADA picnic table.
- The total length of portage from take-out along the reservoir to the put-in point downstream of the Constantine Project spillway was measured at 560 lineal feet.
- The portage route from the take-out along the top of the embankment is wide and flat. The walking surface is primarily grassed with some crushed stone. The upper area is well maintained and well kept.
- Eighteen steps are provided to allow access from the top of the portage embankment to the downstream portion of the portage. Steps are 6 ft. wide X 2.5 ft. deep X 5 in. high. Each has timber framing around crushed stone fill. The crush stone has settled in most of the step areas and should be replenished. To assist with carrying canoes and/or kayaks, a “v-shaped” timber trough is provided adjacent to the steps.
- No trash receptacles are provided.
- The sign at the head of the steps providing information about the Constantine Project is in poor shape and needs to be replaced.
- The portage path downstream of the steps is approximately 18 inches wide having a gravel surface. This section of the portage is in very poor condition with vegetation overgrowth along a major portion of its length. The small bridge over a drainage swale requires those utilizing the portage to take a high step to get onto the bridge as well as getting off. Sections of the portage path downstream of the steps are immediately adjacent to the river and pose some difficulty in following the path.
- The portage put-in is located adjacent to the warning buoys below the Project spillway delineating the limit for boaters travelling upstream. The put-in is in poor condition and is in need of upgrading.
- There is no parking provided. There is unofficial parking along Hull Street nearby for three vehicles. However, vehicles are kept from entering the site by a locked gate. Individuals desiring to access the canoe take-out and fishing access area is along an existing dirt and gravel road utilized for maintenance purposes. The distance from the gate to the portage take-out and fishing access is approximately 600 lineal feet.

Canoe Portage Take-out at the Reservoir (41.84743, -85.66718)

Canoe Portage and Access for Fishing Along Embankment (41.847431,-85.667175)

Maintenance Road from Hull Street to Canoe Take-out and Access for Fishing
(41.84768, -85.66583)

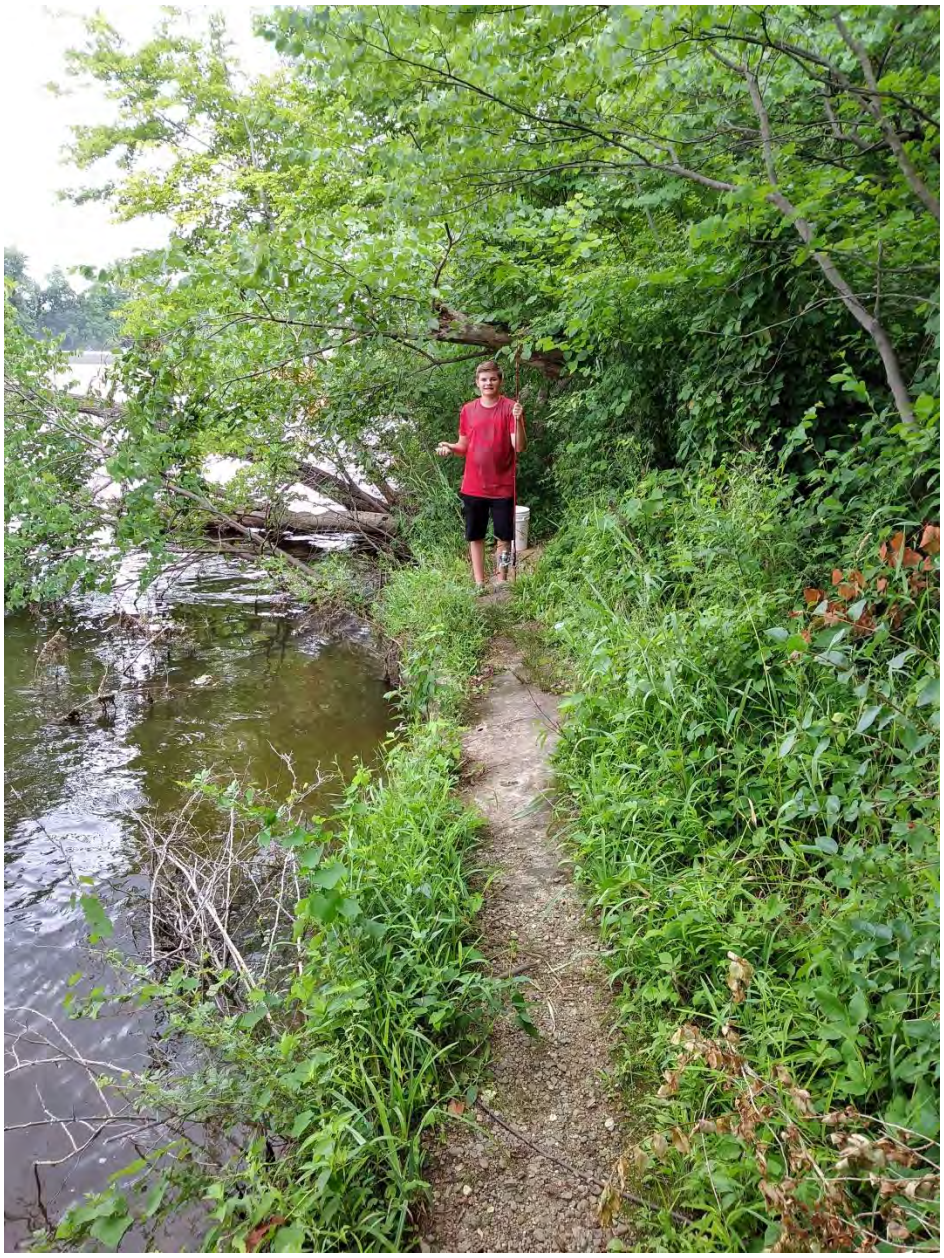
Picnic Table at Portage Take-out and Fishing Access Area (41.847305,-85.667480)

Project Information Sign at Canoe Portage (41.847260,-85.667488)

ADA Porta-John at Portage Take-out and Fishing Access Area (41.84751, -85.66711)

Portage Steps and V-Trough (41.847103,-85.667786)

Portage Downstream of Steps Including Bridge Over Swale (41.84711, -85.66778)



Portage Between Bridge Over Swale and Put-in (41.84671, -85.66776)

Portage Put-in Downstream of Spillway at Warning Buoy (41.84644, -85.66781)

Warning Buoys Downstream of Spillway at Portage Put-in (41.84646, -85.66781)

CONSTANTINE HYDROELECTRIC PROJECT NO. 10661
RIVERVIEW PARK PLAYGROUND AREA AND BOAT LAUNCH
(NON-PROJECT RECREATION SITE)

RECREATION FACILITY INVENTORY AND CONDITION ASSESSMENT
Constantine Hydroelectric Project (FERC No.10661)

Location:	**Riverview Park – Playground Area (41.84396; -85.66581)**
Date: **July 16 & 17, 2019**	**Surveyor:** **F. Simms/J. Lewis**
Photo Number(s):	**Photos Attached**

Type of Amenity	#	ADA	Condition	Notes
Boat Launch Ramp/Lane			N / R / M / G	
Fishing Platform			N / R / M / G	
Portage (put-in/take-out)			N / R / M / G	
Portage Trail/Walking Trail (include length and footing materials)	1	**Yes**	N / R / M / G	Notes Attached – Wood Boardwalk
Picnic Table			N / R / M / G	
Restroom	1	**No**	N / R / M / G	
Trash Receptacles			N / R / M / G	
Other		**Yes**	N / R / M / G	Playground, Basketball Court, Picnic Shelter – Notes

PARKING	Total Spaces: ___4__ Standard: __3___ ADA: ___1__ Double (trailer): _____ Other: _____	**Condition**
	Surface Type: *Asphalt* *Concrete* *Gravel* *Other:*_____	N / R / M / G

Signs	#	Size	Material	Condition	Comments
FERC Project	N/A		wood / metal / other	N / R / M / G	Non-Project Facility
Facility ID	1		wood / metal / other	N / R / M / G	
Regulations	1		wood / metal / other	N / R / M / G	
Directional			wood / metal / other	N / R / M / G	
Interpretive			wood / metal / other	N / R / M / G	

N – Needs replacement (broken or missing components, or non-functional)
R – Needs repair (structural damage or otherwise in obvious disrepair)
M – Needs maintenance (ongoing maintenance issue, primarily cleaning)
G – Good condition (functional and well-maintained)
If a facility is given a rating of "N", "R", or "M", provide specific details.

ADDITIONAL COMMENTS/NOTES:
Note the age of the facilities (if known) as well as any signs of overuse.

- Notes Attached
- Age of Facilities Unknown.

Notes from Village of Constantine Riverview Park Playground Area Inventory and Condition Assessment - July 16 and 17, 2019

- Facilities at park consist primarily of playground, basketball court, and picnic shelter.
- Paved parking provided for five vehicles. One parking space of the five is designated for handicap only.
- Wood raised boardwalk along river that connects with similar boardwalk at downstream boat launch area. Boardwalk was constructed for handicap accessibility but is currently not usable due to extensive damage caused by high river flows in 2018.
- Porta-John provided. Not ADA.
- Park and facilities in very good condition. The entire park is well maintained and kept.
- Information signs provided regarding types of trees.

Playground at Riverview Park (41.84396, -85.66581)

Boardwalk at Connecting Point for Playground Area (41.844395,-85.665932)

Riverview Park Boardwalk Damage (41.84421, -85.66796)

Riverview Park Boardwalk Damage (41.844105,-85.666832)

RECREATION FACILITY INVENTORY AND CONDITION ASSESSMENT
Constantine Hydroelectric Project (FERC No.10661)

Location:	**Riverview Park – Boat Launch (41.84289; -85.66784)**
Date: **July 16 & 17, 2019**	**Surveyor:** **F. Simms/J. Lewis**
Photo Number(s):	**Photos Attached**

Type of Amenity	#	ADA	Condition	Notes
Boat Launch Ramp/Lane	1	**Yes**	N / R / M / G	Notes Attached
Fishing Platform	1	**Yes**	N / R / M / G	Notes Attached
Portage (put-in/take-out)			N / R / M / G	
Portage Trail/Walking Trail (include length and footing materials)	1	**Yes**	N / R / M / G	Notes Attached – Wood Boardwalk
Picnic Table	2	**Yes**	N / R / M / G	Notes Attached
Restroom			N / R / M / G	
Trash Receptacles			N / R / M / G	
Other			N / R / M / G	

PARKING	Total Spaces: 10-14_____ Standard: 6-10_____ ADA: 4_____ Double (trailer): _____ Other: _____	**Condition**
	Surface Type: *Asphalt* *Concrete* *Gravel* *Other:__Dirt_____*	N / R / M / G

Signs	#	Size	Material	Condition	Comments
FERC Project	N/A		wood / metal / other	N / R / M / G	Non-Project Facility
Facility ID	1		wood / metal / other	N / R / M / G	
Regulations			wood / metal / other	N / R / M / G	
Directional			wood / metal / other	N / R / M / G	
Interpretive			wood / metal / other	N / R / M / G	

N - Needs replacement (broken or missing components, or non-functional)
R - Needs repair (structural damage or otherwise in obvious disrepair)
M - Needs maintenance (ongoing maintenance issue, primarily cleaning)
G - Good condition (functional and well-maintained)
If a facility is given a rating of "N", "R", or "M", provide specific details.

ADDITIONAL COMMENTS/NOTES:
Note the age of the facilities (if known) as well as any signs of overuse.

- Notes Attached
- Age of facilities unknown

Notes from Village of Constantine Riverview Park Boat Launch Area Inventory and Condition Assessment - July 16 and 17, 2019

- Single lane concrete paved boat launch with adjacent 12 ft. X 18 ft. floating access platform.
- Floating platform connected to park area by 35 ft. long access bridge.
- Floating platform and access bridge provide for handicap accessibility.
- Dirt and gravel parking and turnaround provided for six to ten vehicles and three to four vehicles with trailers.
- Two ADA tables with seats each provided along with a number of standard benches.
- Information signs provided identifying tree types.
- Boat launch area connected to playground area by wood boardwalk. Damage to boardwalk precludes use at the present time including fishing platform constructed as part of boardwalk. Total length of boardwalk from the boat launch area to playground approximately 600 lineal feet.
- Area well maintained and kept.

Access to boardwalk from boat launch parking area (41.84326, -85.66784)

Boat launch turnaround and parking area (41.84289, -85.66784)

Boat launch at Riverview Park (41.84308, -85.66821)

Tables and seating at boat launch area (41.842892,-85.667831)

Improvement at Boat Launch since July 16 and 17 Inventory

View of Improvements at Riverview Park Boat Launch

CONSTANTINE HYDROELECTRIC PROJECT NO. 10661
SHELBY PARK
(NON-PROJECT RECREATION SITE)

RECREATION FACILITY INVENTORY AND CONDITION ASSESSMENT
Constantine Hydroelectric Project (FERC No.10661)

Location:	**Shelby Park (41.84244; -85.66909)**
Date: **July 16 & 17, 2019**	**Surveyor:** **F. Simms/J. Lewis**
Photo Number(s):	**Photos Attached**

Type of Amenity	#	ADA	Condition	Notes
Boat Launch Ramp/Lane			N / R / M / G	
Fishing Platform	1	**Yes**	N / R / M / G	Length along St. Joseph River = 135 L.F. Concrete surface.
Portage (put-in/take-out)			N / R / M / G	
Portage Trail/Walking Trail (include length and footing materials)			N / R / M / G	
Picnic Table	5	**Yes**	N / R / M / G	Notes Attached
Restroom			N / R / M / G	
Trash Receptacles			N / R / M / G	
Park Benches	6		N / R / M / G	Notes Attached

PARKING	Total Spaces: _____ Standard: _____ ADA: _____ Double (trailer): _____ Other: _____	**Condition**
	Surface Type: *Asphalt* *Concrete* *Gravel* *Other:*_____	N / R / M / G

Signs	#	Size	Material	Condition	Comments
FERC Project	N/A		wood / metal / other	N / R / M / G	Non-Project Facility
Facility ID	1		wood / metal / other	N / R / M / G	
Regulations			wood / metal / other	N / R / M / G	
Directional			wood / metal / other	N / R / M / G	
Interpretive			wood / metal / other	N / R / M / G	

N – Needs replacement (broken or missing components, or non-functional)
R – Needs repair (structural damage or otherwise in obvious disrepair)
M – Needs maintenance (ongoing maintenance issue, primarily cleaning)
G – Good condition (functional and well-maintained)
If a facility is given a rating of "N", "R", or "M", provide specific details.

ADDITIONAL COMMENTS/NOTES:
Note the age of the facilities (if known) as well as any signs of overuse.

- Notes Attached.
- Age of facilities unknown.

Notes from Village of Constantine Shelby Park
Inventory and Condition Assessment - July 16 and 17, 2019

- Park and facilities very well maintained and in good condition. Entire park has paved walkways and is handicap accessible.
- Numerous facilities for sitting including three tables with benches, two picnic tables, and six benches.
- One covered sitting area with four benches.
- Paved area along the St. Joseph River with handrails allowing for fishing for its entire length measured at 135 lineal feet.
- Park has lighting provided.
- One active water fountain provided.
- Information signs describing types of trees.
- Bike racks provided at park entrance.

View of park looking into nearby Constantine commercial area (41.842796,-85.668900)

Covered sitting area and water fountain (41.842903,-85.668816)

Paved fishing area along river (41.842670,-85.669014)

Park identification sign along U.S. Business Route 131 (41.842407,-85.669128)

CONSTANTINE HYDROELECTRIC PROJECT NO. 10661
AMERICAN LEGION BOAT LAUNCH
(NON-PROJECT RECREATION SITE)

RECREATION FACILITY INVENTORY AND CONDITION ASSESSMENT
Constantine Hydroelectric Project (FERC No.10661)

Location:	**American Legion Recreation Facility (41.850980; -85.666892)**
Date: **August 2019**	**Surveyor:** **J. Lewis**
Photo Number(s):	**Photos Attached**

Type of Amenity	#	ADA	Condition	Notes
Boat Launch Ramp/Lane	1	**No**	N / R / M / G	Movable boat dock provided on as-needed basis including boat races.
Fishing Platform			N / R / M / G	Fishing access available along shoreline.
Portage (put-in/take-out)			N / R / M / G	
Portage Trail/Walking Trail (include length and footing materials)			N / R / M / G	
Picnic Table			N / R / M / G	
Restroom			N / R / M / G	Restrooms available to members. Facilities provided by American Legion for boat races.
Trash Receptacles			N / R / M / G	
Other			N / R / M / G	

PARKING	Total Spaces: _____ Standard: _____ ADA: _____ Double (trailer): _____ Other: (See notes)	**Condition**
	Surface Type: *Asphalt* *Concrete* *Gravel* *Other:*_____	N / R / M / G

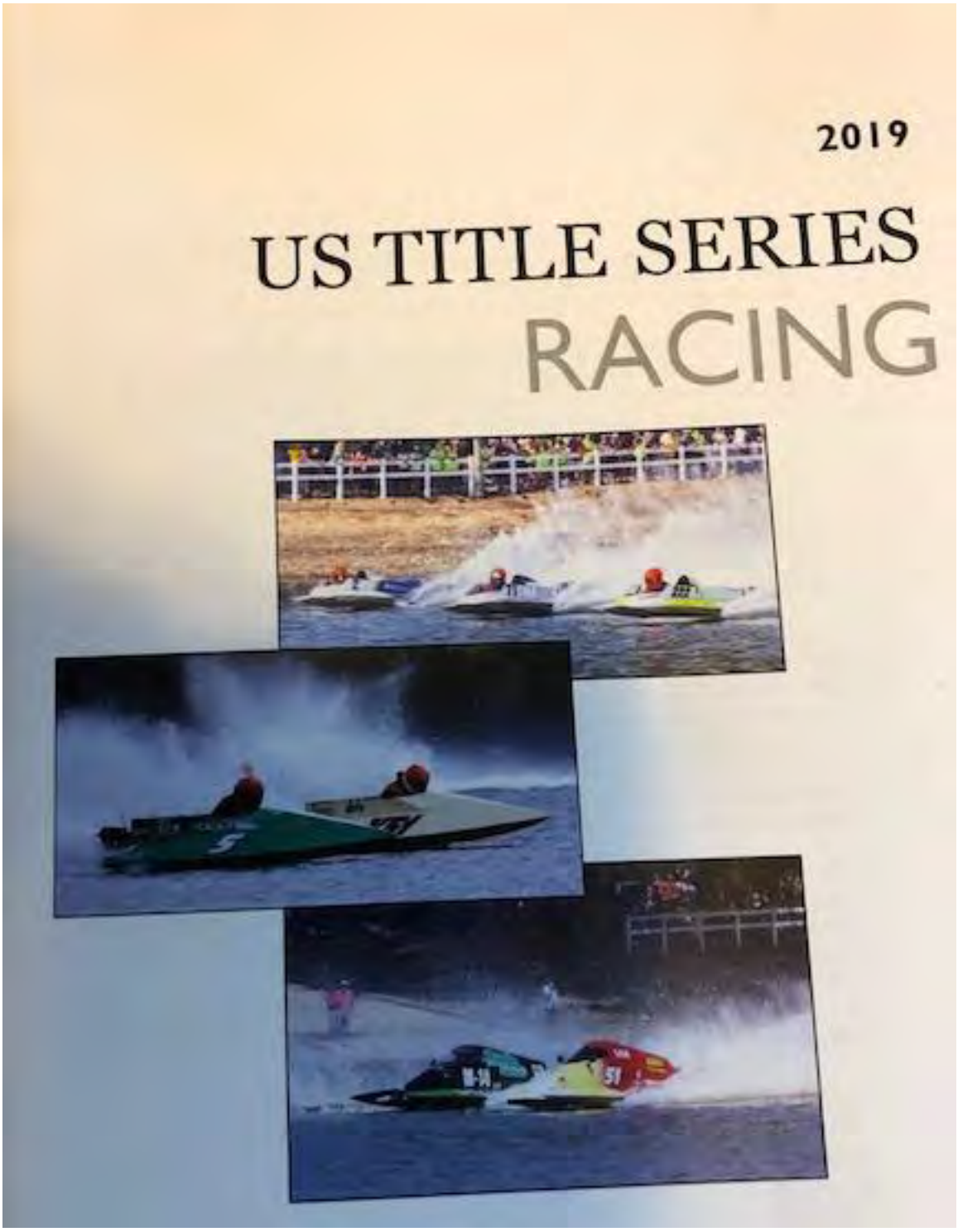
Signs	#	Size	Material	Condition	Comments
FERC Project			wood / metal / other	N / R / M / G	
Facility ID			wood / metal / other	N / R / M / G	
Regulations			wood / metal / other	N / R / M / G	See notes.
Directional			wood / metal / other	N / R / M / G	
Interpretive			wood / metal / other	N / R / M / G	

N – Needs replacement (broken or missing components, or non-functional)
R – Needs repair (structural damage or otherwise in obvious disrepair)
M – Needs maintenance (ongoing maintenance issue, primarily cleaning)
G – Good condition (functional and well-maintained)
If a facility is given a rating of "N", "R", or "M", provide specific details.

ADDITIONAL COMMENTS/NOTES:
Note the age of the facilities (if known) as well as any signs of overuse.

- Gravel parking areas provided. Number of vehicles that can be accommodated undetermined.
- Parking allowed on grass areas during races.
- Signs posted noting that permits from American Legion required for use of facilities.

American Legion Boat Races – Father's Day Weekend – June 2019



Program from U.S. Title Series Boat Racing – July 21, 2019

Two classes of boats for U.S. Title Series Boat Racing – July 21, 2019

Pit area during July 21 boat races.

Participant parking area.

Boat racing on Constantine Project Reservoir.

Competitor trailer.

Spectators at July 21 boat races.

Sign at American Legion Boat Launch

Movable boat dock for American Legion boat launch.

American Legion boat ramp.

Shoreline along Project Reservoir at American Legion boat launch.

CONSTANTINE HYDROELECTRIC PROJECT NO. 10661
WITHERS ROAD CANOE/KAYAK TAKE-OUT
(INFORMAL RECREATION SITE)

RECREATION FACILITY INVENTORY AND CONDITION ASSESSMENT
Constantine Hydroelectric Project (FERC No.10661)

Location:	**Withers Road Canoe/Kayak Take-Out (41.9206; -85.65649)**
Date:	**July 16 & 17, 2019** **Surveyor:** **F. Simms/J. Lewis**
Photo Number(s):	**Photos Attached**

Type of Amenity	#	ADA	Condition	Notes
Boat Launch Ramp/Lane			N / R / M / G	
Fishing Platform			N / R / M / G	
Portage (put-in/take-out)	1	**No**	N / R / M / G	Notes Attached
Portage Trail/Walking Trail (include length and footing materials)			N / R / M / G	
Picnic Table			N / R / M / G	
Restroom			N / R / M / G	
Trash Receptacles			N / R / M / G	
Other			N / R / M / G	

PARKING	Total Spaces: 8-10_____ Standard: 8-10_____ ADA: _____ Double (trailer): _____ Other: _____	**Condition**
	Surface Type: *Asphalt* *Concrete* *Gravel* *Other:*_____	N / R / M / G

Signs	#	Size	Material	Condition	Comments
FERC Project	N/A		wood / metal / other	N / R / M / G	Non- Project Informal Recreation Site
Facility ID			wood / metal / other	N / R / M / G	
Regulations			wood / metal / other	N / R / M / G	
Directional			wood / metal / other	N / R / M / G	
Interpretive			wood / metal / other	N / R / M / G	

N – Needs replacement (broken or missing components, or non-functional)
R – Needs repair (structural damage or otherwise in obvious disrepair)
M – Needs maintenance (ongoing maintenance issue, primarily cleaning)
G – Good condition (functional and well-maintained)
If a facility is given a rating of "N", "R", or "M", provide specific details.

ADDITIONAL COMMENTS/NOTES:
Note the age of the facilities (if known) as well as any signs of overuse.

- Informal recreation site maintained by St. Joseph County.
- Notes Attached.

Notes from Withers Road Canoe/Kayak Take-Out
Inventory and Condition Assessment - July 16 and 17, 2019

- Withers Road Take-out is approximately at the mid-point for the Constantine Project Reservoir. The distances to the boat launch on the St. Joseph River at Three Rivers, Michigan and to the boat launch for the Constantine Hydroelectric Project are approximately equal at three miles.
- Access consists of wood frame steps with crushed stone walking surface. There are a total of five steps leading to a landing. Each step is 12 ft. wide X 2.25 ft. deep X 5 inches high.
- Parking is available for three to five vehicles along the road berm on each side of Withers Road.
- Parking area surface is gravel.
- Picnic table and trash container on site.
- Access maintained by St. Joseph County.

Canoe/Kayak take-out area along north side of Withers Road
(41.920227,-85.671257)

Canoe/Kayak Take-out looking upstream (41.92423, -85.65424)

Access drive and parking for take-out (41.889317,-85.648170)

CONSTANTINE HYDROELECTRIC PROJECT (FERC NO. 10661)
RECREATION STUDY

Appendix –D: Recreation Site Survey Questionnaire Results

Content:

- **Combined Online and On-Site /In-Person Recreation Survey Results**
- **Recreation Study: Online Recreation Survey Results Questions Nos. Q1 Through Q12**
- **Recreation Study: Online Recreation Survey Results Questions Nos. Q-13 Through Q15**
- **Recreation Study: On-Site/In-person Recreation Interview Results Questions Nos. Q-1 Through Q-12**
- **Recreation Study: On-Site/In-Person Recreation Interview Results Questions Nos. Q-13 Through Q-15**

CONSTANTINE HYDROELECTRIC PROJECT (FERC No. 10661)
COMBINED ON-LINE AND ON-SITE/IN-PERSON RECREATION SURVEY RESULTS

Q-1: Regarding the Constantine Project area, do you consider yourself: (1) a regular visitor to the area; (2) an occasional visitor; (3) an infrequent visitor; or (4) is this your first visit?

Visitor Type	Regular	Occasional	Infrequent	First Visit
Number	16	6	1	4
Percentage	59.3	22.2	3.7	14.8

Q-2: On this trip to the Constantine Project area, when did you arrive? When do you expect to leave the Constantine Project area? (See interview results summaries)

Q-3: During the last 12 months (including this trip), which month(s) did you visit the Constantine Project area?

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Number	2	3	8	10	19	18	13	12	10	8	4	3
Percentage	8.0	12.0	32.0	40.0	76.0	72.0	52.0	48.0	40.00	32.0	16.0	12.0

Q-4: Which of the following recreation areas at or near the Constantine Project did you visit for recreation during the past 12 months? Constantine Boat Launch (CBL); Constantine Tailwater Fishing Access (CTFA); Constantine Portage and Reservoir Fishing Access (CPORT); Riverview Park (RP); Riverview Park Boat Launch (RPBL); Shelby Park (SP); American Legion Boat Launch (ALBL); None of the above (NOA); or Other.

Site	CBL	CTFA	CPORT	RP	RPBL	SP	ALBL	NOA	Other
*Number	16	15	17	13	10	10	10	0	0

*Includes 10 visitors indicating use of all facilities during visit.

Q-5: About how many miles did you travel to get to the Constantine Project area? Average = 99.1 (See interview results summaries).

Q-6: Are you staying overnight in the Constantine Project area (not including at you own home) on this trip?

Answer	Yes	No
Number	8	19
Percentage	29.6	70.4

Q-7: If you answered yes to Q-6, at what type of accommodations will you be staying?

Accommodation	RV/Auto/Tent	Motel/Hotel	B&B	Vac. or Rental Home	Other
Number	5	2			1

Q-8: How many people (including you) are in your group? Average = 2.04 (See interview results summaries)

Q-9: Which of the following best describes your group during this trip?

Group Type	Individual	Adult Group (Over 21)	Youth Group (Under 21)	Family (with children)	Mixed Group
Number	6	12	1	1	1
Percentage	28.5	57.1	4.8	4.8	4.8

Q-10: On this trip to the Constantine Project area, in which of the following activities have you or do you expect to participate?

Activity	Bank Fishing	Boat Fishing	Pleasure Boating	Canoe/ Kayak	Picnic	Swim	Sight-Seeing	Hunt	View Wildlife	Other
Number	6	5	6	2	0	0	1	0	1	0
Percent	28.6	23.8	28.6	9.5	0	0	4.8	0	4.8	0

Q-11: Of the activities you circled in Q-10 above, what is the primary activity that you participated in, or expect to participate in on this visit?

Activity	Bank Fishing	Boat Fishing	Pleasure Boating	Canoe/ Kayak	Picnic	Swim	Sight-Seeing	Hunt	View Wildlife	Other
Number	5	5	6	1	0	0	1	0	0	0
Percent	27.8	27.8	33.3	5.6	0	0	5.6	0	0	0

Q-12: If you specified boating or fishing in the primary activity you participated in please rate the following:

Number (Percent)	Totally Unacceptable	Unacceptable	Neutral	Acceptable	Totally Acceptable
Safety			1 (4.8%)		20 (95.2%)
Enjoyment				1 (4.8%)	20 (95.2%)
Crowding	1			2 (10.5%)	17 (89.5%)
Overall Experience				1 (5.9%)	16 (94.1%)

Q-13: If you participated in recreational activities in the Constantine Project area today or in the past, please rate the following: Constantine Boat Launch (CBL); Constantine Tailwater Fishing Access (CTFA); Constantine Portage and Reservoir Fishing Access (CPORT); Riverview Park (RP); Riverview Park Boat Launch (RPBL); Shelby Park (SP); American Legion Boat Launch (ALBL); or Other.

	Accessibility	Parking	Crowding	Safety	Condition of Facilities	Available Facilities	Overall Experience
CBL	4.0	4.3	4.8	3.7	3.7	4.5	4.5
CTFA	4.5	4.0	3.5	3.0	4.0	3.0	3.8
CPORT	3.0	3.0	4.0	4.0	3.0	3.0	3.0
RP	4.5	4.5	4.5	4.0	4.0	4.0	4.0
RPBL							
SP							
ALBL	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Other							

Q-14: Please tell us what type(s) of recreation enhancements you believe are needed and at what specific location(s) at the Constantine Project. (See interview results summaries)

Q-15: Please share any other comments that you have regarding recreation near the Constantine Project. (See interview results summaries)

CONSTANTINE HYDROELECTRIC PROJECT (FERC No. 10661)
RECREATION STUDY: ON-LINE RECREATION SURVEY RESULTS

QUESTIONS NOS. Q-1 THROUGH Q-12

					Site Survey Question Number											Q12			
Survey No.	Home	Date	Age	Gender	Q1	Q2 date	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Safety	Enjoyment	Crowding	Experience
1	Middlebury, Indiana	27-May-19	63	Male	1	5/27/19	5,7	CBL	15	2		1	1	2		3	4	5	4
2	Chesterton, Indiana	4-Jun-19	67	Male	1	6/1/19	5,6	CBL	90	2		2	2	2					
3	Paw Paw, Indiana	17-Jun-19	31	Male	1	6/16/19	3,4,5,6,7,8,9,10	CBL	35	2		2	2	2,4		5	5	5	5
4	White Pigeon, Michigan	14-Jun-19	26	Male	1	6/14/19	3,4,5,6	CBL,CTFA,CPORT	5	2									
5	Three Rivers, Michigan	28-Jul-19	56	Male	1	7/24/19	4,5,6,7,8,9,10	CBL,CPORT	7	2		1	1	2,7,9					
6	St. Marys, Ohio	26-Jul-19	33	Male	1	7/3/19	3,4,5,6,7,8	CBL,CTFA,CPORT,RP	150	1	5	1	2	1					
7	Sidney, Ohio	20-Aug-19	66	Male	1	8/15/19	3,4,8	CPORT	185	2									
	Average		48.86						69.57			1.40				4.00	4.50	5.00	4.50

Legend:
CTFA = Tailwater Fishing Area
RP = Riverview Park
CPORT = Canoe Portage
CBL = Reservoir Boat Launch
All = All Sites

Note: Question numbers and responses refer to the "Recreation Site Survey Questionnaire" for the Constantine Project (See Appendix B).

CONSTANTINE HYDROELECTRIC PROJECT (FERC No. 10661)
RECREATION STUDY: ON-LINE RECREATION SURVEY RESULTS - QUESTIONS Q-13 THROUGH Q-15

QUESTION NO. Q-13: If you participated in recreational activities in the Constantine Project, please rate the following.

	Constantine Boat Launch	Constantine Tailrace Fishing Access	Constantine Portage and Reservoir Fishing Access	Riverview Park
Accessibility	3,5,4	4	3	4
Parking	5,4,4	3	3	4
Crowding	5,5,5,4	3	5,3	4
Safety	3,4,4	4	4	3
Condition of Recreation Facilities	3,4,4	4	3	3
Available Facilities	4,5	3	3	3
Overall Experience	5,4	3	3	3

	Riverview Park Boat Launch	Shelby Park	American Legion Boat Launch	Other
Accessibility				
Parking				
Crowding				
Safety				
Condition of Recreation Facilities				
Available Facilities				
Overall Experience				

QUESTIONS NOS. Q-14 AND Q-15 (Combined Responses)

Question No. Q-14: Please tell us what type of recreation enhancements you believe are needed and at what specific location(s) at the Constantine Project.
Question No. Q-15: Please share any other comments that you have regarding recreation near the Constantine Project.

Survey No. 1: Trash receptacles needed at all sites. Have used Constantine Boat Launch for years. Floating dock at Constantine Boat Launch getting worn and tired from weather and use. Fence at Constantine Boat Launch has sections broken and grass needs mowing. (Note: Fence has been replaced since visit.)
Survey No. 2: No comments.
Survey No. 3: Something should be provided to mark the drop and shallow sides of the lake/river at least up to Withers Road.
Survey No. 4: No comments.
Survey No. 5: More parking needed at Constantine Boat Launch. Floating dock needs upkeep. More walleye should be planted at Project. Fish at Project probably more than other people and take grandchildren along. We troll for walleye and pike, and view wildlife. Cannot express enough how this has to continue for all. What a great place. Anything I can do to help would be pleasure.
Survey No. 6: Need more access area for bank fishing at Constantine Boat Launch. Additional bank fishing should also be provided elsewhere at Project.
Survey No. 7: No comments.

***Notes**: Question numbers and responses refer to the "Recreation Site Survey Questionnaire" for the Constantine Project (See Appendix-B).*
Ratings are based on a scale of "1 to 5" with "5" being the highest.
Survey Nos. are also those listed for Questions Q-1 through Q-12.

CONSTANTINE HYDROELECTRIC PROJECT (FERC No. 10661)
RECREATION STUDY: ON-SITE/IN-PERSON RECREATION INTERVIEW RESULTS

QUESTIONS NOS. Q-1 THROUGH Q-12

						Site Survey Question Number											Q12			
Survey No.	Site Visited	Home	Date	Age	Gender	Q1	Q2 (Arrive/Leave)	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Safety	Enjoyment	Crowding	Experience
1	CTFA	Constantine, Michigan	29-May-19	42	Female	3		6,7,8	CTFA	0.25	2		3	4	1	1	5	5	5	5
2	CTFA	Constantine, Michigan	27-May-19	20	Female	1	5-27/5-27	5,6,7,8,9,10	CTFA, CPORT, RP	0.5	2		2	2	1	1	5	5	4	5
3	CTFA	Three Rivers, Michigan	27-May-19	51	Male	1	5-27/5-27	5,9,10	CPORT	9	2		4	3	2	2	5	5	5	5
4	RP	Sherwood, Michigan	1-Jul-19	34	Female	2	7-1/7-1	6,7,8	RP		2		6	2	4	4	5	5	5	5
5	RP	Constantine, Michigan	27-May-19	61	Male	1		ALL 12	RP		2		4							
6	ALL	Wetmore, Michigan	20-Jul-19	61	Male	4	7-20/7-21	6	ALL	95	1	1	2	2	3	3,7	5	5	5	5
7	ALL	New Lothrup, Michigan	20-Jul-19	64	Male	2	7-20/7-20	5	ALL	200	1	2	2				5	5	5	5
8	ALL	Ft. Wayne, Indiana	20-Jul-19	64	Male	4	7-20/7-21	6	ALL	95	1	1	2	2	3	3	5	5	5	5
9	CTFA	Jones, Michigan	17-Jul-19	63	Male	2	7-17/7-17	2,3,4,5,6,7,8,9,10,11,12	CTFA	14	2		3	1			5	5	5	5
10	CPORT	Constantine, Michigan	27-May-19	29	Male	1		4.5.6.7.8.9.	CPORT	2	2		1	1	1	1	5	5	5	5
11	CTFA	Sturgis, Michigan	27-May-19	22	Male	1	5-27/5-27	4,5,6,7,8,9	CTFA	70	2		1	1	1	1	5	5	1	5
12	CTFA	Constantine, Michigan	27-May-19	65	Male	1	5-27/5-27	3,4,5,6.7.8.9.10,11	CFTA	1	2		1	1	1	1	5	5	4	5
13	ALL	Elkhart, Indiana	16-Jun-19	52	Male	2	6-15/6-16	5	ALL	41	1	1	6	2	3	3	5	5	5	5
14	ALL	Camden, Indiana	16-Jun-19	20	Male	2	6-15/6-16	5	ALL	50	1	1	6	2	3	3	5	5	5	5
15	ALL	Schoolcraft, Michigan	15-Jun-19	75	Male	1		ALL 12	ALL	15	2		2	2	3	3	5	5	5	5
16	ALL	Schoolcraft, Michigan	15-Jun-19	35	Male	2	6-15/6-16	6	ALL	140	1	1	5	5	3	3	5	5	5	5
17	ALL	Paw Paw, Michigan	16-Jun-19	72	Male	4	6-16/6-16	5	ALL	40	2		3	2			5	5	5	
18	ALL	Bentley, Michigan	15-Jun-19	41	Male	1	6-15/6-22	5,6	ALL	1200	1	2	8	2			5	5	5	
19	ALL	White Pigeon, Michigan	15-Jun-19	71	Male	4	6-15/6-15		ALL	8	2						5	5		
20	CTFA	Sturgis, Michigan	15-Jun-19	61	Male	1	6-15/6-15		CFTA	10	2						5	5	5	
	Average			50.15						110.60			2.44				5.00	5.00	4.17	5.00

Legend: *CTFA = Tailwater Fishing Area*
RP = Riverview Park
CPORT = Canoe Portage
CBL=Reservoir Boat Launch
All = All Sites

Note : Question numbers and responses refer to the "Recreation Site Survey Questionnaire" for the Constantine Project (See Appendix-B).

CONSTANTINE HYDROELECTRIC PROJECT (FERC No. 10661)
RECREATION STUDY: ON-SITE/IN-PERSON RECREATION INTERVIEW RESULTS - QUESTIONS Q-13 THROUGH Q-15

QUESTION NO. Q-13: If you participated in recreational activities in the Constantine Project, please rate the following.

	Constantine Boat Launch	Constantine Tailrace Fishing Access	Constantine Portage and Reservoir Fishing Access	Riverview Park
Accessibility		5		5
Parking		5		5
Crowding		4		5
Safety		2		5
Condition of Recreation Facilities		4		5
Available Facilities				5
Overall Experience		4-5		5

	Riverview Park Boat Launch	Shelby Park	American Legion Boat Launch	Other
Accessibility			5,5,5,5,5,5	
Parking			5,5,5,5,5,5	
Crowding			5,5,5,5,5,5	
Safety			5,5,5,5,5,5	
Condition of Recreation Facilities			5,5,5,5,5,5	
Available Facilities			5,5,5,5,5,5	
Overall Experience			5,5,5,5,5,5	

QUESTIONS NOS. Q-14 AND Q-15 (Combined Responses)

Question No. Q-14: Please tell us what type of recreation enhancements you believe are needed and at what specific location(s) at the Constantine Project.
Question No. Q-15: Please share any other comments that you have regarding recreation near the Constantine Project.

Survey No. 1: More docks. Repair boardwalk at Riverview Park
Survey No. 2: Repair boardwalk at Riverview Park. Provide porta-potty and trash receptacles at Riverview Park Boat Launch. Overall, enjoy facilities and return often.
Survey No. 3: Facilities are great. Trash receptacles should be considered. Overall, enjoy all facilities and return often.
Survey No. 4: Kayak or canoe launch at Riverview Park.
Survey No. 5: Swimming hole needed. Facilities are well maintained.
Survey No. 6: Shrubbery appears to be too large along water at American Legion boat launch site.
Survey No. 7: Beach area should be provided.
Survey No. 8: No comments.
Survey No. 9: Fish ladder suggested. Always accept facilities as provided.
Survey No. 10: Portage trail needs to be cleared.
Survey No. 11: Lighting at Tailwater Fishing Access gets shot out. Need more parking.
Survey No. 12: Need porta-potty and trash receptacle at Tailwater Fishing Access. Existing rip-rap along reservoir embankment a good idea.
Survey No.13: Update bleachers and pavillion at American Legion boat launch.
Survey No. 14: Nothing needs to be changed. Enjoy boat races at American Legion.
Survey No. 15: Enhancements to pavillion at American Legion. Blowing leaves in river not acceptable.
Survey No. 16: Stadium seating at American Legion. Overall, good place to come back to.
Survey No. 17: Walleye should be stocked in reservoir. Want more boat races.
Survey No. 18: Pit area at American Legion needs grass.
Survey No. 19: No comments.
Survey No. 20: More organizations to utilize the waterway. Sailing an example.

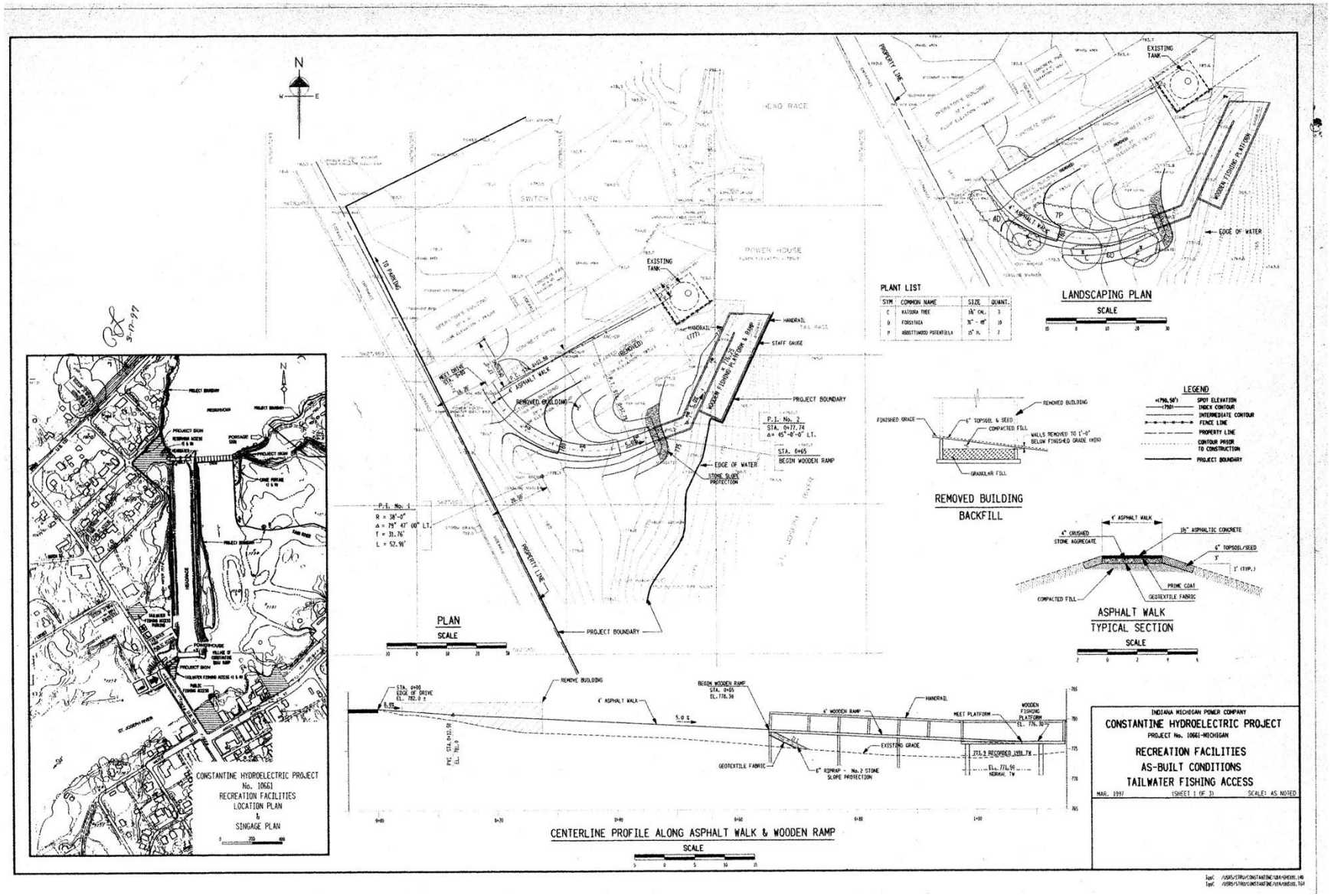
***Notes**: Question numbers and responses refer to the "Recreation Site Survey Questionnaire" for the Constantine Project (See Appendix-B).*
Ratings are based on a scale of "1 to 5" with "5" being the highest.
Survey Nos. are also those listed for Questions Q-1 through Q-12.

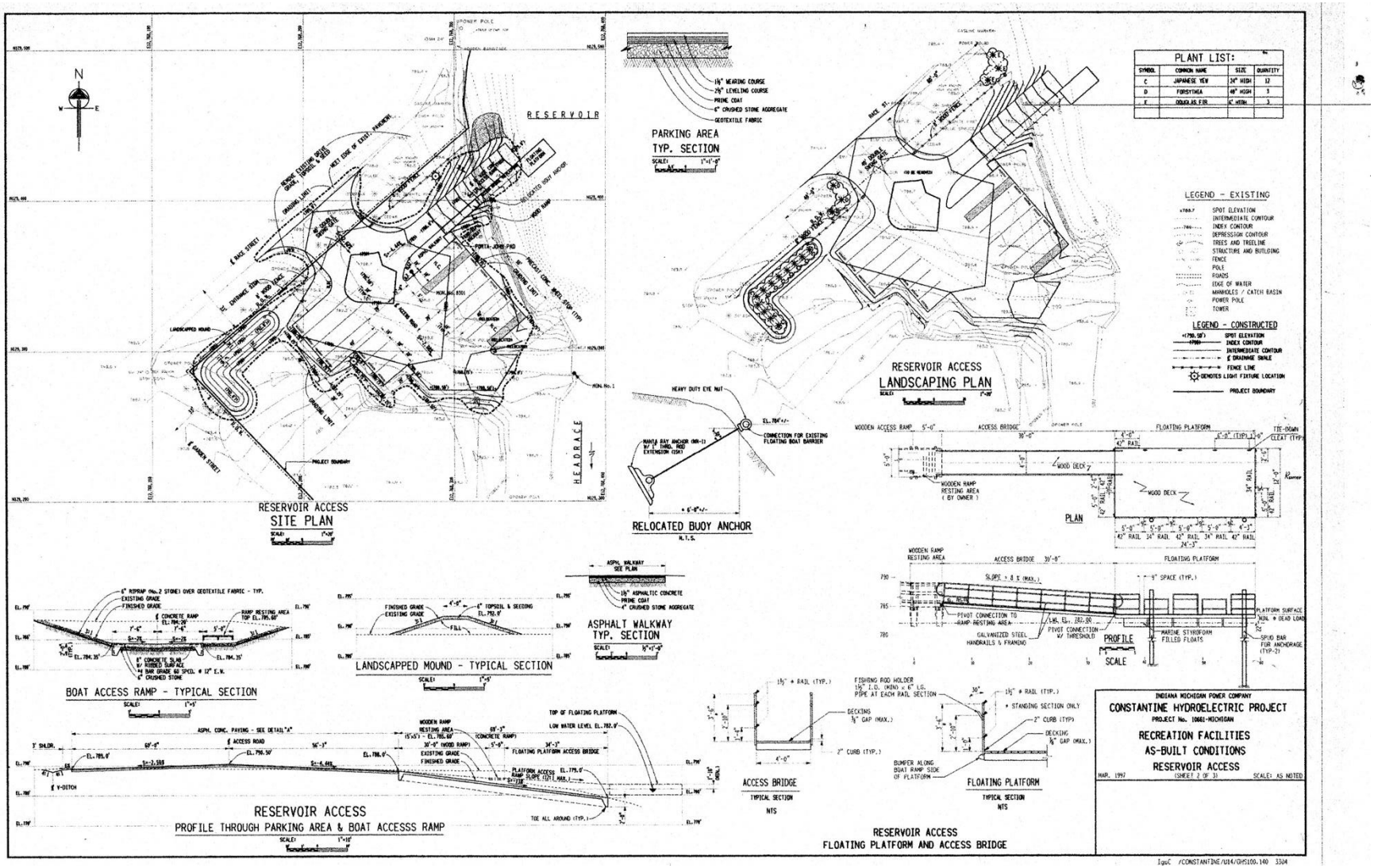
CONSTANTINE HYDROELECTRIC PROJECT (FERC NO. 10661)
RECREATION STUDY

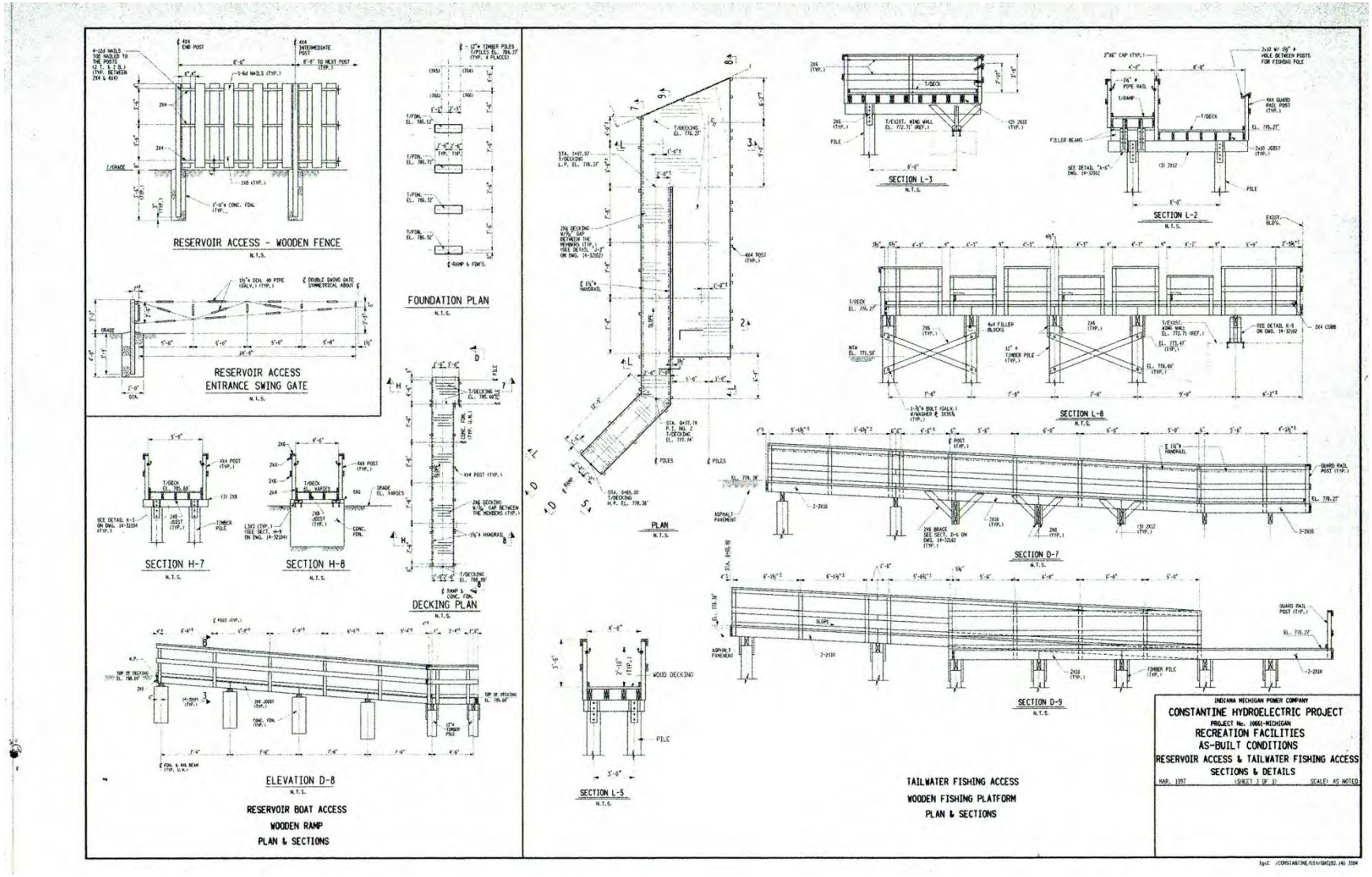
Appendix – E: Exhibit R Drawings

Content:

- **Sheet 1 of 3: Recreation Facilities As-Built Conditions Tailwater Fishing Access**
- **Sheet 2 of 3: Recreation Facilities As-Built Conditions Reservoir Access**
- **Sheet 3 of 3: Recreation Facilities As-Built Conditions Reservoir Access & Tailwater Fishing Access Sections & Details**







CONSTANTINE HYDROELECTRIC PROJECT (FERC NO. 10661)
RECREATION STUDY

Appendix – F: Monthly Progress Reports

Content:

CONSTANTINE HYDROELECTRIC PROJECT (P-10661)
RECREATION STUDY – PROGRESS REPORT NO. 1
Progress through MAY 31, 2019

Introduction:

Progress Report No.1 presents the work completed by Young Energy Services (YES) through May 31, 2019 for the Constantine Hydroelectric Project (Project) Recreation Study. Included are reports by YES staff and Jim Lewis and assistant presenting the field activities accomplished during the referenced time period.

Summary:

As noted in the field reports, YES staff commenced field survey activities on Wednesday, May 22, 2019, which represents the one randomly selected weekday required under the approved Recreation Study Plan. Field surveys were then also performed on Monday, May 27, 2019 in accordance with the schedule established for the Recreation Study for the Memorial Day weekend. Weather conditions had impacts on recreation at the Project both days. However, YES staff was able to gather information for the greater part of each day at the Project and non-Project facilities identified for the Recreation Study where field information is to be obtained. The information obtained included interviews with individuals utilizing the recreation facilities resulting in the completion of ten to twelve interview/survey forms created by Indiana Michigan Power Company (I&M) for the Recreation Study.

In order to capture as many comments regarding the recreation facilities and recreation use within and around the Project as possible, YES staff created flyers that direct those individuals that YES staff were either not able to interview or did not desire to complete the survey in the field to the online survey established by HDR for I&M. To capture recreationists who were boating on the Project reservoir during the time YES staff were on site, flyers were placed on the windshields of vehicles parked at the Project and non-Project recreation facilities. A copy of the flyer is attached as part of this report.

Recreation Report-Constantine Hydroelectric Project-May 22, 2019

Time and Weather:

We had to delay our start time as we had storms and rain that lasted until about 11:00am. Arrived at 11:30am, temperature was 55° and by 12:30, it was about 70°.

Boat/Launch Lane:

Very little use in the morning. By the afternoon there was one truck with a boat trailer. Boat was not visible on the reservoir. Put a request on the windshield of the truck to complete the online visitor survey. Very little use of the area, probably due to the weather that day. (See Facility inventory for pictures). Facility Coordinates: Latitude 41.847630, Longitude -85.669464

Fishing Platform:

Again, very little use, but we were lucky to catch a fisherman about 11:00am, an 80-year-old man with two fishing lines. We were able to interview him. He was from Constantine, spends quite a bit of time fishing in the tailwater area. Says the fishing is not as good as it used to be, but he feels very safe and loves the area and very happy that it is available. Did comment that when the dock was put in at the boat launch it ruined the fishing because access to the area inside of the buoy was limited.

Portage Area:

Portage area is in very good condition. No one there all day, and I have noticed (even in prior study) that this area is not utilized. Picnic table is fair, and ADA accessible, but the trail to the picnic table is not ADA accessible. Walking trail to the canoe portage is in good shape. Facility Coordinates: Latitude 41.8473222, Longitude -85.667848

Restrooms:

Restrooms at the Canoe Portage area, as well as the Boat Launch, are in fair condition.

Trash Receptacles:

There are no trash receptacles

Constantine Riverview Park (Not I&M responsibility)

This park is maintained by the village and has a fishing dock, picnic tables and further up on shore there is a playground area. Again, few people there. One couple stopped for a few minutes to eat lunch. However, one young man (29) came to fish. Says he comes to the area almost every day to throw in a line and absolutely loves the fishing. Later in the evening he fishes from a boat. Likes the entire area and would like to see the dock at Riverview Park fixed. It is not very stable and depending on the water level is often underwater.

Boat Launch: Wood and metal are in good shape. Restroom in the background is in fair shape. Parking lot is in very good shape. May need some trimming of vegetation.

Tailwater Fishing: Wood and metal are in good shape. Needs a trash receptacle (although fisherman pointed out that if they put a receptacle here, people tend to dump their household trash).

Portage Area: Area is in very good shape and well maintained. Restroom is fair. Trail is in good shape; picnic table is fair.

Riverview Park: Park is in very good shape. Picnic tables and benches. Dock is in fair shape, however not very stable and tends to get covered according to water table.

Recreation Report-Constantine Hydroelectric Project-May 27, (Memorial Day) 2019

Time and Weather:

Again, due to rain and storms, we had to delay start time as we had storms and rain that lasted until about 9:00am. Arrived at 10:00am, temperature was 63° and by 12:30, it was about 70°.

Boat/Launch:

When we arrived, there were already 5 cars with boat trailers in the boat launch. I could not see any boats on the reservoir. We put paper requests on each car and decided to stay for a while to see if the boats came in. Nothing for a long time. Surprising for the weather, there were a lot of boats, but as the weather got nicer, I could see why people were on the reservoir. I was told that in order to interview those people (fisherman), I would have to be there at 5:00-5:30am or after it gets dark.

Constantine Riverview Park (Not I&M responsibility):

This park is maintained by the village and has a fishing dock, picnic tables and further up on shore there is a playground area. On a day like today (even though the weather was fair), this is a very popular area. Throughout the day, the park was primarily used as pass-through as many people parked there in the morning for the Memorial Day Parade. I did ask several families as they came to their cars what they thought about the park and all were very positive. This is a very clean park area that is well utilized, and the consensus is that the dock needs to be updated.

Tailwater Fishing Platform:

When I first got to the parking area for the Tailwater Fishing Platform I was very excited because there were 10 cars. I figured I would be able to get a lot of opinions. We were coming from the Boat Launch, so we couldn't see the platform. Again, it was a parking area for the Memorial Day Parade. Everyone that came got in their cars and left. We decided to run over to Riverview Park and look for people. We then returned to the Tailwater fishing platform and found 2 people fishing. A young man (29) and an older man (76). We surveyed them and asked them all the questions and talked with them about the site. Both love it there and fish all the time. The older man said that he came there almost every day. Three important comments: Trash cans, light on the building (see photos) and why isn't there a Porta-John when there is one every other site? I told them I would pass on the comments. Almost everyone comments on the porta-john and lack of a trash can. Many regulars have said that people tend to bring household trash and even steal the trash can. It would also appear that there is no level surface around the tailwater for a Porta-John. Later that afternoon, we saw more people at the Tailwater Fishing Area and went over again. It was the older man's family who came out to fish with him. The day had become very nice and it was a nice family activity. We interviewed his

son and daughter-in-law and their comments included a porta-john and a question about building the dock out further into the river.

Shelby Park:

There is not very much action in the park, but when I went in, there was a man with his grandchildren, and I asked him if he would allow me to ask him some questions (survey). He said gladly. He was born and has lived all his life in Constantine. He really enjoys the river, although the majority of the times he just goes to various sites (mainly Shelby and Riverview parks) to sit and relax. However, as I was talking to him I told him about coming to the boat races, and he happens to be the man in charge of the boat races on Father's Day. He gave me his number and told me to feel free to call him and to see him at the boat races where he would put me in contact with people to talk about the Constantine Site. I also have permission from the American Legion to be on its property during the Boat Races and ask people questions.

Portage Area:

Again, the Portage area is in very good condition. I ran into several fishermen and had them fill out the survey. One man was there with his family and grandchildren, fishing. We talked a great deal about the area, and he said that the community members were very lucky to have the site. There is a concern that someone is actually living at the Portage Site (you can see the fire pit in the photos).

The portage trail is in very poor condition. I spoke with 2 fisherman who we just coming up from the trail. It is in pretty poor shape (probably due to the rain). There is a great deal of trash (see photo) and the bridge along the trail seems to be dangerous because of the step up and down. I think that the area can be improved. If this in fact is a trail to bring a canoe or kayak through to the river, that would be difficult.

Finally, as you can see in the photos, signage at the portage is in pretty poor condition. The sign that tells about the hydro plant is old and should be replaced.

Restrooms:

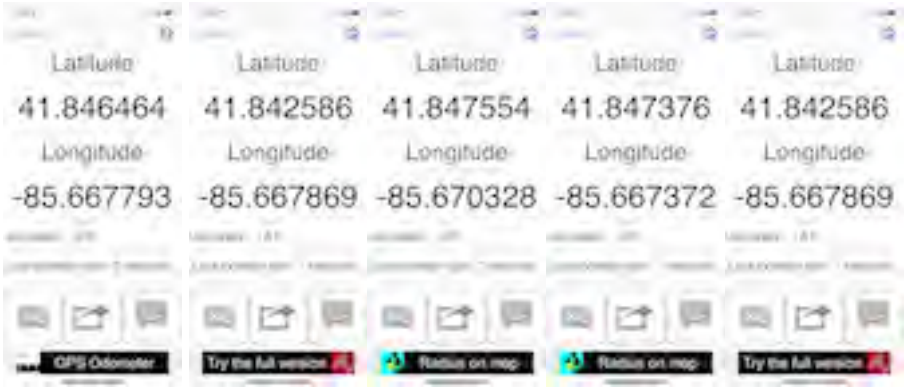
Restrooms at the Canoe Portage area, as well as the Boat Launch are in fair condition.

Trash Receptacles:

There are no trash receptacles, and this topic was mentioned by almost everyone who was interviewed. One person pointed out that the trash receptacles are often stolen or used by people to dispose of household trash which makes it difficult to put trash receptacles at the sites. They are, however, the #1 topic mentioned.

Locations:

I did take screen shots of the phone GPS. Here are the various locations:



Canoe Portage	Riverview Park	Boat Launch	Bank Fishing	Riverview Park

Boat Launch-No new pictures of the boat launch

Riverview Park:

There are a lot of teenagers and younger kids who like to use Riverview Park for fishing and wading.

Tailwater Fishing:

Tailwater Fishing

One of the people fishing says that he has replaced the light by himself several times and that people shoot it out. Fisherman like to fish after dark and a light would help.

Shelby Park:

Park is nice, well cared for, and is in very good shape. Signage needs work.

Portage Area:

It seems like the sign should be replaced.

You can see a fire pit (recent) and there are some signs that a person is staying there.

Step up or down from bridge can be very dangerous.

Trash (bottles and glass) left along the portage trail.

Information About Accessing Online Survey

The following information is placed on windshields of vehicles at the parking areas for the recreation facilities and provided to individuals not wanting to fill out the forms at the sites:

"I & M (Indiana Michigan Power) is conducting a Recreation Study as part of the relicensing of the Constantine Hydroelectric Project FERC No. 10661

Please participate in the Recreation Study by visiting the website below to take a brief online survey intended to gather information about recreational use at the Constantine Hydroelectric Project.

You can follow either link to get to the survey:

www.aephydro.com/HydroPlant/Constantine (click on The Recreation Survey Link

Or go straight to this link:

https://hdrinc.co1.qualtrics.com/jfe/form/SV_by1FPypkLuQRT9z

Thank you!"

CONSTANTINE HYDROELECTRIC PROJECT (P-10661)
RECREATION STUDY – PROGRESS REPORT NO. 2
Progress: June 1 through June 30, 2019

Introduction:

Progress Report No. 2 presents the work completed and observations made by Young Energy Services (YES) related to the Constantine Hydroelectric Project (Project) Recreation Study for the period June 1 through June 30, 2019. Included are reports by YES staff, Jim Lewis and assistant, presenting the field activities accomplished during the referenced time period.

Summary:

YES staff was in the field during the Father's Day weekend (June 15 and 16) to observe activities during the scheduled boat races. As noted in the attached field report, weather had a definite impact on the boat races resulting in minimal participation by the public. YES staff also went to the recreation sites for the Constantine Project on June 28. Again, weather had an impact on recreation activities. In general, usage of the recreation facilities, both those provided by I&M and the Village of Constantine, was similar to that recorded in the month of May. Comments by the public interviewed reflected satisfaction with and appreciation for the facilities that exist.

YES staff was informed of professional hydroplane races on the river scheduled for mid-July. YES staff plans to be on-site during the races to interview spectators and observe activities.

Recreation Report-Constantine Hydroelectric Project-June 2019

June 2019 was a very strange weather month in Michigan. The usual average temperature in June is between 70° and 80°. The temperature was below average almost every day for the first 20 days of June, and most days when the temperature was average, it rained. Kalamazoo experienced a lot of rain during the first half of June (https://wwmt.com/news/local/mother-nature-might-be-confused-kalamazoo-2019-has-seen-more-precipitation-than-seattle). In fact, according to the National Weather Service, the Southwestern Michigan region averages about 2.7 inches of rain in June. In June 2019, Southwest Michigan had over five inches of rain. (There is not a weather station for Constantine, this is based on St. Joseph County).

We spent three days in Constantine in June. The boat races (see photos) happen the weekend of Father's Day. Instead of going only on Father's Day, we went the entire weekend (Saturday and Sunday). On both days the high temperature was approximately 65°, cloudy and overcast. Because of the weather, there were not many spectators, but we interviewed those who were there. If you look at two of the pictures, you can see that one of the popular places to watch the boat races is the Portage area. However, because of the weather, no one was there.

We also spent another day in Constantine, although again the weather was not very good and found perhaps one or two people to interview.

Boat Launch, Riverview Park, Tailwater Fishing, Shelby Park, and the Portage are all as reported in the May report. There was not a lot of use the first part of June. Interestingly, when we ask people about the area, most of them would not add anything to the area and really enjoy the opportunities presented on the river. Many of those interviewed expressed that they are aware of the fact that I&M Power provides some of the recreation facilities in the area and are happy with those that are provided.

There was one comment from people at the boat races. Apparently, there was some type of situation with the Department of Natural Resources in regard to the races and I was told that the races last year were canceled.

In mid-July, there are professional hydroplane races on the river, and we plan to be there to interview spectators. We have been told there are very powerful boats and usually a very large crowd.

Photos from boat races at Constantine Project during Father's Day Weekend

CONSTANTINE HYDROELECTRIC PROJECT (P-10661)
RECREATON STUDY – PROGRESS REPORT NO. 3
Progress: July 1 through July 31, 2019

Introduction:

Progress Report No.3 presents the work completed and observations made by Young Energy Services (YES) related to the Constantine Hydroelectric Project (Project) Recreation Study for the period July 1 through July 31, 2019. Included are reports by YES staff, Jim Lewis and assistant, presenting the field activities accomplished during the referenced time period.

Summary:

As noted in the attached field report, YES staff was at the Project on three separate days in July. Activities during those days were varied ranging from: (1) surveys and interviews on July 1 accomplished similarly as in previous months; (2) inventories and condition assessments of Project and Non-Project recreation facilities on July 17; and (3) attendance at the U.S. Title Series Boat Racing held July 21 by the American Legion. In general, use of the Project and Non-Project facilities was similar to that recorded in previous months. The exception was on July 21 when the boat races occurred. Comments provided by the public interviewed reflected satisfaction with and appreciation for the existing facilities.

Regarding the inventories and condition assessments, most Project and Non-Project recreation facilities were found to be in good condition with only minor maintenance work needed. Exceptions were the canoe portage around the spillway for the Project and the boardwalks at Riverview Park which were damaged during high river flows.

Recreation Report-Constantine Hydroelectric Project-July 2019

The weather at the beginning of July appeared to be a repeat of June. It was cool, overcast, and rainy. However, as the month progressed, we finally got into Michigan weather and even into several very hot and humid days.

There were three trips to Constantine in July. The first was completed by myself and my student (Brandon) on July 1. It was a sunny but cool, so we did not know what to expect. We got down there about 11:00 am (the main road to Constantine, Highway 131 was under construction, so it took us a while to get there). We checked all of the spots and spent the most time at the Tailwater Fishing Area and the Canoe Portage. There is nothing to report from that day because there were no cars in any of the parking areas, and no one fishing or utilizing the river.

The second trip to Constantine was with Frank Simms on July 17th. We spent time at all the areas where Frank completed maintenance reports on the Boat Launch, which is in pretty good shape. There was one car parked there, but I could not see a boat on the lake, so I left a flyer on the windshield. We spent time at the Tailwater fishing area where we saw two men fishing, one of the men with his grandchildren. I took advantage of meeting the men and interviewed one of them. While we were there, one of the men caught several fish, one which was approximately 17-inch small mouth (see photo). Again, Frank conducted measurements and we talked with the men for a while. We went to the Canoe Portage and again Frank took measurements. We walked down the portage trail. As I reported earlier, the trail is not in the greatest shape, and needs work. It would be very difficult to portage canoes or kayaks, through that trail. Frank and I also took a walk on the boardwalk through Riverview Park, most of which has been destroyed by flooding. I know that they had severe flooding in the Spring, and we were able to discuss the flooding with a man who was exercising his dog. The water was powerful and high enough to move several sections of the boardwalk. He said that he had heard that it was going to be repaired but didn't know when.

Our final day in Constantine in July (me and Brandon) was July 21st. We did a run through of all the areas but saw no cars or people. However, July 21st was the U.S. Title Series Boat Racing. We spent a great deal of time at the American Legion Post, site of the racing. We were lucky enough to talk to several people in the crowd, and then spend time walking through the competitor pit areas and even talk to some of the competitors. July 21st was a beautiful, sunny day and a perfect day for racing. Most of the people who attend the races come only for the races, but like the area (usually come each year). All of them were very complimentary of the area, the river (reservoir), the competition, and the community.

Interestingly, when we interview people and ask them the final question on the interview sheet pertaining to what they would add to make the river a better place, almost no one would add or change a thing. Brandon and I spent time watching the race (this was a higher class of boats

then the June races and much faster) and walking through the areas observing license plates. On the following pages you will see pictures of the area, several boats on the course and other pictures of the pit area.

Automobile Count:

We conducted an automobile count at the Boat Races. This is what we found:

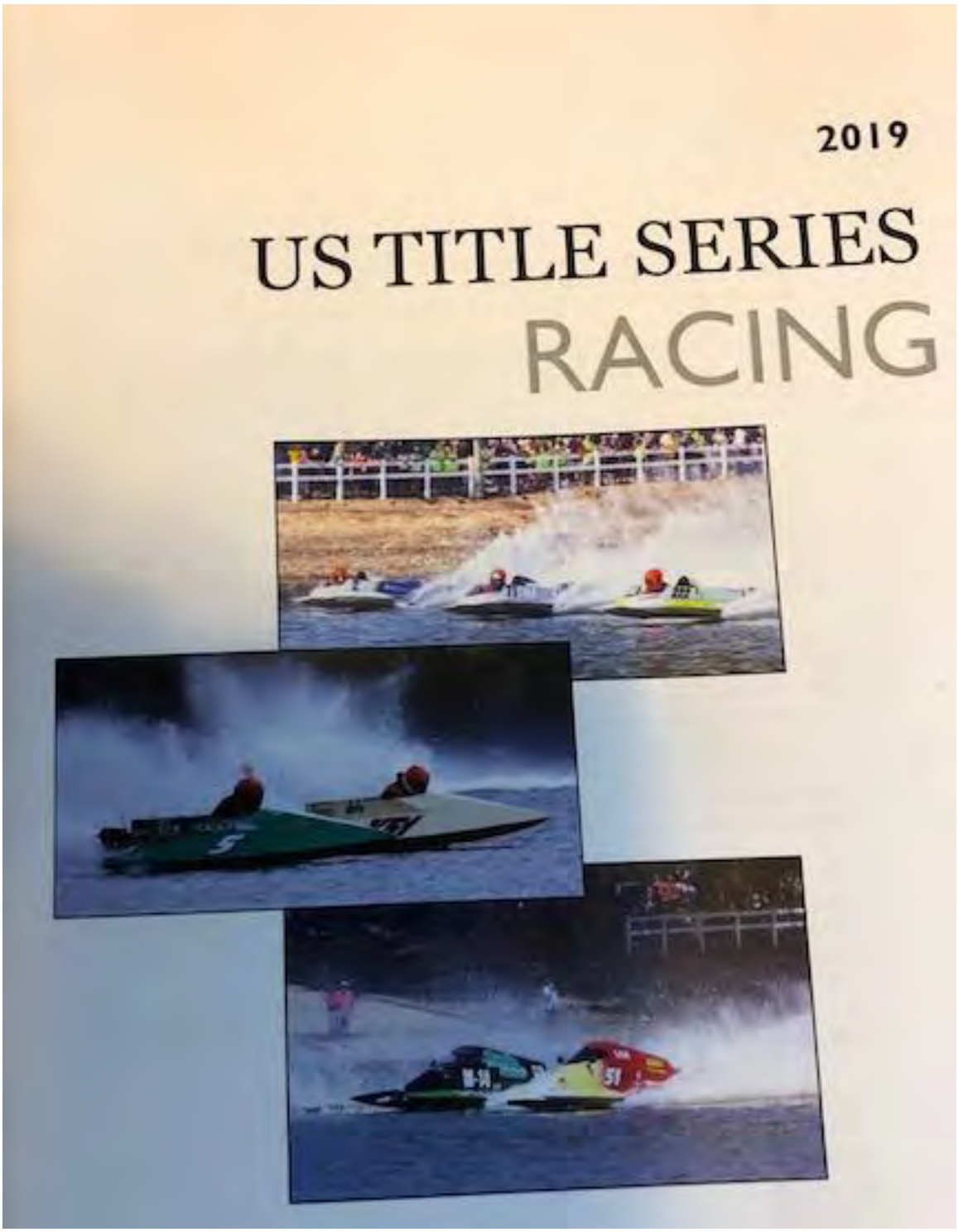
50 Cars

Michigan Plates: 21

Out of State Plates

Florida 5
New York 1
Indiana 3
Iowa 10
Illinois 6
Connecticut 1
Ohio 1
Wisconsin 1
South Carolina 1

July 17th, Constantine Tailwater Fishing, 17.5-inch small mouth bass.



This is the program for the weekend of racing at Constantine. There are 2-3 weekends of racing, the highest class of boat races July 19-21.

Two of the boat classes. Both of these are lower classes because they do not have enclosed cockpits

.

This is a picture of the pits from outside the fence.

This is the parking for competitors who come from all over the Midwest.

One of the boats racing on the course.

Better picture of a higher class of boat.

This is probably the largest participant in the racing. They had about 4 boats from different classes. We had a chance to discuss the races with one of their crew chiefs.

Some of the viewers. It was a very nice day for racing.

CONSTANTINE HYDROELECTRIC PROJECT (P-10661)
RECREATION STUDY – PROGRESS REPORT NO. 4
Progress: August 1 through August 31, 2019

Introduction:

Progress Report No.4 presents the work completed and observations made by Young Energy Services (YES) related to the Constantine Hydroelectric Project (Project) Recreation Study for the period August 1 through August 31, 2019. Included is the report by YES staff, Jim Lewis and assistant, presenting the field activities accomplished during the referenced time period.

Summary:

YES staff was at the Project for two days in August observing activities at the Project and Non-Project recreation sites. Use of the sites was similar to that recorded for the previous months. Of note was the number of vehicles observed at Village of Constantine's Riverview Park. It was also observed that the fencing at the entrance to the Project Reservoir Boat Access which had been noted during the inventory and condition assessments in July as having sections failing was replaced. As for the bridge section in front of the headgate structure shown in the field report photographs attached, it is utilized as a log boom to keep larger floating debris from entering the Project headrace.

Recreation Report-Constantine Hydroelectric Project-August 2019

There were two trips to Constantine in August. The first was completed by myself and my student (Brandon) on August 15th. Temperature wise it was warm, but it was an overcast day. We checked all of the spots and spent the most time at the boat launch speaking with a fisherman about the area. There is very little to report from that day because there were no cars in any of the parking areas, and no one fishing or utilizing the river except for the one person we talked with. In the photos you will notice one picture that is a concern at the entrance to the Portage area. Everyone walks around the gate since it is locked and on one side there is a wire that is about head high that can easily cut a person walking. We also noted that the fence on the side yard of the boat launch was being rebuilt.

The second trip to Constantine was on August 25th. We spent time at all the areas and ran into quite a few people fishing at the canoe portage area. That is sort of unusual because we rarely saw people there fishing. It was interesting because one group of young men had never been fishing there and were anxious to fish. The minute they threw in their lines, one person immediately caught a fish. We interviewed all of them and there was another couple who told me that he comes fishing on the at least three times a week. He points out that about a year ago AEP did construction on the dam and left a walkway in that seems to have ruined the fishing from the boat launch. He has no idea why the walkway was left in, and I told him that I would take pictures and see if we could find an answer. We also found that there were about 7-8 trucks parked at Riverview Park that day (it was a Sunday). No one was there, so I am assuming that they launched some type of boat or kayaks for a day on the river. Seven of the license plates were Michigan, the eighth was from Texas.

Fishermen asked about this bridge. It was put in for construction about a year ago and has created some problems for fishing. Why is it still there?

This is actually wire that is about the height of one's head. It is also sharp. It was a fence to prevent people from walking around the gate, but it is now just pieces of the fence left over.

New fence at the boat launch. (It is now complete.)

Fishermen want to know if this can be cleared to allow more fishing at the portage site. (it is at the bottom of the stairs).

The clearing (in the previous picture,) would be to the left of this fisherman.

CONSTANTINE HYDROELECTRIC PROJECT (P-10661)
RECREATION STUDY – PROGRESS REPORT NO. 5
Progress: September 1 through September 30, 2019

Introduction:

Progress Report No. 5 presents the work completed and observations made by Young Energy Services (YES) related to the Constantine Hydroelectric Project (Project) Recreation Study for the period September 1 through September 30, 2019. Included is the report by YES staff, Jim Lewis and assistant, presenting the field activities accomplished during the referenced time period.

Summary:

As noted in the attached summary of field activities, YES staff was at the Project on September 27 and 29. For one of those days (September 29), weather conditions were such that recreation activities at the Project were non-existent. On the 27th, recreation activities were observed as were improvements made by the Village of Constantine at Riverview Park and by I&M at the Reservoir Boat Launch. Inclement weather precluded recreation activities taking place during the weekend days for the Labor Day holiday.

The observations made during the month of September represent the conclusion of field work for the Recreation Study. Information collected during interviews of individuals at the Project and Non-Project related recreation facilities is being reviewed and assembled along with the condition inventories and assessments. The surveys submitted electronically by recreationists will need to be obtained in order to be incorporated into the Recreation Study Report to be prepared by YES for the Constantine Hydroelectric Project.

Recreation Report-Constantine Hydroelectric Project-September-2019

There were two trips to Constantine in September. The first was Friday, September 27th. It was cool and overcast that day and there was not a lot going on. The first thing that I did was to go to the American Legion and check out the condition of the boat launch and shoreline. The Legion has a very nice boat launch and the shoreline is accessible in a lot of places. Anyone can use the shoreline if they purchase a permit from the Legion. I have no idea how many permits they sell because I have never observed anyone using the area by the Legion.

From there I went to the boat launch. There were two trucks with boat trailers at the boat launch. I put flyers on the windshields directing them to the web site. They have also put up a new fence along the property (City or AEP..see photo). After that I checked all of the spots. It was interesting because I was at Riverview Park and as I drove up I noticed people launching a boat with electronic equipment on it. I went to the area and took pictures and they came in to speak with me. They were from GLEC in Traverse City, a firm that is doing a fish count for HDR. We talked for a little while about the area and then I noticed that at Riverview the boat launch has been improved with new retaining walls and gravel (see photo's). They have done a great job fixing it up. (Another photo from across the river shows all the gravel). Aside from that there were very few people around, but I did notice someone fishing near the dam. I went over to the tailwater fishing area and noticed that the fisherman was someone who I had interviewed on a previous trip. We sat and talked about the river and fishing and as I have said, a lot of people are very content with the fishing in the area. One observation that I did make was the silt buildup by the boat launch which is probably the result of the lowering of the river.

I planned to go on Sunday, September 29th and got there and it poured. Of course, there were not boats on the river and there was no fishing. The storm started Friday, let up for a while at Saturday, and started again Saturday night. By Sunday afternoon, Constantine had received about 2 inches of rain.

American Legion Boat Launch

Latitude: 41.850980

Longitude: -85.666892

Permit Sign at American Legion Boat Launch

Movable Dock at American Legion (used for boat races)

Boat Launch at the American Legion

Shoreline at the American Legion

Completed fence at I&M Reservoir Boat Launch

Silt at the I&M Boat Launch

Side of the boat launch at Riverview Park

Improvements at Riverview Park

Appendix I. Cultural Resources Study

(filed as privileged)

Yayac, Maggie

Subject: FW: Constantine Hydroelectric Project (FERC No. 10661) -- Filing of Initial Study Report
Attachments: Constantine Initial Study Report Cover Letter.pdf

From: Hanson, Danielle
Sent: Wednesday, April 15, 2020 9:03 AM
To: 'Advisory Council on Historic Preservation' <jeddins@achp.gov>; 'Cass County Conservation District' <korie.blyveis@macd.org>; 'Forest County Potawatomi Community' <michael.laronge@fcpotawatomi-nsn.gov>; 'Friends of the St. Joe River Association Inc.' <fotsjr.outreach@gmail.com>; 'Michigan Department of Environmental Quality' <antieauc@michigan.gov>; 'Michigan Department of Natural Resources' <KRUGERK@michigan.gov>; 'Michigan DNR' <MistakJ@michigan.gov>; 'Michigan DNR' <ThiamkeelakulK@michigan.gov>; 'Michigan Hydropower Relicensing Coalition' <stuberbob@gmail.com>; 'NOAA' <Michael.Pentony@noaa.gov>; 'Pokagon Band of Potawatomi Indians' <kelly.curran@pokagonband-nsn.gov>; 'St. Joseph River Basin Commission' <paddleheadz@gmail.com>; 'US Deparment of the Interior' <Mary.Manydeeds@bia.gov>; 'US Department of Agriculture' <martin.rosek@mi.usda.gov>; 'US Environmental Protection Agency' <pelloso.elizabeth@epa.gov>; 'US Environmental Protection Agency' <westlake.kenneth@epa.gov>; 'US Fish and Wildlife Service' <Jack_Dingledine@fws.gov>; 'USGS MI Water Science Center' <tlweaver@usgs.gov>; 'USGS MI Water Science Center' <dhubbell@usgs.gov>; 'Village of Constantine' <skelton-m@comcast.net>; 'Village of Constantine, Village Manager' <mhoneysett@comcast.net>; 'Village of White Pigeon' <whitepigeonvillage@comcast.net>
Cc: 'Jonathan M Magalski (jmmagalski@aep.com)' <jmmagalski@aep.com>; Elizabeth B Parcell <ebparcell@aep.com>; Quiggle, Robert <Robert.Quiggle@hdrinc.com>
Subject: Constantine Hydroelectric Project (FERC No. 10661) -- Filing of Initial Study Report

Constantine Hydroelectric Project Stakeholders:

Indiana Michigan Power Company (I&M), a unit of American Electric Power (AEP), is the licensee, owner and operator of the Constantine Hydroelectric Project (FERC No. 10661) (Project) located on the St. Joseph River in St. Joseph County, Michigan. The Project is operated under a license issued by the Federal Energy Regulatory Commission (FERC). The existing FERC license for the Project expires on September 30, 2023. I&M is pursuing a new license for the continued operation of the Project in accordance with FERC's Integrated Licensing Process (ILP). Pursuant to the ILP, I&M filed the Initial Study Report (ISR) for the Project on April 14, 2020. The ISR describes the status and results of the studies that I&M conducted in support of Project relicensing.

On behalf of I&M, we are notifying stakeholders of the availability of the ISR. For your convenience, a copy of the cover letter filed with the ISR is attached. Please note that, due to file size restrictions, the ISR has not been included in this email. I&M encourages stakeholders to view the filing online at FERC's eLibrary at https://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=15510064. I&M will also be adding the ISR to the Project's public relicensing website (http://www.aephydro.com/HydroPlant/Constantine) in the coming days.

The Commission's regulations at 18 C.F.R. § 5.15(c) require I&M to hold an ISR Meeting with participants and FERC staff within 15 days of filing the ISR. Accordingly, I&M will hold an ISR Meeting (via Webex) from 9 AM to 4 PM on April 23, 2020.

To allow for adequate planning, I&M respectfully requests that those planning on joining the ISR Webex Meeting RSVP by emailing Jon Magalski at jmmagalski@aep.com on or before close of business April 21, 2020.

Should you have any questions regarding this filing or the ISR Meeting, please contact Jon Magalski with AEP at (614) 716-2240 or jmmagalski@aep.com.

Thank you,

Danielle Hanson
Environmental Scientist

American Electric Power
1 Riverside Plaza
Columbus, OH 43215
aep.com

April 27, 2020

Subject: Constantine Hydroelectric Project (FERC No. 10661)
Cultural Resources Study Reports

Dear Consulting Parties:

Indiana Michigan Power Company (I&M), a unit of American Electric Power (AEP), is the Licensee, owner, and operator of the 1.2 megawatt Constantine Hydroelectric Project (Project) (FERC Project No. 10661). The Project is located along the St. Joseph River in St. Joseph County, Michigan.

I&M operates and maintains the Project under a license from the Federal Energy Regulatory Commission (FERC or Commission). The Project's existing license expires on September 30, 2023. I&M is pursuing a subsequent license for the Project using the Commission's Integrated Licensing Process (ILP) as defined in 18 Code of Federal Regulations (CFR) Part 5.

I&M has conducted studies as provided in the March 15, 2019 Revised Study Plan (RSP) and approved in the Commission's April 9, 2019 Study Plan Determination (SPD) for the Project. In accordance with 18 CFR § 5.15, I&M filed the Initial Study Report (ISR) with the Commission on April 14, 2020. The reports associated with the approved Cultural Resources Study were filed as privileged appendices to the ISR. I&M is hereby providing the attached Cultural Resources Study Reports for your review. I&M respectfully requests your concurrence with the results and recommendations provided in the attached reports within 30 days of receipt of this letter.

Pursuant to the approved Cultural Resources Study Plan, I&M is also consulting with the Michigan State Historic Preservation Officer, Forest County Potawatomi Community, Pokagon Band of Potawatomi Indians (PBPI), Nottawaseppi Huron Band of the Potawatomi, and the Miami Tribe of Oklahoma (collectively, the "Consulting Parties") regarding Traditional Cultural Properties (TCP). TCPs are properties of traditional religious and cultural importance to Native American Tribes that are eligible for inclusion in the National Register of Historic Places (NRHP). TCPs may be eligible for inclusion in the NRHP because of their association with cultural practices or beliefs of a living community that are: (1) rooted in that community's history; and (2) important in maintaining the continuing cultural identity of the community.

I&M recognizes the special expertise of Native American Tribes to identify and assess TCPs within the Project's Area of Potential Effects (APE). To date, I&M has not identified or been made aware of any TCPs or potential TCPs within the Project's APE. Should the Consulting Parties have additional information or wish to continue consultation regarding TCPs, please notify I&M in writing within 30 days of your receipt of this letter.

If there are any questions regarding these reports, please do not hesitate to contact me at (614) 716-2240 or jmmagalski@aep.com.

Sincerely,

Jonathan M. Magalski
Environmental Specialist Consultant
American Electric Power Services Corporation, Environmental Services

Cc: Distribution List
Liz Parcell (AEP)
Rob Quiggle (HDR)

Constantine Hydroelectric Project (FERC No. 10661)
Cultural Resources Study Reports
Distribution List

State Agency

State Historic Preservation Office
735 East Michigan Avenue
PO Box 30044
Lansing, MI 48909

Tribes

Mr. Michael LaRonge
Tribal Historic Preservation Officer
Forest County Potawatomi Community
5320 Wensaut Lane
PO Box 340
Crandon, WI 54520

Ms. Kelly Curran
Pokagon Band of Potawatomi Indians
58620 Sink Road
PO Box 180
Dowagiac, MI 49047

Nottawaseppi Huron Band of the
Potawatomi
1485 Mno-Bmadzewen Way
Fulton, MI 49052

Diane Hunter
Tribal Historic Preservation Officer
Miami Tribe of Oklahoma
P.O. Box 1326
Miami, OK 74355

American Electric Power
1 Riverside Plaza
Columbus, OH 43215
aep.com

Via Electronic Filing

May 8, 2020

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

Subject: Constantine Hydroelectric Project (FERC No. 10661)
Summary of Initial Study Report Meeting

Dear Secretary Bose:

Indiana Michigan Power Company (I&M), a unit of American Electric Power (AEP), is the Licensee, owner, and operator of the 1.2 megawatt Constantine Hydroelectric Project (Project) (FERC Project No. 10661). The Project is located along the St. Joseph River in St. Joseph County, Michigan.

I&M operates and maintains the Project under a license from the Federal Energy Regulatory Commission (FERC or Commission). The Project's existing license expires on September 30, 2023. I&M is pursuing a subsequent license for the Project using the Commission's Integrated Licensing Process (ILP) as defined in 18 Code of Federal Regulations (CFR) Part 5.

Pursuant to 18 CFR § 5.15(c), I&M filed the Initial Study Report (ISR) with the Commission on April 14, 2020. The timely filing of the ISR was consistent with the requirements of the ILP and with the pre-filing process plan and schedule presented in I&M's June 4, 2018 Pre-Application Document and in the Commission's Scoping Document 1 and Scoping Document 2, dated July 25, 2018 and November 13, 2018, respectively.

The Commission's regulations direct license applicants to convene an Initial Study Report Meeting (ISR Meeting) within 15 days of filing the ISR. Therefore, concurrent with the April 14, 2020 filing of the ISR, I&M filed notification that the ISR Meeting would be held on April 23, 2020.

The ISR Meeting was held from 9:00 a.m. to approximately 12:00 p.m. on April 23, 2020. The Commission's regulations at 18 CFR § 5.15(c)(3) require I&M to file this summary of the ISR Meeting, including any proposed modifications to ongoing studies or new studies proposed by the Licensee, within 15 days of the ISR Meeting.

1.0 Purpose and List of Participants

1.1 Purpose

In accordance with 18 CFR § 5.15(c)(2), I&M held an ISR Meeting with the relicensing participants and the Commission staff via Webex to discuss the study results and the Licensee's or other participant's proposals, if any, to modify the study plan in light of the progress of the study plan and data collected.

The study plan approved by the Commission directed I&M to conduct 8 studies in support of relicensing the Project:

1. Botanical Resources Study
2. Shoreline Stability Assessment
3. Water Quality Study
4. Wetlands Study
5. Recreation Study
6. Cultural Resources Study
7. Fisheries Survey
8. Mussel Survey

The purpose of this ISR Meeting was to discuss available study results and any proposals to modify the study plans in light of the progress of studies and data collected.

In furtherance of these objectives, I&M presented information regarding the relicensing process for the Project, and specific information regarding each approved study, including:

- Study status;
- Summary of study methods and results; and
- Variances from the approved study plan.

A copy of the presentation is attached to this ISR Meeting Summary.

1.2 Participants

Concurrent with the April 14, 2020 filing of the ISR, resource agencies, Tribes, non-governmental organizations, and other interested parties were invited to participate in the ISR Meeting. Table 1 presents the meeting participants and their respective organization/affiliation.

TABLE 1
CONSTANTINE PROJECT ISR MEETING PARTICIPANTS

Participant	Organization / Affiliation
Lee Emery	Federal Energy Regulatory Commission (FERC)
Colleen Corballis	Federal Energy Regulatory Commission (FERC)
Michael Davis	Federal Energy Regulatory Commission (FERC)
Laura Washington	Federal Energy Regulatory Commission (FERC)
Paul Makowski	Federal Energy Regulatory Commission (FERC)
Scott Hicks	U.S. Fish and Wildlife Service (USFWS)
Kyle Kruger	Michigan Department of Natural Resources (MDNR)
Kesiree Thiamkeelakul	Michigan Department of Natural Resources (MDNR)
Amira Oun	Michigan Department of Environmental Quality (MDEQ) now known as Michigan Department of Environment, Great Lakes, and Energy (EGLE)
Bob Stuber	Michigan Hydro Relicensing Coalition
Jon Magalski	American Electric Power (AEP)
Liz Parcell	American Electric Power (AEP)
Christina Svoboda	American Electric Power (AEP)
Yun Gao	American Electric Power (AEP)
Rob Quiggle	HDR Engineering, Inc. (HDR)
Danielle Hanson	HDR Engineering, Inc. (HDR)
Dennis McCauley	Great Lakes Environmental Center, Inc. (GLEC)
Bill Arnold	Great Lakes Environmental Center, Inc. (GLEC)
Philip Mathias	EnviroScience, Inc. (EnviroScience)
Ryan Schwegman	EnviroScience, Inc. (EnviroScience)

2.0 Summary of ISR Meeting

As noted above, I&M presented information regarding the relicensing process, approved pre-filing schedule, and study activities to date. This information is summarized in the presentation attached to this ISR Meeting Summary. The following sections summarize the information presented and the discussion/questions in regards to the approved studies.

2.1 Introduction

Jon Magalski (AEP) provided an introduction to the meeting and everyone introduced themselves to the group. Jon Magalski discussed the filing of the ISR, purpose of the ISR Meeting, and reviewed the agenda. The overall Process Plan and Schedule for the Project was also reviewed. The logistics and requirements for requesting modifications or new studies were presented to the

group as well upcoming ILP milestones. An opportunity was given for general questions regarding process, etc. There were no questions from the group.

2.2 Botanical Resources Study

Dennis McCauley (GLEC) presented the objectives of, methods for, and results of the Botanical Resources Study.

Summary of Study Methods and Results

- The main goal of this study was to describe the vegetation types within the Project boundary. All observations and data collected were within the Project boundary.
- Historically, the Project area was described as a "mixed hardwood community". However, as a result of this study GLEC further described the Project area as more of a floodplain forest.
- There were a number of rare, threatened and endangered (RTE) species as well as invasive plant species that were identified to search for and document during the surveys. A list of these plant species was developed and is included in Table 1 of the Botanical Resources Study Report.
- Habitat maps were developed using historical inventories from the Michigan Natural Features Inventory and GoogleEarth. Those maps were then taken into the field to be ground-truthed.
- Field biologists paid specific attention to RTE and invasive species during the surveys. It was noted that the Project area is heavily agricultural.
- Three map figures are included in the Botanical Resources Study Report. Figure 1 shows RTE species locations, Figure 2 shows invasive species locations, and Figure 3 shows vegetation and land cover.
- Table 1 of the study report lists the 11 species of interest for the study. During the inventory, a total of 23 non-native species were discovered. In addition to this study AEP conducts annual invasive plant surveys, which began in 2016. GLEC relied heavily on this information for this study. Purple loosestrife is most concentrated in the island areas in the upper reservoir and Eurasian watermilfoil is present throughout the Project area.
- GLEC also searched for wild rice beds and did not find any, although they have been documented in the area historically.
- Jon Magalski clarified that AEP has been conducting invasive species surveys as early as the 1990s and those reports have all been filed with FERC. For clarity, invasive species surveys for purple loosestrife and Eurasian watermilfoil formally began in 1998.
- Figure 2 from the study report was presented to the group showing the invasive species locations. Dennis McCauley pointed out that the main invasive species were purple loosestrife and Eurasian watermilfoil.

Variances from FERC-approved Study Plan

- The study plan stated that high resolution aerial imagery would be used. However, this was not available for the Project area and GoogleEarth was used for field mapping and ESRI imagery was used to develop the maps that are included in the study report.

- The vegetation community in the Project area was previously described as "mixed hardwood", but based on field observations GLEC biologists recharacterized the Project area as a floodplain forest.

Questions

- There were no questions from the group related to this study.

2.3 Shoreline Stability Assessment

Dennis McCauley presented the objectives of, methods for, and results of the Shoreline Stability Assessment.

Summary of Study Methods and Results

- The field work associated with this study was completed in the summer of 2019. The goal of this study was to observe the entire reservoir and focus on spots of instability or erosion. The Rosgen Method was used to score each site as high, medium, or low.
- Sites were visited in June and September concurrent with the Fisheries Survey. In June, 57 sites were visited, with 12 of those sites located in the bypass reach and 45 in the reservoir. In September, 31 sites were evaluated, with 8 of those sites located in the bypass reach and 23 in the reservoir.
- As mentioned previously, the Rosgen Method was used to score the sites based on root depth, root density, surface protection, and bank angle. The sites that were evaluated in June ranged from low to moderate; there were no high ratings. Similar results were recorded in September. Site BA 16 was rated as moderate with some soil falling into the bypass reach. There was also very little vegetation cover at this site.
- There were no areas of high erosion or instability documented in the study area. Some of the photos in the study report show areas of hardened shorelines that include riprap, which was taken into account when trying to apply the Rosgen Method so that the values were not being over or under estimated.

Variances from FERC-approved Study Plan

- There were no variances from the FERC-approved Study Plan.

Questions

- Paul Makowski (FERC) asked if there was a figure in the study report that showed the locations of the sites that were assessed and noted that it would be helpful for the reader.
- Dennis McCauley stated that Figure 1 shows the locations of the sites, but it would be good to update the figure to include the site numbers.
- Paul Makowski also asked what was used for the root depth if the Rosgen Method does not take into account the hardened areas. He inquired if those sites with hardened areas would be the ones labeled as Not Applicable.
- Dennis McCauley responded that the hardened areas were recorded as Not Applicable.

2.4 Water Quality Study

Dennis McCauley presented the objectives of, methods for, and results of the Water Quality Study.

Summary of Study Methods and Results

- Continuous water temperature and dissolved oxygen (DO) monitoring was conducted from May 1 through October 31, 2019.On a monthly basis GLEC conducted discrete multi-parameter water quality sampling using an YSI ProDSS handheld unit at each of the continuous monitoring locations. During the monthly data collections, GLEC calibrated data loggers and replaced any missing data loggers.
- Additionally, discrete water quality data was collected during the Fisheries Survey and is provided in the Fisheries Survey Report.
- GLEC collected sediment samples in the upper, middle, and lower reservoir along transects.
- Figure 1 in the Water Quality Study Report shows the locations of all of the water quality sampling sites.
- All of the water quality data collected has been plotted and is included in the appendices of the Water Quality Study Report. The data collected shows typical diurnal fluctuation.
- There was a lot of vandalism with the data loggers. Sometimes they were pulled out of the water and a few of the data loggers were actually cut from the cables and removed.
- For the continuous data loggers, a backup logger was deployed at each location in case there were any issues. In most instances when there were issues with the loggers, data was able to be used from the backup data logger. A lot of times the issues experienced were due to human interference and people pulling the loggers out of the water.
- There were a few occasions where the river flows pushed the data loggers up onto the shore and the loggers were temporarily out of the water. Some instances of rapidly declining DO occurred when the logger was desiccated and out of the water, but those instances were very low.
- Primary observations during the study:
    - Water quality data collected in the reservoir and power canal fell within the state thresholds for the entire monitoring period.
    - Water temperature was exceeded downstream of the Fawn River in October, but it was very close to the accuracy range of the data logger.
    - In the tailrace, DO readings were below the state thresholds on July 16, 2019. Due to probe damage and malfunction, only one data logger was recording in July so there was not a second set of data to verify low DO readings.
    - Instantaneous DO readings in the bypass reach were below the state threshold on multiple dates in August. During this time there was no water coming over the spillway and all of the water was going through the power canal.
    - All of the data collected is plotted and provided in Appendix A of the Water Quality Study Report.
- FERC's Study Plan Determination (SPD) did not require I&M to conduct sediment chemistry sampling. However, it was conducted at the request of MDNR and EGLE. Samples were compared to published sediment quality guidelines. Sediment chemistry is affected greatly by agricultural and industrial influences beginning upstream of Three Rivers. Sediment chemistry results are pretty homogenous throughout the St. Joseph River.
- In the Project area, mercury was slightly above the threshold, lead was equal to the threshold, and arsenic exceeded the threshold. Even though the levels were at or above the

thresholds they are not likely to have an adverse effect on aquatic life or human health. Mercury and lead concentrations were measured at or near the Threshold Effects Level and Effect Range Low which would indicate a very low risk to aquatic life. Arsenic concentrations in the lower reservoir were measured at concentrations that may adversely affect aquatic life, but were at concentrations less than the median effects level.

Variances from FERC-approved Study Plan

- There was physical disturbance of the data loggers due to human interference and high flows in the bypass reach.
- Data is missing from the bypass reach upstream of the Fawn River from June 27 through August 1, 2019 because both data loggers were discovered to be missing.
- FERC did not require I&M to conduct sediment sampling, but I&M conducted it per resource agencies' requests.

Questions

- There were no questions from the group related to this study.

2.5 Wetlands Study

Dennis McCauley presented the objectives of, methods for, and results of the Wetlands Study.

Summary of Study Methods and Results

- Field work was completed in 2019 when everything was in bloom and the river flows were low. The study included a field inventory and mapping portion.
- Bill Arnold (GLEC) stated that the maps developed for the Wetlands Study Report were based on USFWS' National Wetland Inventory (NWI) maps. The existing wetland acreage to be reviewed was clipped out within the Project boundary.
- Field biologists visited the wetland areas identified in the NWI maps to verify and update any wetland classifications as necessary. Biologists went to all of the wetland areas and documented any changes they noticed in relation to the NWI maps. There were very few minor changes in the upper reservoir area. The only larger change was an island near the powerhouse. GLEC biologists reclassified the wetland from Freshwater Emergent Wetland (PEM1C) to Forested Shrub Wetland (PFO1C).
- Wetlands were accessed via boat and biologists stepped out to make observations from shore if possible, or observations were made from the boat if they were unable to access the shoreline. No wetland delineations were performed as part of this study.
- Field survey notes for the 48 sites that were visited are included in Section 7 of the Wetlands Study Report. Biologists identified any changes to wetland types and updated acreages as necessary.
- Figure 1 of the Wetlands Study Report shows the locations of wetlands and labels the 48 sites that were visited during the survey. There were some slight changes in classifications from scrub-shrub to emergent due to the purple loosestrife infestations. The island between the powerhouse and the bypass reach was reclassified as a Forested Shrub Wetland instead of a Freshwater Emergent Wetland.

- The observations made by the field biologists were similar to what was described in the Pre-Application Document (PAD). The total acreage was also similar to what was reported in the PAD, with minor changes to classifications. There is a lot of purple loosestrife present in the Project area that is changing the wetland areas in the upper reservoir.

Variances from FERC-approved Study Plan

- Section 11 of the Revised Study Plan (RSP) variously describes the wetlands study area as wetlands within or adjacent to the Project boundary. Biologists made observations of wetlands within the FERC Project boundary.
- Soil survey maps were not used in the wetlands survey or post-survey mapping exercises as it was determined to be unnecessary.
- Section 7 of the Wetlands Study Report provides field survey notes that document where biologists have agreed with NWI wetland classifications or proposed minor changes to wetland types.
- The RSP stated that USFWS NWI and EGLE wetland maps would be used during the study. These maps appeared to be the same so GLEC only used the NWI maps.

Questions

- There were no questions from the group related to this study.

2.6 Recreation Study

Danielle Hanson (HDR) presented the objectives of, methods for, and results of the Recreation Study.

Summary of Study Methods and Results

- The Recreation Study was conducted by Young Energy Services.
- A Recreation Facility Inventory and Condition Assessment was performed for all existing Project and non-Project recreation facilities in the Project area.
- Visitor use data was also collected at all existing recreation sites through a combination of in-person surveys, field reconnaissance, and photographic documentation.
    - Recreation visitor use data was collected from May through September of 2019, generally from 8:00 AM until 6:00 PM.
- Field surveys were conducted on May 22 and 27, June 15, 16 and 28, July 1 and 21, August 15 and 25, and September 27 and 29.
- A team of two technicians rotated between the recreation sites in random order and conducting interviews with willing participants. Technicians also recorded relevant conditions, including observed recreational activities, estimated number of vehicles, and number of recreational users, along with other general information. A total of 21 recreation surveys were completed in the field.
- I&M also developed an online version of the interview questions for respondents to provide survey responses electronically.

  - The online survey was available from May 1 through September 30, 2019. A notice of the online survey was posted to AEP's relicensing website and signs were posted at each of the Project's recreation facilities notifying recreationists of how to complete the survey.
  - Seven online surveys were completed during the study period.
- Results of the survey show that the existing Project and non-Project recreation facilities are well maintained and utilized by the public.
- Overall, the public is pleased with the recreation facilities provided by I&M, St. Joseph County, and the Village of Constantine.
  - The cooperative effort of I&M and local governments has resulted in recreation facilities that meet the goals and objectives of the relevant recreation plans and also contribute to the economies of the area. This is evident based on the number of people that travel to the area for the annual boat race and other individuals that travel to the area to canoe/kayak, and fish the river and reservoir. One individual that completed the survey traveled approximately 600 miles, while a couple of other survey respondents traveled 200 and 150 miles to the Project area.
- The primary recreation activities observed were boat fishing, bank fishing, fishing in the trailrace area, and pleasure boating.
- Survey respondents indicated that their overall experience at the Project was totally acceptable.
- Overall, survey respondents appear to be very satisfied with the existing recreation facilities in the Project area.
  - Suggested improvements at the recreation sites were detailed in Section 2.3.1 of the Recreation Study Report.
  - Recommended improvements were signage improvements, identifying Americans with Disabilities-accessible parking, and improvements to vegetation management.
  - The Project recreation site with the most recommended improvements was the canoe portage. Suggested improvements were: better signage, upgraded walking surface, and increasing the trail width.

Variances from FERC-approved Study Plan

- There were no variances from the FERC-approved Study Plan.

Questions

- There were no questions from the group related to this study.

2.7 Cultural Resources Study

Rob Quiggle (HDR) presented the objectives of, methods for, and results of the Cultural Resources Study.

Summary of Study Methods and Results

- The Cultural Resources Study was conducted by the Commonwealth Heritage Group (Commonwealth).
- The study was initiated by consulting with the Michigan State Historic Preservation Office (SHPO) and Tribes regarding the Area of Potential Effects (APE). I&M received a response from the Forest County Potawatomi concurring with the general APE. I&M never received a response from the SHPO.
- Commonwealth conducted a background literature review and architectural and archaeological investigations. The background research was conducted using the APE consistent with the FERC Project boundary, including an additional one-mile buffer.
- The Project facilities were surveyed and recommended as eligible for the National Register of Historic Places.
- I&M was in the process of distributing hardcopies of the Cultural Resources Study Reports to the SHPO and Tribes.
- I&M will continue to consult with the SHPO and Tribes regarding Traditional Cultural Properties.
- The Tribes were interested in the presence of wild rice in the Project area. No wild rice beds were identified during the Botanical Resources Survey.

Variances from FERC-approved Study Plan

- There were no variances from the FERC-approved Study Plan.

Questions

- Michael Davis (FERC) asked for clarification that the SHPO and Tribes had not yet received copies of the Cultural Resources Study Reports. Rob Quiggle stated that the reports were being mailed out the following day.

2.8 Fisheries Survey

Dennis McCauley presented the objectives of, methods for, and results of the Fisheries Survey.

Summary of Study Methods and Results

- Field work was completed in 2019. GLEC received the scientific collector's permit prior to conducting field work and notified the appropriate individuals when they were on-site conducting surveys.
- Two sampling events were completed: one in the late spring/early summer and one in late summer/early fall. The gear types used for both sampling events were boat electrofishing and fyke nets. Various habitat types were targeted during the surveys.
- Intake velocities were also measured upstream of the trashracks. Due to interference with the equipment and the hydro plant, intake velocity measurements were moved further upstream from the trashracks than stated in the RSP.
- Kyle Kruger (MDNR) asked what distance upstream of the trashracks the velocity measurements were taken. Dennis McCauley stated that he was not sure of the exact distance and would have to double check, but he thought it was approximately 100 feet

upstream of the trashracks. Kyle Kruger commented that MDNR usually looks for velocity data to be collected right at the trashracks and that MDNR will take another look at the data provided in the Fisheries Survey Report.

- Lee Emery (FERC) asked for a list of fish species that were collected in the power canal during a different survey that was conducted be another contractor in 2019. Dennis McCauley referred to Table 3 in the Fisheries Survey Report that includes several surveys conducted by other contractors, including the survey conducted in the power canal in 2019.
- Lee Emery asked what the depth was in the bypass reach. Dennis McCauley did not know the water depth offhand, but stated that it was more difficult to electrofish in the summer because the boat was bouncing off objects in the river.
- Lee Emery asked if I&M had a separate report for the fish collection effort and mussel relocation that was performed in 2019. Jon Magalski stated that I&M has the report for that effort and could either email it to Lee Emery or efile it with FERC. The subject report was efiled concurrently with this ISR Meeting Summary.
- Two figures were presented to the group. Figure 1 showed all of the electrofishing and fyke net locations, and Figure 2 showed where the velocity transects were recorded.
- Fish tissue samples were not required by FERC's SPD, but I&M decided to collect them anyways based on comments from the resource agencies and because they were required in the Mottville Project's license (next Project downstream, owned by AEP).
- During fish collections in June and September of 2019, 46 species of fish were documented. There were several fish species collected in past surveys that were not collected during the 2019 survey. There were also several species collected in the 2019 survey that had not been collected during past surveys. Almost 2,500 fish were collected during the 2019 surveys.
- Intake velocities collected in 2019 were similar to those collected during the previous survey in 1990-1991. Intake velocities were compared to fish swim speeds in Table 11 of the Fisheries Survey Report.
- Lee Emery inquired as to whether there was a good variation of age classes among the fish that were collected during the 2019 surveys. Dennis McCauley recalled that there appeared to a good age class distribution in the 2019 survey.

<u>Variances from FERC-approved Study Plan</u>

- At some of the fish collection locations, Secchi disk readings were not able to be collected due to the swift current.
- Intake velocity measurements were collected further upstream than 1-foot in front of the trashracks because of interference experienced with the Acoustic Doppler Current Profiler.
- The power canal was not sampled due to issues with access and safety concerns. However, based on data from a previous survey in 2019 and consultation with MDNR it was determined that sampling the power canal was not necessary.
- There were not enough Common Carp or Channel Catfish collected during the survey for the fish tissue sampling so Shorthead Redhorse were substituted to represent the bottom

feeder species. GLEC still has samples of the fish tissues that were collected and would be willing to share them with the resource agencies if requested. The fish tissue samples are still at the lab being analyzed and will be provided to stakeholders once the analyses are complete.

Questions

- Questions were received from the group throughout the discussion and are included in the Summary of Study Methods and Results section above.

2.9 Mussel Survey

Philip Mathias (EnviroScience) presented the objectives of, methods for, and results of the Mussel Survey.

Summary of Study Methods and Results

- The mussel surveys were completed in 2019. The study area is classified as a Group 2S stream known to host threatened and endangered species. EnviroScience submitted a Mussel Survey Sampling Plan with the scientific collector's permit application.
- The survey was a qualitative survey, with a semi-quantitative component, that used both visual and tactile methods.
- The study plan stated that two sampling sites would be located in the Project's reservoir, one above Fawn River, and one below Fawn River. One of the sampling locations in the bypass reach ended up being at the mouth of the Fawn River due to access issues with maneuvering the 24-foot boat around all of the rocks in the river.
- Discrete water quality samples were collected at each of the sampling sites.
- Thirty subsamples were collected at each sampling location. Approximately five hours of diving and searching was performed at each site.
- A lot of the species found during the 2019 were also found in previous studies. Table 4 of the Mussel Survey Report compares the species collected in the EnviroScience 2019 survey to other previous studies. A total of 19 different species have been found in previous surveys. EnviroScience found 12 species during the 2019 survey. The headrace study conducted by Cardno in 2019 found 11 species.
- It was documented that there was quite a bit of recruitment in the downstream area of the Project.
- Appendix B of the Mussel Survey Report contains shell length histograms of each species. Most of the histograms had a bell-shape curve.
- The state-listed threatened and species of concern were found during the surveys. They were only found dead in the downstream area and were found live in the headrace. Table 1 of the Mussel Survey Report details the state-listed species and species of concern that were collected during the surveys.
- There were a few species that had been found in previous studies that were not found in the 2019 EnviroScience survey.

- Zebra mussels were present in the downstream areas. Based on the small number of zebra mussels (one or two) present on the mussels collected, it did not appear to be a large infestation.

Variances from FERC-approved Study Plan

- There were no variances from the FERC-approved Study Plan.

Questions

- There were no questions from the group related to this study.

3.0 Conclusion

I&M is filing this ISR Meeting Summary in accordance with 18 CFR § 5.15(c)(3) of the Commission's regulations. After review of the ISR Meeting Summary, stakeholders may file disagreements with the meeting summary, request modifications to ongoing studies, or request new studies. Disagreements with the ISR Meeting Summary and any requests to amend the study plan to include new or modified studies must be filed with the Commission no later than 30 days after the filing of the ISR Meeting Summary (on or before June 7, 2020). In requesting modifications to ongoing studies or new studies, stakeholders must take into account the following criteria:

- *Criteria for Modification of Approved Study (18 C.F.R. 5.15(d)).* Any proposal to modify an ongoing study must be accompanied by a showing of good cause why the proposal should be approved, and must include, as appropriate to the facts of the case, a demonstration that:
  (1) Approved studies were not conducted as provided for in the approved study plan; or
  (2) The study was conducted under anomalous environmental conditions or that environmental conditions have changed in a material way.
- *Criteria for New Study (18 C.F.R. 5.15(e)).* Any proposal for new information gathering or studies must be accompanied by a showing of good cause why the proposal should be approved, and must include, as appropriate to the facts of the case, a statement explaining:
  (1) Any material changes in the law or regulations applicable to the information request;
  (2) Why the goals and objectives of any approved study could not be met with the approved study methodology;
  (3) Why the request was not made earlier;
  (4) Significant changes in the project proposal or that significant new information material to the study objectives has become available; and
  (5) Why the new study request satisfies the study criteria in 18 C.F.R. § 5.9(b).

I&M will have 30 days to respond to any disagreements or requests to amend the study plan (July 7, 2020). The Commission's Director of the Office of Energy Projects will resolve any disagreement and amend the approved study plan, as appropriate, within 30 days of the due date for I&M's response (no later than August 6, 2020).

If there are any questions regarding this filing, please do not hesitate to contact me at (614) 716-2240 or jmmagalski@aep.com.

Sincerely,

Jonathan M. Magalski
Environmental Specialist Consultant
American Electric Power Services Corporation, Environmental Services

Attachments:
Attachment A – ISR Meeting Presentation
Attachment B – Constantine Project Stranded Fish and Mussel Survey Report

Cc: Distribution List
Liz Parcell (AEP)
Rob Quiggle (HDR)

Constantine Hydroelectric Project (FERC No. 10661)
Distribution List

Federal Agencies

Mr. John Eddins
Office of Federal Agency Programs
Advisory Council on Historic Preservation
401 F Street NW, Suite 308
Washington, DC 20001-2637

Ms. Kimberly Bose
Secretary
Federal Energy Regulatory Commission
888 1st St NE
Washington, DC 20426

FEMA Region 5
536 South Clark Street, 6th Floor
Chicago, IL 60605

Mr. Michael Pentony
Regional Administrator
NOAA Fisheries Service
Greater Atlantic Regional Fisheries Office
55 Great Republic Drive
Gloucester, MA 01930-2276

Mr. Martin J. Rosek
State Soil Scientist
US Department of Agriculture
Natural Resources Conservation Service
3001 Coolidge Road, Suite 250
East Lansing, MI 48823

Ms. Mary Manydeeds
Bureau of Indian Affairs, Midwest Region
US Department of the Interior
Norman Pointe II Building
5600 W. American Boulevard, Suite 500
Bloomington, MN 55437

Office of the Solicitor
US Department of the Interior
1849 C Street, NW
Washington, DC 20240

Mr. Lindy Nelson
Regional Environmental Officer, Office of
Environmental Policy & Compliance
US Department of the Interior
Philadelphia Region
Custom House, Room 244
200 Chestnut Street
Philadelphia, PA 19106

Ms. Liz Pelloso
Wetland/Environmental Scientist, Region 5
US Environmental Protection Agency
77 West Jackson Boulevard (E19-J)
Chicago, IL 60604

Mr. Ken Westlake
Chief, NEPA Implementation Section - Region 5
US Environmental Protection Agency
77 West Jackson Boulevard (E19-J)
Chicago, IL 60604

Mr. Jack Dingledine
Assistant Field Office Supervisor/Michigan
Ecological Services Field Office
US Fish and Wildlife Service
2652 Coolidge Road, #101
East Lansing, MI 48823

Ms. Alisa Shull
Chief, Endangered Species - Midwest Region
(Region 3)
US Fish and Wildlife Service
5600 American Boulevard West, Suite 990
Bloomington, MN 55437-1458

Mr. Derrick Hubbell
Michigan Water Science Center
US Geological Survey
6520 Mercantile Way, Suite 5
Lansing, MI 48911-5991

Mr. Tom Weaver
Michigan Water Science Center
US Geological Survey
6520 Mercantile Way, Suite 5
Lansing, MI 48911-5991

US Geological Survey
1451 Green Road
Ann Arbor, MI 48105

Hon. Aaron Miller
US Congressman, 59th District
US House of Representatives
N-993 House Office Building
PO Box 30014
Lansing, MI 48909

Constantine Hydroelectric Project (FERC No. 10661)
Distribution List

Mr. Michael Reynolds
Acting Director, Headquarters
US National Park Service
1849 C Street, NW
Washington, DC 20240

Hon. Gary Peters
US Senate
Hart Senate Office Building
Washington, DC 20510

Hon. Debbie Stabenow
US Senate
713 Hart Senate Office Building
Washington, DC 20510-2204

State Agencies

Michigan Department of Agriculture
525 West Allegan Street
Lansing, MI 48933

Mr. Chris Antieau
Great Lakes Shorelands Unit - Water Resources Division
Michigan Department of Environmental Quality
525 West Allegan Street
PO Box 30473
Lansing, MI 48909-7973

Kalamazoo District Office
Michigan Department of Environmental Quality
7953 Adobe Road
Kalamazoo, MI 49009-5025

Ms. Jessica Mistak
Michigan Department of Natural Resources
PO Box 30028
Lansing, MI 48909

Mr. Kyle Kruger
Senior Fisheries Biologist
Michigan Department of Natural Resources
Mio Field Office
191 S. Mt. Tom Road
Mio, MI 48647

Ms. Kesiree Thiamkeelakul
Michigan Department of Natural Resources
Mio Field Office
191 S. Mt. Tom Road
Mio, MI 48647

Mr. Brian D. Conway
State Historic Preservation Officer, Lansing Office
State Historic Preservation Office
735 East Michigan Avenue
PO Box 30044
Lansing, MI 48909

Local Governments

Ms. Korie Blyveis
District Manager
Cass County Conservation District
1127 East State St.
Cassopolis, MI 49031

Mr. Robert Hile
Mayor
City of Sturgis
130 North Nottawa
Sturgis, MI 49091

Friends of the St. Joe River Association, Inc.
PO Box 1794
South Bend, IN 46634

St. Joseph County
PO Box 189
Centreville, MI 49032

Ms. Carolyn Grace
Administrator
St. Joseph County Conservation District
693 E. Main Street
Centerville, MI 49032

Mr. Mark R. Brown
Supervisor
Township of Constantine
425 Centreville Street
Constantine, MI 49042

Constantine Hydroelectric Project (FERC No. 10661)
Distribution List

Mr. George E. Morse
Supervisor
Township of Sturgis
70669 Stubey Road
Sturgis, MI 49091

Mr. Donald E. Gloy, Jr.
Supervisor
Township of White Pigeon
16825 Tomahawk Trail
White Pigeon, MI 49099

Mr. Mark Honeysett
Village Manager
Village of Constantine
115 White Pigeon Street
Constantine, MI 49042

Ms. Marcia Skelton
Village of Constantine
115 White Pigeon Street
Constantine, MI 49042

Mr. Tyler Royce
President
Village of White Pigeon
103 South Kalamazoo
PO Box 621
White Pigeon, MI 49099

Tribes

Mr. Michael LaRonge
Tribal Historic Preservation Officer
Forest County Potawatomi Community
5320 Wensaut Lane
PO Box 340
Crandon, WI 54520

Ms. Kelly Curran
Pokagon Band of Potawatomi Indians
58620 Sink Road
PO Box 180
Dowagiac, MI 49047

Nottawaseppi Huron Band of the Potawatomi
1485 Mno-Bmadzewen Way
Fulton, MI 49052

Non-governmental Organizations

Mr. John Seebach
American Rivers
1104 14th St NW, Suite 1400
Washington, DC 20005

Mr. Kevin Richard Colburn
National Stewardship Director
American Whitewater
PO Box 1540
Cullowhee, NC 28779

Michigan Audubon Society
2311 Science Parkway, Suite 200
Okemos, MI 48864

Michigan Citizens for Water Conservation
PO Box 1
Mecosta, MI 49332

Michigan Environmental Council
602 West Ionia Street
Lansing, MI 48933

Mr. Bob Stuber
Fisheries Biologist
Michigan Hydropower Relicensing Coalition
1620 High Street
Traverse City, MI 49684

Michigan Loon Preservation Association
10181 Sheridan Road
Millington, MI 48746

Michigan Nature Association
2310 Science Parkway, Suite 100
Okemos, MI 48864

Mr. Matt Meersman
Director
St. Joseph River Basin Commission
227 West Jefferson Boulevard
1120 County-City Boulevard
South Bend, IN 46601

Attachment A - ISR Meeting Presentation

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Constantine Hydroelectric Project

Initial Study Report Meeting
April 23, 2020

BOUNDLESS ENERGY℠

AMERICAN ELECTRIC POWER

BOUNDLESS ENERGY℠

Initial Study Report

- Indiana Michigan Power Company (I&M) is pursuing a new license for the Project from the Federal Energy Regulatory Commission (FERC or Commission) in accordance with FERC's Integrated Licensing Process (ILP) at 18 CFR Part 5.
- Pursuant to the ILP, I&M developed an Initial Study Report (ISR) that was filed with the Commission on April 14, 2020.
  - The ISR describes I&M's overall progress in implementing the study plan and schedule approved in FERC's April 9, 2019 Study Plan Determination (SPD), the data collected, and any variances from the study plan and schedule.
- The Commission's regulations at 18 C.F.R. § 5.15(c) requires I&M to hold an ISR Meeting within 15 days of filing the ISR.
- The purpose of the ISR Meeting is to discuss available study results and any proposals to modify the study plans in light of the data collected.

BOUNDLESS ENERGY℠

AMERICAN ELECTRIC POWER

BOUNDLESS ENERGY℠

Meeting Agenda

April 23, 2020	Schedule
Welcome and Introduction	9:00 AM – 9:10 AM
Botanical Resources Study	9:10 AM – 9:50 AM
Shoreline Stability Assessment Study	9:50 AM – 10:30 AM
Water Quality Study	10:30 AM – 11:10 AM
Break	11:10 AM – 11:20 AM
Fisheries Survey	11:20 AM – 12:00 PM
Mussel Survey	12:00 PM – 12:40 PM
Lunch Break	12:40 – 1:30 PM
Wetlands Study	1:30 PM – 2:10 PM
Recreation Study	2:10 PM – 2:50 PM
Cultural Resources Study	2:50 PM – 3:30 PM
Discussion and Questions	3:30 PM – 4:00 PM

AMERICAN ELECTRIC POWER

BOUNDLESS ENERGY℠

Process Plan and Schedule

Major Milestones	Responsible Party	Dates
File PAD and NOI (18 CFR §5.5(d))	I&M	June 4, 2018
Issue Notice of PAD/NOI and SD1 (18 CFR §5.8(a))	FERC	August 3, 2018
File Proposed Study Plan (PSP) (18 CFR §5.11)	I&M	November 16, 2018
Study Plan Meeting(s) (18 CFR §5.11(e))	I&M	December 11, 2018
Comments on PSP (18 CFR §5.12)	Stakeholders	February 14, 2019
File Revised Study Plan (RSP) (18 CFR §5.13(a))	I&M	March 16, 2019
Comments on RSP Due (18 CFR §5.13(b))	Stakeholders	March 31, 2019
Issuance of Study Plan Determination (18 CFR §5.13(c))	FERC Director	April 9, 2019
Initial Study Report (ISR) (18 CFR §5.15(c))	**I&M**	**April 14, 2020**
File Draft License Application (18 CFR §5.16(a))	I&M	May 3, 2021
File Updated Study Report (USR) (18 CFR §5.15(f)) (if necessary)	I&M	April 14, 2021
File Final License Application (18 CFR §5.17)	I&M	September 30, 2021

Studies Approved in the SPD

FERC's April 9, 2019 SPD directed I&M to conduct 8 studies:

1. Botanical Resources Study
2. Shoreline Stability Assessment
3. Water Quality Study
4. Fisheries Survey
5. Mussel Survey
6. Wetlands Study
7. Recreation Study
8. Cultural Resources Study

BOUNDLESS ENERGY℠

Proposals to Modify Studies or for New Studies

At this time, I&M has completed all of the studies approved in the Commission's April 9, 2019 SPD and is not proposing any modifications or new studies.

- I&M will file an ISR Meeting Summary with the Commission on or before May 8, 2020.
- Stakeholders and FERC may file comments on the meeting summary, request modifications to studies, or request new studies on or before June 7, 2020.
  - If requesting modifications to studies, stakeholders must take into account FERC's Criteria for Modification of Approved Studies (18 C.F.R. § 5.15(d)).
  - If requesting new studies, stakeholders must take into account FERC's 7 Criteria for New Study (18 C.F.R. § 5.15(e)).

BOUNDLESS ENERGY℠

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Upcoming ILP Milestones

Milestone	Responsible Party	Date
File Initial Study Report Meeting Summary (18 CFR §5.15(c)(3))	I&M	5/8/2020
File Meeting Summary Disagreements (18 CFR §5.15(c)(4))	Stakeholders	6/7/2020
File Responses to Meeting Summary Disagreements (18 CFR §5.15(c)(5))	I&M	7/7/2020
Resolution of Disagreements (18 CFR §5.15(c)(6))	FERC	8/6/2020

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Botanical Resources Study

BOUNDLESS ENERGY℠

Botanical Resources Study

Study Status

I&M initiated and completed the Botanical Resources Study in accordance with the schedule and methods described in the RSP and SPD.

Summary of Study Methods and Results:

- The Project's FERC-approved Project boundary was surveyed and locations of RTE and invasive species were mapped and photographed. Additionally, GLEC searched for and documented the presence of any wild rice beds.
- Botanical resources were inventoried in August and September of 2019. Specific attention was given to the discovery of state and federal RTE species, such as wild rice, American water willow (*Justicia americana*) and eastern prairie fringed orchid (*Platanthera leucophaea*), as well as the presence and abundance of invasive plant species, such as, Eurasian watermilfoil (*Myriophyllum spicatum*), purple loosestrife (*Lythrum salicaria*), Carolina fanwort (*Cabomba caroliniana*) and crispy pondweed (*Potamogeton crispus*).
- Principal habitat types were described as a result of the inventory and consisted primarily of a mixture of floodplain forested communities, residential areas and scrub/shrub and emergent wetlands.
- Results were compared to historical inventories from the Michigan Natural Features Inventory, previous assessments and historical (pre-reservoir) maps. Notable differences were noted between the southern, midsection and northern reaches of the Project.

BOUNDLESS ENERGY℠

AMERICAN ELECTRIC POWER

BOUNDLESS ENERGY℠

Botanical Resources Study

- Twenty-three non-native plants were discovered in the inventory.
- Purple loosestrife abundance was noted as a specific threat to the existing wetlands, particularly in the northern sections of the Project boundary. Eurasian watermilfoil was also noted as becoming more abundant than previously noted in the other assessments. Both purple loosestrife and Eurasian watermilfoil have the greatest potential to significantly alter the native habitats in the wetland and off-shore aquatic communities in the Project area.
- Based on this assessment and the annual invasive species assessments, it continues to appear that in general, the light and heavy infestations within the Project boundary continue to increase including the Eurasian watermilfoil. The overall assessment of the botanical resources at the Constantine Project remains similar to that described in the Pre-Application Document (PAD) and the 1993 assessment (FERC 1993).

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Botanical Resources Study

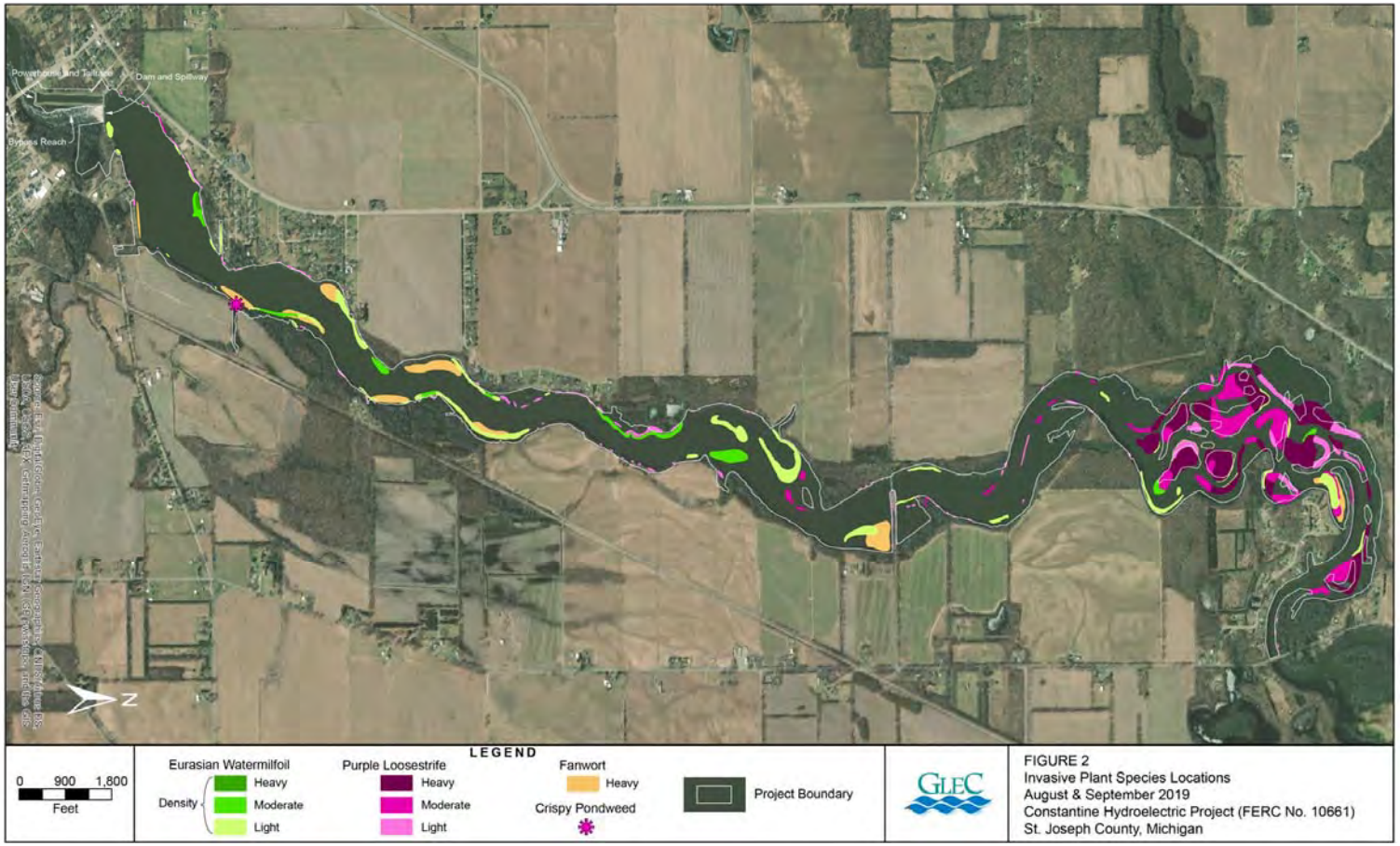


FIGURE 2
Invasive Plant Species Locations
August & September 2019
Constantine Hydroelectric Project (FERC No. 10661)
St. Joseph County, Michigan

BOUNDLESS ENERGY℠

AMERICAN ELECTRIC POWER

BOUNDLESS ENERGY℠

Variances from FERC-approved Study Plan

Variances from FERC-approved Study Plan:

- The actual Botanical Resources Survey and study methods applied some interpretations of and minor variances from the method details outlined in Section 6 Botanical Resources Study of the March 15, 2019 RSP. Under Task 6.6.1 Desktop Mapping of Vegetation, the RSP indicates that I&M "will obtain high-resolution aerial imagery to characterize the vegetation in the Project area, to the extent practical." For this study, the research biologists and Geographic Information System (GIS) specialists utilized standard satellite imagery provided by Google Earth and ESRI ArcMap streaming services for feature interpretation. No other "special" high resolution imagery was obtained or utilized for the study.

- Existing information regarding botanical resources in the Project area, presented in Section 5.5 of the PAD, classifies the vegetation as a "mixed hardwood community of predominantly oak, with some ash, beech, hickory, maple, cottonwood, and aspen" and falling within the Beech-Maple Association of Eastern Deciduous Forest (I&M 1988, Bailey 1978). For this study, the classification and description scheme developed by the Michigan Natural Features Inventory was used to update and further expound upon the forest cover types (Kost et al. 2007). Preliminary descriptions of the Project area state that along its lower third, the reservoir is largely within pre-existing river banks and is bordered by a fringe of trees, while along the upper two-thirds of the reservoir the river often covers more extensive (up to 1,200 feet) widths of lowland areas (I&M 1988). Upon the completion of Meander surveys and a full species list, this study determined that this fringe of trees within the lower third, to half, of the reservoir is more specifically classified as floodplain forest and the lowland areas within the upper reaches of the reservoir are primarily forested and emergent wetlands, dominated by willow (Salix spp.) and silver maple trees.

AMERICAN ELECTRIC POWER

BOUNDLESS ENERGY℠

Shoreline Stability Assessment Study

BOUNDLESS ENERGY℠

Shoreline Stability Assessment Study

Study Status

I&M initiated and completed the Shoreline Stability Assessment Study in accordance with the schedule and methods described in the RSP and SPD.

Summary of Study Methods and Results

- Prior to conducting field surveys, a literature review was performed to review any existing information on geology and soils in the study area that may be useful to assess bank composition and erosion potential in the study area.
- Shoreline observations of the reservoir and bypass reach were made June 2-4 and September 24-27, 2019. Assessed sites were located at various points along the shoreline within the reservoir and bypass reach.
  - During the June survey event, 57 sites were evaluated. Of the 57 sites evaluated, 12 were located in the bypass reach and 45 were located in the reservoir.
  - During the September survey event, 31 sites were evaluated. Of the 31 sites evaluated, 8 were located in the bypass reach and 23 were located in the reservoir.

BOUNDLESS ENERGY℠

Shoreline Stability Assessment Study

In summary, primary observations and conclusions from the Shoreline Stability Assessment are:

- In June, modified Bank Erosion Hazard Index (BEHI) scores in the Project area ranged from Very Low to Moderate at 57 individual sites. In the bypass reach, sites were scored as; 5 Very Low, 1 Low, 3 Moderate, and 3 not applicable (NA). In the reservoir area, sites were scored as; 2 Very Low, 20 Low, 12 Moderate, and 11 NA.
- In September, BEHI scores in the Project area ranged from Low to Moderate at 39 sites. In the bypass reach, sites scored as; 5 Low, 2 Moderate, and 1 NA. In the reservoir area, sites were scored as; 19 Low and 12 Moderate.

BOUNDLESS ENERGY℠

Shoreline Stability Assessment Study

- Based on observations used to calculate the modified BEHI, three areas may require additional assessment to confirm and possibly mitigate potential future erosion hazards within the Project:
  1. Site BA03 located at the downstream end of the Project. This site has an area of erosion located against concrete at the base of the bridge extending under the overhanging vegetation. This erosion area is likely caused by current hitting the bank from the tailrace.
  2. Site BA16 located at the upstream end of the bypass reach. This isolated point has no vegetation and soil is actively falling into the bypass reach.
  3. In the reservoir, the area from site SJR05 to SJR12. This area is located in a more riverine section of the Project along an outside bend in the river channel. This area has had the riparian vegetation removed for home construction and maintained turf grass lawns.

Variances from FERC-approved Study Plan

The Shoreline Stability Assessment was conducted in full conformance with the Commission's SPD.

BOUNDLESS ENERGY℠

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Water Quality

BOUNDLESS ENERGY℠

AMERICAN ELECTRIC POWER

BOUNDLESS ENERGY℠

Water Quality Study

Study Status

I&M initiated and completed the Water Quality Study in accordance with the schedule and methods described in the RSP and SPD.

Summary of Study Methods and Results

- Water quality data was collected at five locations (reservoir, power canal, tailrace and two locations in the bypass reach) using calibrated Onset® HOBO U26 dissolved oxygen (DO) Data Loggers set to record water temperature and DO at 15-minute intervals.
- Discrete multi-parameter water quality measurements of temperature, DO, pH, and specific conductance were also collected at the monitoring locations using a calibrated YSI ProDSS water quality meter.
- Continuous water temperature and DO measurements were recorded from May 1 through October 31, 2019. Discrete multi-parameter water quality measurements were collected at each of the five monitoring locations on a monthly basis from May through October.
- Additionally, sediment contaminant sampling was conducted along three transects in the Project reservoir.
  - Although FERC's SPD did not require I&M to perform sediment contaminant sampling, based on I&M's experience at other projects (i.e., Mottville Project) and the resource agencies' interest in these data, I&M agreed to conduct the sampling and provide this information to resource agencies.

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Water Quality Study

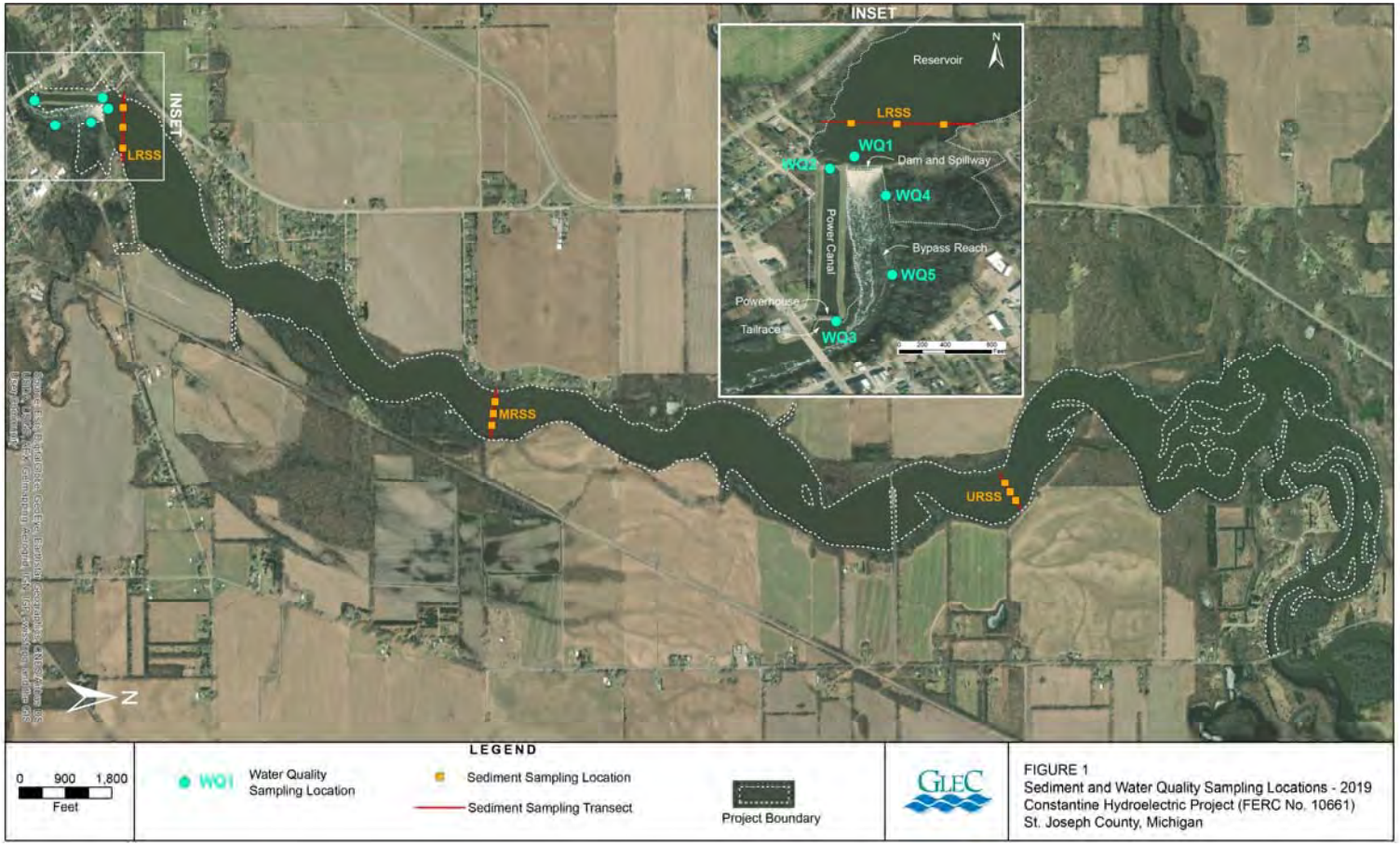


FIGURE 1
Sediment and Water Quality Sampling Locations - 2019
Constantine Hydroelectric Project (FERC No. 10661)
St. Joseph County, Michigan

BOUNDLESS ENERGY℠

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Water Quality Study

In general, the DO and water temperature plots demonstrate a typical diurnal fluctuation that is reflective of day and night respiration (dissolved oxygen) and the relatively rapid change in water temperature due to changes in air temperature. However, there were several instances when this pattern was interrupted possibly due to meter malfunctioning, meter desiccation (temporarily out of the water) or vandalism. Specifically;

- the mid-June and mid-July DO data for the tailrace,
- rapidly declining DO and temperature data in late August for the bypass reach upstream of the Fawn River,
- the rapid decline and then increase in water temperature mid- to late September in the tailrace, and
- spikes in DO to levels greater than saturation in late September in the bypass reach upstream of the Fawn River.

In each instance the anomalies were investigated by reviewing the field conditions, maintenance and calibration logs and the data from the secondary data logger (if available) to determine the problem.

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Water Quality Study

Primary observations from the Water Quality Study include:

- DO readings fell within state threshold limits for the entire duration of the study in both the reservoir and power canal. Water temperature readings were below the monthly maximum threshold limits in the reservoir, power canal, tailrace, and the bypass reach upstream of the Fawn River.
- The monthly water temperature threshold was exceeded on October 1 and 2, 2019 in the bypass reach downstream of the Fawn River for 26 consecutive instantaneous measurements. However, 14 of the 26 measurements were above the threshold by only 0.2°C, which is within the accuracy range of the temperature probe. It's possible that water temperature at this location may be heavily influenced by warm water coming from the Fawn River rather than exceedances only attributable to influences in the St. Joseph River.
- In the tailrace, instantaneous DO readings as well as the daily average DO were below state thresholds on July 16, 2019. Due to probe damage and malfunction, only one logger was recording in the tailrace in July and so there was not a second set of data to verify these low readings. DO values recorded at all other water quality monitoring stations were above the thresholds on this day.
- Instantaneous DO readings below the state threshold were recorded on August 7, 18, and 19, 2019 in the bypass reach downstream of the Fawn River. The daily average DO fell below the threshold on July 21, 2019 and August 19, 2019 for this location.

In the bypass reach upstream of the Fawn River, instantaneous DO values below the threshold were recorded on eight days in August and ten days in September. For five of those days in August and five in September, the daily average DO also fell below the state threshold. The majority of the DO exceedances observed during the Water Quality Study appeared to correspond to water flow away from the bypass reach and into the power canal.

AMERICAN ELECTRIC POWER

BOUNDLESS ENERGY℠

Water Quality Study

Sediment Chemistry

- Sediment analysis results were compared to published sediment quality guidelines (SQG) (MacDonald et al. 2000, Ingersoll et al. 2002, GeoEngineer 2015, and WDNR 2003) to determine the relative risk to aquatic life and human health. Relative risk to aquatic life was determined by comparing the sediment analysis to Probable Effect Levels (PEL), Threshold Effect Levels (TEL), Effect Range Median (ERM) and Effect Range Low (ERL).
  - With the exception of mercury, lead and arsenic, each analyte concentration in the Constantine reservoir sediments were measured at concentrations less than the most restrictive SQG (TEL).
  - Sediment chemistry is typically affected by agricultural runoff within the basin and is not considered to be the result of Project operations.

Mercury

- The sediment mercury concentration in the Lower Reservoir (LRSS) duplicate sample slightly exceeded the TEL (0.17 milligrams per kilogram [mg/kg]) at 0.19 mg/kg in the duplicate sample.

Lead

- Lead concentrations in the LRSS duplicate sample were equal to the TEL and ERL SQG at 35 mg/kg.

Arsenic

- Arsenic concentrations in the LRSS samples exceeded the PEL (17 mg/kg). The LRSS lead concentration was measured at 28.8 mg/kg.

Variances from FERC-approved Study Plan

Variances from FERC-approved Study Plan:

- On or around May 21, 2019, it is suspected that both loggers in the tailrace were pushed up onto the concrete ledge due to upwelling. The primary logger was damaged during this action and quit recording on May 21 while the secondary logger continued to record data from what could have been a position above the water. Because of the damage to the primary logger, data from the secondary logger was used for the month of May. The primary logger was replaced on May 30, 2019.
- Both the primary and secondary continuous temperature and DO loggers were discovered to be missing from the bypass reach upstream of the Fawn River during the monthly download on August 1, 2019. No data exists for that location for June 27 to August 1, 2019. A new primary logger was placed at the site on August 1, 2019. A secondary logger was added the following month. The data collected during this time period from the other water quality monitoring stations suggests that no major adverse events occurred between June 27 and August 1, 2019.
- The Commission's SPD did not require that I&M conduct the sediment contaminant sampling component. However, based on I&M's experience at other projects on the St. Joseph River, I&M decided to proceed with the data collection and analysis.

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Fisheries Survey

BOUNDLESS ENERGY℠

AMERICAN ELECTRIC POWER

BOUNDLESS ENERGY℠

Fisheries Survey

Study Status

I&M initiated and completed the Fisheries Survey in accordance with the schedule and methods described in the RSP and SPD.

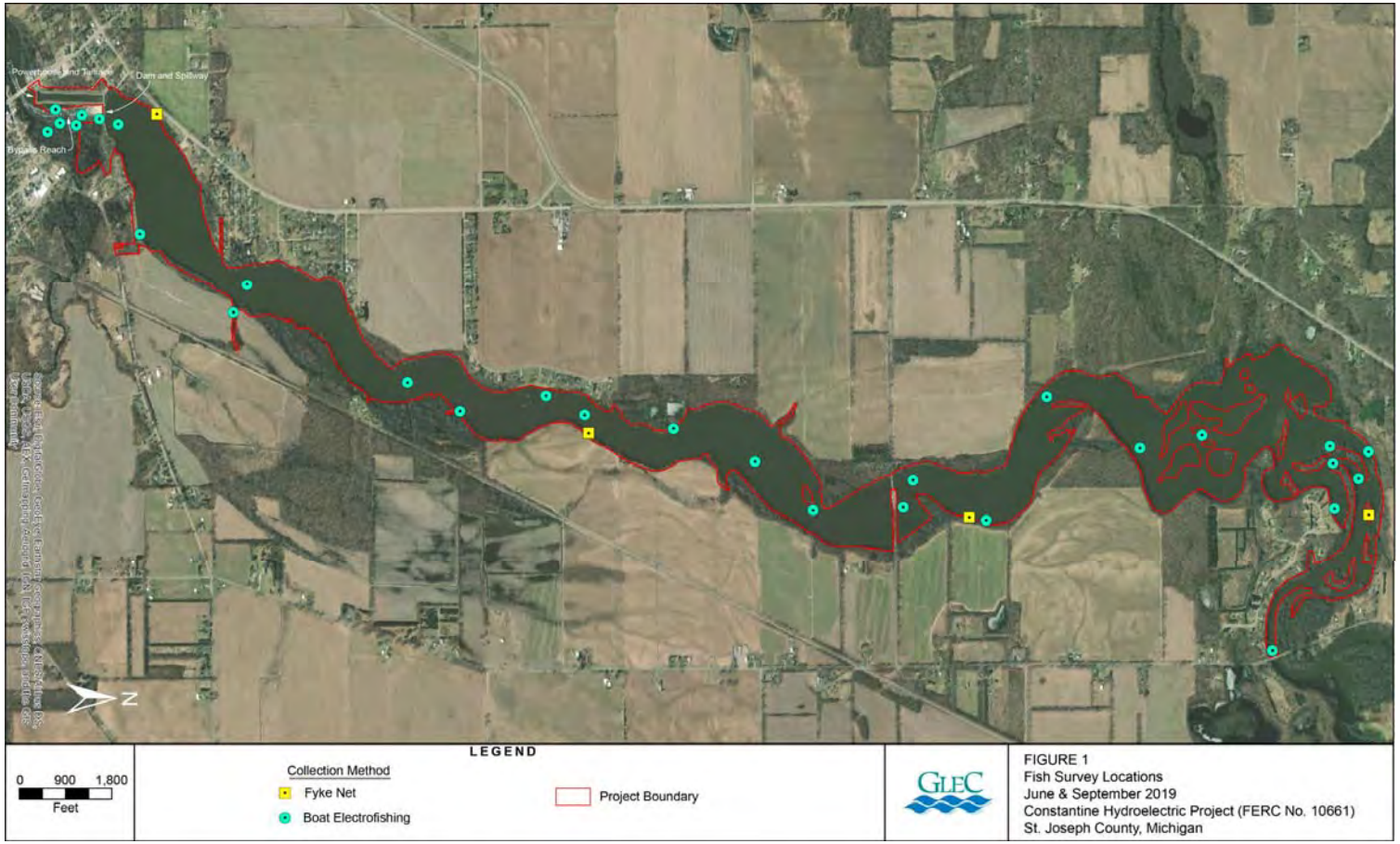
Summary of Study Methods and Results

- Prior to conducting field surveys, the required scientific collector's permit was obtained from the Michigan Department of Natural Resources (MDNR).
- Two sampling events were conducted during daylight hours in the late spring/early summer (May-June) and the late summer/early fall (August-September) of 2019. Fish sampling was conducted using boat electrofishing and fyke nets.
- Both near-shore (shallow) and mid-channel (deep) habitats were sampled to characterize fish communities and life stages that use these different habitat types. Supporting data was recorded at each sampling location, including: (1) location (Global Positioning System [GPS]); (2) sampling gear type; (3) mesohabitat; (4) representative photographs; (5) time and date; (6) weather; (7) general descriptions of depth, flows, and substrate; and (8) cover type and estimated percentage of cover. In addition to this supporting data, discrete water quality measurements of water temperature, DO, pH and specific conductance were also recorded at each sampling location. A secchi disk reading was also taken at each sampling site.
- The average approach velocities 1-foot in front of the existing trashrack structure were also measured. Measurements were collected at the Project's maximum and efficient generation rates using an Acoustic Doppler Current Profiler (ADCP).

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Fisheries Survey



BOUNDLESS ENERGY℠

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Fisheries Survey

BOUNDLESS ENERGY℠

AMERICAN ELECTRIC POWER

BOUNDLESS ENERGY℠

Fisheries Survey

- Additionally, fish tissue samples were collected from ten Largemouth Bass (*Micropterus salmoides*) and ten Shorthead Redhorse (*Moxostoma macrolepidotum*) in the Project reservoir that were analyzed for mercury and PCBs. Contaminants that affect fish in the St. Joseph River often come from agricultural runoff and other local sources of pollution within the basin. Any potential contaminants present in fish in the Project area are not considered to be the result of Project operations.
  - Although FERC's SPD did not require I&M to perform fish tissue sampling, based on I&M's experience at other projects (i.e., Mottville Project) and the resource agencies' interest in these data, I&M agreed to conduct the sampling and provide this information to resource agencies. The results of the fish tissue sampling have not been received from the lab at the time the ISR was submitted. The Fisheries Survey Report will be supplemented with this information when available.

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Fisheries Survey

Fish Community Baseline Survey Compared to Historical Community Data

- During fish collections in June and September of 2019 a diverse and abundant fish community was documented. The 2,343 fish representing 46 species are equal in species richness to collections made in the area in the historical record. The June and September fish sampling collected the same or more species than historical sampling records as shown in Table 2.4-1 of the ISR. It appears that the community has not changed significantly since the last major survey.
- Species collected in the past, but missing from this year's collections included Brook (*Lampetra planeri*) and Silver Lamprey (*Ichthyomyzon unicuspis*), Central Stoneroller (*Campostoma anomalum*), Common Shiner (*Luxilus cornutus*), Creek Chub (*Semotilus atromaculatus*), Fathead Minnow (*Pimephales promelas*), Spotted Gar (*Lepisosteus oculatus*), and Stonecat (*Noturus flavus*). During the 2019 fish collection, six species were collected that were not seen in past records including: Brown Bullhead (*Ameiurus nebulosus*), Emerald Shiner (*Notropis atherinoides*), Flathead Catfish, Northern Sunfish (*Lepomis peltastes*), Pirate Perch (*Aphredoderus sayanus*), and White Crappie (*Pomoxis annularis*). Most species collected remain the same from the last broad survey completed by AEP in 1990-1991.

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Fisheries Survey

Intake Velocities for Fish Impingement and Entrainment Potential

- The intake velocities recorded at two locations within the power canal were similar to those reported in the entrainment survey completed in 1991 (AEP 1991).
  - As reported in the PAD, during original licensing in 1988, velocities were measured as 1.8 feet per second (fps) through the trackracks and 1.3 fps at the face of the trackracks (I&M 2018). This is very similar to average velocities measured in the power canal by the ADCP sensors in June, 2019 of 1.57 fps (47.9 centimeters per second [cm/s]) just downstream of the headgate structure (Transect 1) and 1.33 fps (40.5 cm/s) upstream of the trashracks (Transect 2).
  - This supports the assumption made in the PAD that velocities would likely remain unchanged as there have been no change to Project operations or modification of significant Project features.
- Table 2.4-2 of the ISR presents a comparison of published swim speeds for several freshwater fish that include the species collected during the 2019 Fisheries Survey. Entrainment susceptibility may be judged in part by the ability of a fish to swim against the current upstream of the powerhouse. The average swim speeds reported are very similar to the measured water velocity in the power canal, whereas the published maximum or burst swim speeds often exceed the velocity measurements in the power canal.
- Fish entrainment is also affected by the downstream migration or movement of fish and the downstream drift of larval and juvenile fish. No estimates of fish entrainment were completed with this study.

Variances from FERC-approved Study Plan

Variances from FERC-approved Study Plan:

- Visual estimates of the water clarity were made by recording the depth at which a Secchi disk disappeared at fish collection sites, recorded to the nearest tenth of a meter. However, at some fish collection locations the current was too swift to accurately measure transparency using a Secchi disk, these locations were marked as Secchi depth NA.
- During the measurement of intake velocities in the power canal interference to the surveying unit was encountered while trying to record measurements 1-foot upstream of the Project's trashracks as specified in the RSP. In order to record useable measurements, the velocity profile transect for this location was shifted slightly upstream in the power canal to the point where interference was alleviated and velocities could be successfully recorded.
- The Project's power canal was initially included in the fish sampling study area pursuant to the RSP, but there were concerns regarding safety and access to the power canal for effective sampling due to lack of boat access and that the canal is too deep and swift to use other sampling methods safely. The power canal was excluded from the sampling area based on communication with MDNR staff from the Fisheries Division in the Southern Lake Michigan Unit, who agreed that the stranded fish survey of the power canal in spring 2019 provided sufficient data to predict the species present (McCauley, personal communication, July 10-11, 2019). No additional fish collections were made in the power canal during this survey.
- During collection of fish tissue samples field staff were unable to collect enough individuals of either of the preferred bottom-feeding species identified in the RSP, Common Carp or Channel Catfish. Field staff substituted (10) Shorthead Redhorse to represent the bottom feeder fish species.

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Mussel Survey

BOUNDLESS ENERGY℠

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Mussel Survey

Study Status

I&M initiated and completed the Mussel Survey in accordance with the schedule and methods described in the RSP and SPD.

Summary of Study Methods and Results

- Prior to conducting field surveys, the appropriate required scientific collector's permit was obtained from the MDNR.
- The mussel surveys were conducted in August of 2019, according to MDNR's Michigan Freshwater Mussel Survey Protocols and Relocation Procedures.
- A qualitative mussel survey was conducted at two sites in the reservoir, one site in the bypass reach, and one site downstream of the Project's powerhouse (including multiple sub-reaches). Mussel survey locations are depicted in the following figure.
  - Basic habitat information such as substrate type (e.g., gravel, cobble, boulder), water depth, habitat type (e.g., riffle, run, pool), cover type (e.g., woody debris), stream width, and qualitative water velocity was recorded at each sampling location.
  - Representative photographs were also taken of each species.
  - Additionally, water quality data, including water temperature, DO, pH, and specific conductance were collected from representative locations in the survey areas during the mussel survey.

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Mussel Survey

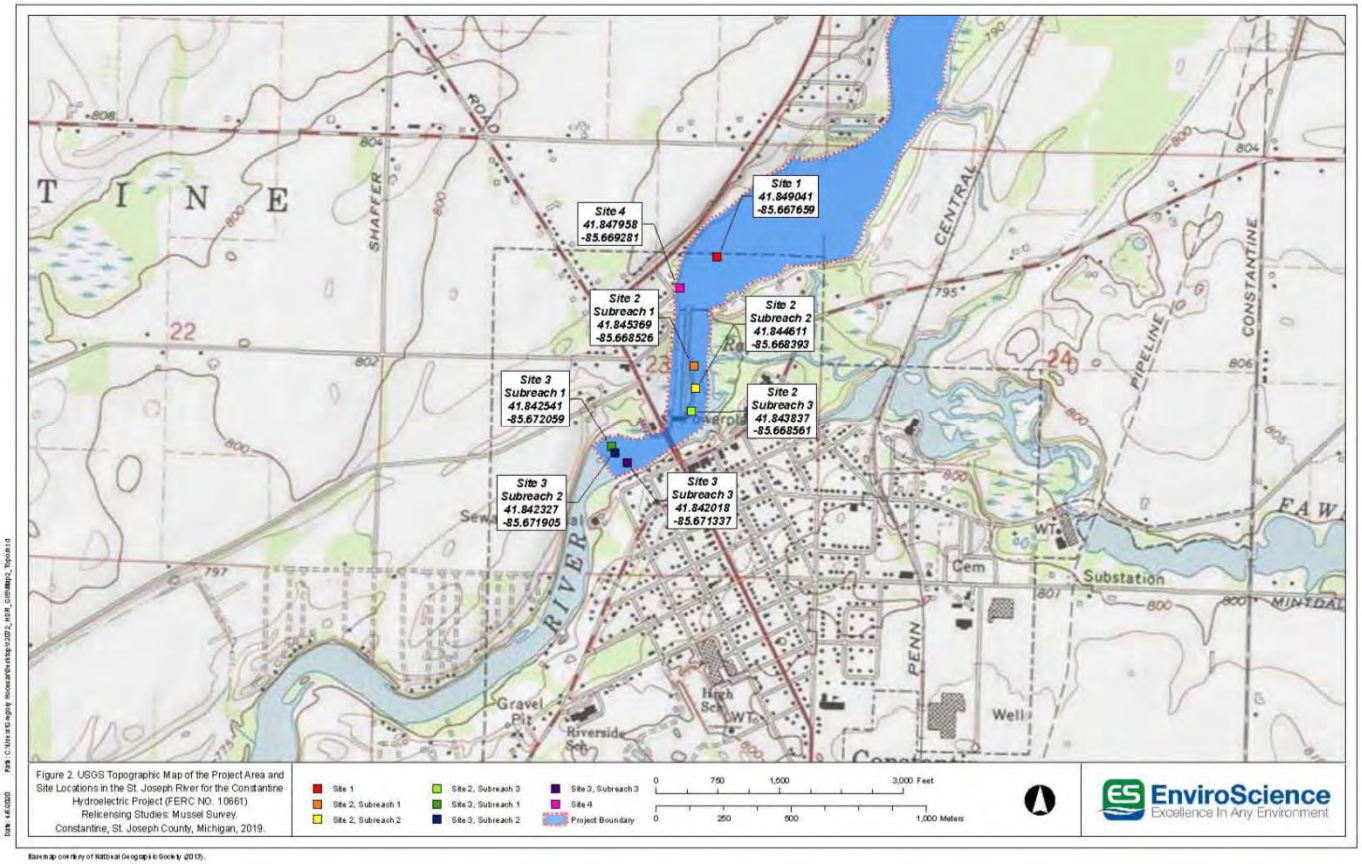


Figure 2. USGS Topographic Map of the Project Area and Site Locations in the St. Joseph River for the Constantine Hydroelectric Project (FERC NO. 10661) Relicensing Studies: Mussel Survey. Constantine, St. Joseph County, Michigan, 2019.

Base map courtesy of National Geographic Society (2013).

BOUNDLESS ENERGY℠

AMERICAN ELECTRIC POWER

BOUNDLESS ENERGY℠

Mussel Survey

- Mussel assemblage in the Project study area was similar to historic records near the area. Nineteen species have been documented in this portion of the St. Joseph River and 12 were observed live in this study.
  - Species observed in this study and not documented downstream by Wesley and Duffy (1999) included the Mapleleaf (*Quadrula quadrula*), Lilliput (*Toxolasma parvum*), and Paper Pondshell (*Utterbackia imbecillis*).
  - Conversely, species observed pre-1999 and not recorded in this study included Cylindrical Papershell (*Anodontoides ferrussacianus*), Purple Wartyback (*Cyclonaias tuberculata*), Ohio Pigtoe (*Pleuorbema cordatum*), and Rainbow (*Villosa iris*).
  - An undetectable, and not very diverse, mussel community may occupy the region upstream of the dam. Only six species were reported by Wesley and Duffy (1999) near Three Rivers, Michigan. A study performed near the dam headrace in 2019, associated with a separate project, collected 11 species. Species collected in that survey were like those observed at Sites 2 and 3 in this study, except for Round Pigtoe (live; *Pleurobema sintoxia*) and live Purple Wartyback.
- No federally listed mussel species were detected within the Project area. An undetectable mussel community may occupy the region upstream of the dam, and mussel scarcity is likely due to a lack of habitat and unstable conditions in Sites 1 and 4.
- There appears to be a stable, recruiting mussel community below the dam that has likely persisted for several years based on the diversity and abundances observed in this survey and historical records. The mussels observed would likely not be affected by continued operation assuming relicensing would not alter the existing hydraulics.

Variances from FERC-approved Study Plan

The Mussel Survey was conducted in full conformance with the Commission's SPD.

BOUNDLESS ENERGY℠

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Wetlands Study

BOUNDLESS ENERGY℠

Wetlands Study

Study Status

I&M initiated and completed the Wetlands Study in accordance with the schedule and methods described in the RSP and SPD.

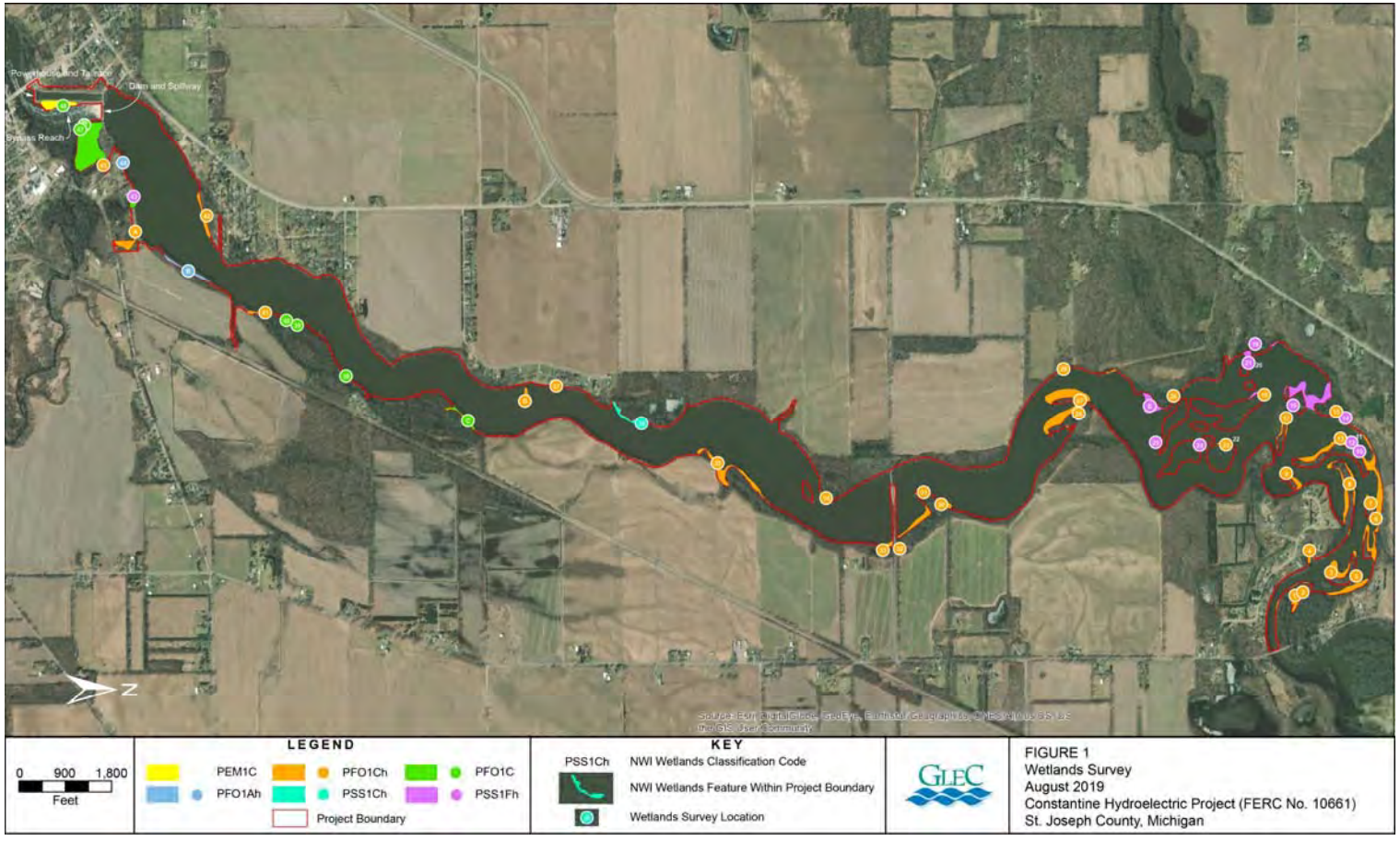
Summary of Study Methods and Results

- On August 14-16, 2019, wetland complexes in the Constantine reservoir, bypass reach and tailrace areas within the Project boundary were surveyed. The purpose of the survey was to verify the wetland map features in the Project NWI wetland map that was provided in the PAD. The survey was conducted by boat and walking nearshore areas over the length of the Project.
  - Observations were recorded at 48 stations generally adjacent to or overlying the NWI wetlands features within the Project boundary. Observations of wetland habitats near the Project boundary were recorded at 8 stations (14, 24, 25, 37, 38, 39, 40). Descriptions of the vegetative cover, species composition, and wetland classifications are provided in the field survey notes section of the Wetlands Study Report.
  - Any changes in wetland type or characteristics to the existing NWI classification were noted when relevant. Coordinate positions were recorded with a Global Positioning System (GPS) device at 40 of the 48 stations and marked on a large-scale field map for the remaining 8 stations.

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Wetlands Study



BOUNDLESS ENERGY℠

AMERICAN ELECTRIC POWER

BOUNDLESS ENERGY℠

Wetlands Study

- The classification of wetlands and the acreages observed in this study vary very little from the results from previous assessments described in the PAD. The most notable change documented was the reclassification of the island between the tailrace and bypass reach from PEM1C Freshwater Emergent Wetland to PFO1C Forested Shrub Wetland. This change was made due to the ground-truthing and identification of a discrepancy in the NWI wetland map.
- Total wetland acreage strictly within the Project boundary was estimated to remain at approximately 35.8 acres across five NWI categories that fall under the system/class categories palustrine forested and palustrine scrub-shrub wetland habitats. The majority of the Project wetland area (20.8 acres) is classified as: PF01Ch Palustrine, Forested, Broad Leaved Deciduous, Seasonally Flooded, and Diked/Impounded. These observations are consistent with the information presented in the PAD.
- Modifications to existing NWI wetlands map classifications were attributable to invasive species competition; purple loosestrife overwhelming the scrub-shrub communities in the modified zones. Modifications are described for each station in Section 7 of the Wetlands Study, which is included in Appendix G of this ISR. As noted in the RSP and PAD, the Constantine Project is operated as run-of-river and has little effect on reservoir levels that could potentially impact wetlands within the Project boundary.

Variances from FERC-approved Study Plan

Variances from FERC-approved Study Plan:

- Actual wetland survey and study methods had some minor variances from the methods in Section 11 of the RSP. Section 11 variously describes the wetlands study area as wetlands within or adjacent to the project boundary. The survey and mapping tasks addressed wetlands within the FERC Project boundary as relevant to Project operations. Wetland areas adjacent to (i.e., outside) the Project boundary were referenced in some areas to support and verify observations, but were not re-classified or studied to update wetland features relating to the Project. The RSP Task 1 Desktop Mapping approach suggests source data could include maps from NWI and from MDEQ. It was determined that the best source data for wetlands was the USFWS NWI wetlands map.

- Soil maps were not used in the wetlands survey or post-survey mapping exercises. Field notes and the Summary and Discussion section above discuss soil regimes in the study area. However, there is no doubt that the soils are hydric and either somewhat “dried” due to low river conditions, or wet depending on the size of the wetland adjacent to the Project boundary or juxtaposition of the riverine habitat.

- Task 2 Field Verification of Wetland Maps in the RSP prescribes that any map change recommendations include species composition, successional stage, and extent of shoreline. Where changes to Project NWI wetland features were recommended, field measurements were not taken to verify extent of shoreline where the feature was reclassified.

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Recreation Study

BOUNDLESS ENERGY℠

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Recreation Study

Study Status

I&M initiated and completed the Recreation Study in accordance with the schedule and methods described in the RSP and SPD.

Summary of Study Methods and Results

- A Recreation Facility Inventory and Condition Assessment was performed for all existing Project and non-Project recreation facilities in the Project area.
- Visitor use data was also collected at all existing recreation sites through a combination of in-person surveys, field reconnaissance, and photographic documentation.
  - Recreation visitor use data was collected from May through September of 2019, generally from 8:00 AM until 6:00 PM.
  - Field surveys were conducted on May 22 and 27 (Memorial Day), June 15, 16 (Father's Day) and 28, July 1 and 21 (Boat Race), August 15 and 25, and September 27 and 29.
  - A team of two technicians rotated between the recreation sites in random order and conducting interviews with willing participants. Technicians also recorded relevant conditions, including observed recreational activities, estimated number of vehicles, and number of recreational users. General information regarding date, time, and weather conditions was also recorded. A total of 21 recreation surveys were completed in the field.

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Recreation Study

- In addition to the personal interviews, I&M developed an online version of the interview questions for respondents to provide survey responses electronically.
  - The online survey was available from May 1 through September 30, 2019. A notice of the online survey was posted to AEP's relicensing website and signs were posted at each of the Project's recreation facilities notifying recreationists of how to complete the online survey.
  - A total of seven surveys were completed online during the study period.
- Results of the Recreation Survey demonstrate that the existing recreation facilities, both Project and Non-Project, are well maintained and utilized by the public.
- Overall, the public is pleased with the recreation facilities provided by I&M, St. Joseph County, and the Village of Constantine.
  - The cooperative effort of I&M and local governments has resulted in recreation facilities that not only meet the goals and objectives of the relevant recreation plans but contribute to the economies of the area. This is evidenced by individuals from outside of St. Joseph County visiting to boat on the Constantine Project reservoir, canoe/kayak the St. Joseph River, and fish the river and reservoir. According to the comments received, the existing facilities contribute to the enjoyment of all participating in those activities.

AMERICAN ELECTRIC POWER

BOUNDLESS ENERGY℠

Recreation Study

- The primary recreation activities observed are fishing by boat, bank fishing, fishing from the tailwater fishing access platform located adjacent to the powerhouse, and pleasure boating.
- Those surveyed indicated that the overall experience recreating at the Project was totally acceptable.
- Overall, survey respondents appear to be very satisfied with the existing recreation facilities in the Project area.
  - Suggested improvements for each of the existing Project recreation sites are detailed in Section 2.3.1 of the Recreation Study Report included in Appendix H of this ISR.
  - The recommended improvements primarily reflect the need for signage improvements, identifying Americans with Disabilities-accessible parking areas, and improvements to vegetation management.
  - The Project recreation site with the most suggested improvements is the canoe portage below the Project spillway. Suggested improvements include: better signage, upgraded walking surface, and increasing the trail width.

Variances from FERC-approved Study Plan

The Recreation Study was conducted in full conformance with the Commission's SPD.

BOUNDLESS ENERGY℠

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Cultural Resources Study

BOUNDLESS ENERGY℠

Cultural Resources Study

Study Status

- I&M initiated and completed the Cultural Resources study in accordance with the schedule and methods described in the RSP and SPD.

Summary of Study Methods and Results

- I&M consulted with the Michigan State Historic Preservation Office (SHPO), Forest County Potawatomi Community, Pokagon Band of Potawatomi Indians, and Nottawaseppi Huron Band of the Potawatomi Tribes regarding Project's Area of Potential Effects (APE).
- I&M received a response from the Forest County Potawatomi on March 7, 2019, concurring with the general APE as defined by I&M, but noted that field surveys should be conducted in order to adequately determine the potential impact of hydro operations on cultural and historic properties. I&M did not receive a response from the Michigan SHPO or other Tribes.
- I&M retained Commonwealth Heritage Group (Commonwealth) to conduct the cultural resources studies at the Project. Commonwealth conducted: (1) records and literature review, (2) architecture history/field investigations, and (3) archaeological field investigations.

Cultural Resources Study

- Background research to identify previously recorded above-ground resources was conducted in July 2019, prior to field survey. Research was conducted at the Michigan SHPO in Lansing, Michigan, and by utilizing online resources including the National Park Service database. Background investigations revealed that there were no previously recorded historic properties in the APE. The cultural resources field survey for aboveground resources was completed in July 2019.

- Commonwealth surveyed all above-ground properties over 50 years of age in the APE. As a result of this survey, one property, the Constantine Hydroelectric Plant, was identified as retaining historic integrity. Further investigation of the complex, including the powerhouse, headgates, power canal and earthen embankments, dam and spillway, substation, and machine shop led Commonwealth to recommend the property as eligible for listing in the National Register of Historic Places.

- Commonwealth conducted an archaeology survey on July 22 through July 24, 2019, in accordance with the guidelines established by the U.S. Secretary of the Interior and acceptable to the Michigan SHPO. The topographic relief from the water surface to the maximum height of the bank in any portion of the Project's APE is limited, heavily vegetated, and most of the adjacent properties are privately owned. Thus, Commonwealth archaeologists found accessing and inspecting the riverbanks by canoe to be the most efficient method for visual inspection.

- No previously unrecorded archaeological sites were identified during the survey. Commonwealth found no historic properties to be affected by the proposed continued operation of the Project. Based on the results of the Cultural Resources Study, I&M will consult with federally-recognized Indian Tribes to develop and conduct an inventory of properties of traditional religious and cultural importance (often referred to as "traditional cultural properties") within the APE and will provide the Commission with an inventory report in conjunction with the DLA filing.

Variances from FERC-approved Study Plan

The Cultural Resources Study was conducted in full conformance with the Commission's SPD.

BOUNDLESS ENERGY℠

ISR Meeting: Stakeholder Participation

- I&M will file the Initial Study Report Meeting Summary with FERC by May 8, 2020.
- Meeting summary disagreements, requests for modifications to studies, or requests for new studies should be filed with FERC by June 7, 2020.
- I&M will file responses to meeting summary disagreements by July 7, 2020.
- FERC will make a determination on any disputes/amendments to the approved study plan by August 6, 2020.
- Stakeholders can contact I&M with questions or comments:

Jonathan Magalski
Environmental Specialist Consultant
American Electric Power Service Corporation
c/o Indiana Michigan Power Company
1 Riverside Plaza, Columbus, OH 43215
(614) 716-2240
jmmagalski@aep.com

BOUNDLESS ENERGY℠

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

Closing

BOUNDLESS ENERGY℠

Attachment B - Constantine Project Stranded Fish and Mussel Survey Report

Stranded Fish and Mussel Survey Report

Constantine Dam Head Race, St. Joseph River Drawdown

St. Joseph County, Michigan

May 13, 2019

Cardno
Shaping the Future

Document Information

Prepared for	American Electric Power
Client Contact	Christina Svobota
Project Name	Constantine Dam Head Race, St. Joseph River Drawdown, Stranded Fish and Mussel Survey
Project Number	Cardno #J080101M32
Project Manager	John Richardson (Cardno)
Date	May 13, 2019

Prepared for:

C/O Christina Svoboda

13840 East Jefferson Road

Mishawaka, IN 46545-7343

Prepared by:

Cardno
708 Roosevelt Road, Walkerton, IN 46357

Table of Contents

Appendices

Tables

Figures

1 Introduction

Cardno was contracted to complete a stranded fish and mussel survey and relocation within the St. Joseph River, downstream of the Constantine Dam in the head race portion of the river (Figure 1). The drawdown of the Constantine Dam head race was being completed in response to required maintenance and assessment activities at the Constantine Dam. The maintenance and assessment activities performed by American Electric Power (AEP) required the complete dewatering of the approximately 10 feet deep head race channel to expose the upstream structures on the power house. Permitting requirements of the river drawdown specified the maximum daily water level change was to be 0.5 feet and therefore would occur over a 20 day period. The river drawdown was started on March 11, 2019 and finished on April 4, 2019. It is important to note the head race channel could not be completely dewatered and permeant flow was sustained during the maintenance and assessment activities. Water leaking through the head gates and high water levels at the downstream end of the power house prohibited complete dewatering of the head race channel. The sustained water level within the channel varied from 0.3 feet to 1.5 feet deep. Deeper pools at the upstream and downstream extent of the channel were also present due to localized bed scour areas. The entire head race channel was searched for stranded mussels and fish, an area approximately 1,300 feet by 100 feet (Figure 1). Cardno surveyed the project area on March 27 – 29, April 1, 2, and 4, 2019 for stranded fish and mussels and the results of those efforts are reported here.

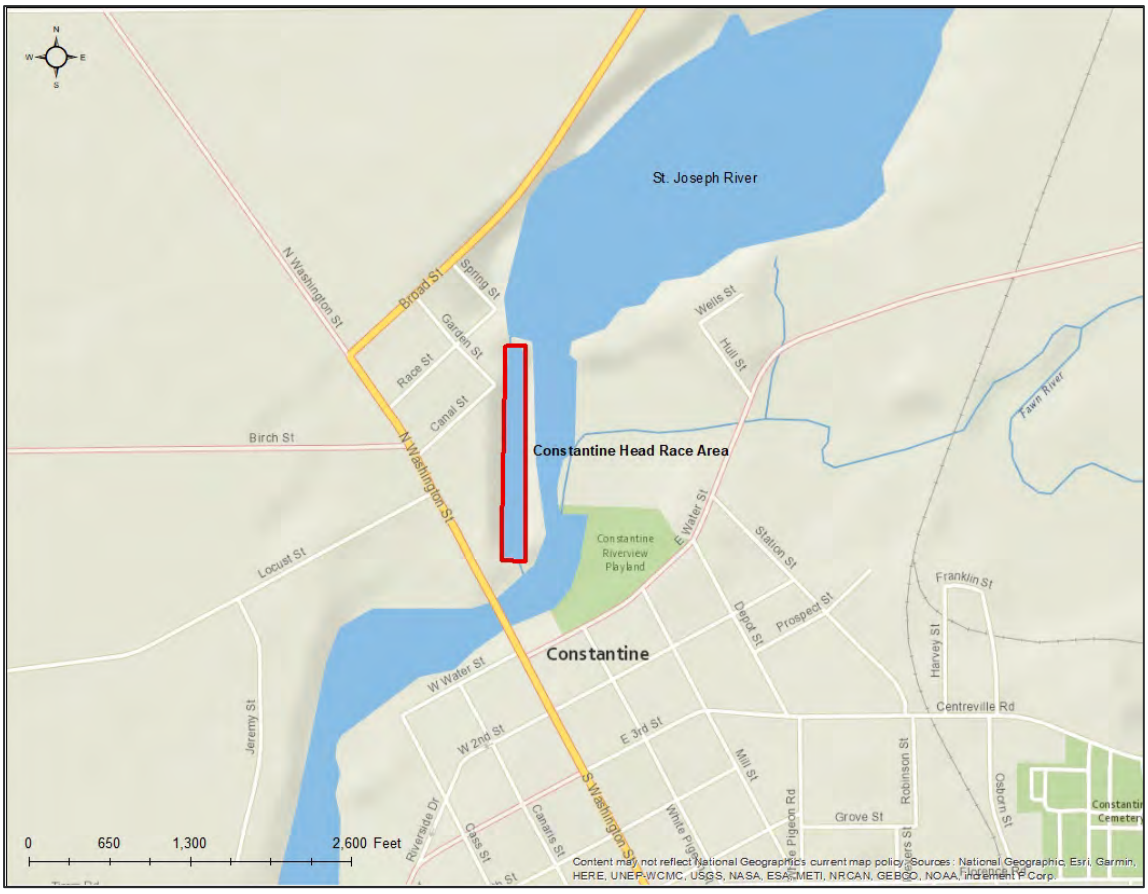


Figure 1. General location map showing Constantine head race channel drawdown area (outlined in red) St. Joseph County, Michigan.

2 Methods

2.1 Collectors Permit

Prior to stranded fish and mussel survey and relocation efforts the necessary State permits were obtained by Cardno. Fish and mussel relocation efforts were completed under the Michigan Scientific Collectors Permit issued to Cardno staff member Thomas Estrem and Michigan Threatened and Endangered Species permit # TE 150 issued to Mr. Estrem. A copy of both State collectors permits can be found in Appendix A.

2.2 Survey and Relocation Methods

River drawdown activities within the head race were initiated on March 11, and completed on April 4, 2019. During that timeframe a stranded mussel and fish survey and relocation was completed on March 27-29 and April 1, 2 and 4. Survey and relocation efforts were not completed until the end of the drawdown period because the banks of the head race channel are composed of stone and therefore not conducive for mussel habitation (Figure 2). Mussel habitat did not become exposed until the bottom three feet of channel banks at which point finer substrates became available (Figure 3). During each day of survey effort all exposed sediments were searched for stranded mussels. Mussels collected were placed in mesh diving bags and kept submerged in flowing water until relocation of individuals was completed at the end of each sampling day. All mussels collected were identified to species, representative species photos taken and transported to the relocation area shown in Figure 4. Mussels were distributed into the relocation area by wading into the channel and placing the individuals by hand. Habitat within the relocation area was suitable for mussel habitation and was a mixture of sand, gravel and cobble, with some submerged and emergent aquatic vegetation. The current was slow to moderate and water depth ranged from 1.5 to 4 feet.

Fish relocation efforts were planned to occur once the water depth within the channel was approximately 1.5 feet or less to allow for efficient removal of individuals utilizing barge electrofishing equipment. Electrofishing activities were completed on March 27 and 28, but suspended after that time when it became apparent that complete dewatering of the channel would not occur and the sustained water level was determined suitable for prolonged fish habitation. Block nets were placed at numerous points within the channel to create smaller reaches which limited the chasing of fish during electrofishing efforts. A Smith Root Type VI barge electrofishing unit with two anodes probes was used to collect fish. Electrofishing activities were completed in an upstream direction and occurred in approximately 500 feet long reaches created by installed block nets. After a 500 feet reach was fished all individuals collected were enumerated and identified to species. Fish were then placed in a water filled cooler and transported to the relocation point for release (Figure 4). Fish collection efforts were effective at removing the majority of individuals within the channel. While individual lengths were not recorded during the effort it was noted that larger individuals and game fish species were collected in greater abundance on the first day of relocation efforts, while on the second day smaller individuals and less game fish species were captured.

Figure 2. Water level in the head race channel on March 27, 2019. Note stone on channel banks and channel bank toe-of-slope just starting to become exposed. Photo taken at downstream end of head race at power house, facing upstream.

Figure 3. Representative photo of exposed bars and approximate final minimum water level achieved within the head race channel on April 2, 2019. Photo taken approximately 800 feet upstream of power house, facing downstream.

Figure 4. Location of fish release point and mussel relocation area.

3 Survey Results

3.1 Results

In total, 233 live mussels, representing 11 species were collected and relocated during the stranded mussel survey (Table 1). Plain pocketbook (*Lampsilis cardium*) was the most abundant species collected accounting for 38% of individuals, followed by creeper (*Strophitus undulatus*; 14%), elktoe (*Alasmidonta marginata*; 13%), mucket (*Actinonaias ligamentina; 11%*) and fluted shell (*Lasmigonia costa*11%). One species collected, purple wartyback (*Cyclonaias tuberculata*), is listed as threatened in Michigan and accounted for 2% of individuals. Additionally, there were four species collected that are identified as species of special concern in Michigan including elktoe, fluted shell, round Pigtoe (*Pleurobema sintoxia*) and paper pondshell (*Utterbackia imbecillis*). Cumulatively, species listed as threatened or special concern accounted for 30% of the total number of individuals relocated. All other mussel species collected do not have special conservation status designations and are relatively common to the St. Joseph River and southern Michigan as a whole. Representative mussel species photos are available in Appendix B.

The majority of mussels collected were located in exposed sand and gravel bars in the upstream one-third of the channel and on the bottom three feet of the channel banks. Mussels collected from the sand and gravel beds were sometimes completely exposed from the substrate while other individuals were located by siphon holes or depressions in the substrate. Mussels not exposed were found buried in the substrate up to 0.4 feet deep. Mussels found on the channel banks were generally exposed from the substrate. While each individual collected was not measured, overall there was a variety of sizes collected from a minimum of approximately 35 mm up to 130 mm. Mussel mortality resulting from drawdown activities was low and only six individuals were observed. These included two elktoe, three plan pocketbook and one fluted shell. In general, these individuals were located higher on the channel banks than most individuals collected, in isolated areas where marginal mussel habitat was present.

Table 1. Live mussels collected during stranded mussel survey and relocation effort.

Species Name	Common Name	Collection Date						Total
		3/27/2019	3/28/2019	3/29/2019	4/1/2019	4/2/2019	4/4/2019	
Actinonaias ligamentina	Mucket	-	2	17	3	-	5	**27**
Alasmidonta marginata	Elktoe (SC)	-	2	16	3	1	10	**32**
Cyclonaias tuberculata	Purple Wartyback (T)	-	-	1	1	-	3	**5**
Elliptio dilatata	Spike	-	-	2	-	-	-	**2**
Fusconaia flava	Wabash Pigtoe	-	-	4	2	4	2	**12**
Lampsilis cardium	Plain Pocketbook	22	9	35	9	2	12	**89**
Lasmigonia costata	Fluted Shell (SC)	3	1	17	3	1	1	**26**
Pleurobema sintoxia	Round Pigtoe (SC)	-	-	-	-	1	1	**2**
Quadrula pustulosa	Pimpleback	-	-	-	-	-	1	**1**
Strophitus undulatus	Creeper	3	1	11	8	4	6	**33**
Utterbackia imbecillis	Paper Pondshell (SC)	-	-	3	1	-	-	**4**
	Total	**28**	**15**	**106**	**30**	**13**	**41**	**233**

(SC)=State Special Concern (T)=State Threatened

Fish relocation efforts collected a total of 930 individuals, representing 21 species (Table 2). None of the fish species collected were on the list as having special conservation status by the State of Michigan. The most abundant species collected was smallmouth bass (*Micropterus dolomieu*) accounting for 35 percent of individuals, followed by rainbow darter (*Etheostoma caeruleum*; 26%), and logperch (*Percina caprodes*; 18%). All other species were collected in relatively low abundance, at 3% or less of total individuals (Table 2). While individual lengths were not collected as part of the effort, in general the following length distributions were observed for gamefish of interest. The majority of smallmouth bass were less than six inches, however, individuals were collected up to 14 inches. All walleye collected were relatively small and less than 12 inches. Other gamefish such as bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), yellow perch (*Perca flavescens*) and black crappie (*Pomoxis nigromaculatus*) were all represented by smaller individuals, generally below harvestable size. Fish mortality resulting from drawdown efforts was not observed during the effort.

Table 2. Number of live fish relocated from project area.

Scientific Name	Common Name	Collection Date		Total
		3/28/2019	3/29/2019	
Ambloplites rupestris	Rock Bass	9	18	**27**
Ameiurus natalis	Yellow Bullhead	18	17	**35**
Etheostoma blennioides	Greenside Darter	-	3	**3**
Etheostoma caeruleum	Rainbow Darter	69	174	**243**
Etheostoma nigrum	Johnny Darter	14	16	**30**
Hypentelium nigricans	Northern Hog Sucker	3	1	**4**
Ictalurus punctatus	Channel Catfish	-	9	**9**
Labidesthes sicculus	Brook Silverside	3	-	**3**
Lepomis cyanellus	Green Sunfish	1	-	**1**
Lepomis macrochirus	Bluegill	9	7	**16**
Luxilus cornutus	Common Shiner	1	3	**4**
Micropterus dolomieu	Smallmouth Bass	186	139	**325**
Micropterus salmoides	Largemouth Bass	1	1	**2**
Moxostoma erythrurum	Golden Redhorse	10	7	**17**
Moxostoma macrolepidotum	Shorthead Redhorse	2	-	**2**
Noturus flavus	Stonecat	-	1	**1**
Perca flavescens	Yellow Perch	3	3	**6**
Percina caprodes	Logperch	70	99	**169**
Percina maculata	Blackside Darter	3	17	**20**
Pomoxis nigromaculatus	Black Crappie	-	1	**1**
Sander vitreus	Walleye	12	-	**12**
	Total Individuals	**414**	**516**	**930**
	Total Species	**17**	**17**	**21**

4 Conclusion

4.1 Conclusion

Cardno completed a stranded fish and mussel survey and relocation effort in response to the river drawdown necessary for maintenance activities at the Constantine Dam on the St Joseph River. The drawdown lowered the head race channel approximately 10 feet which reduced the water level in the channel to 0.3 to 1.5 feet deep, with a sustained flow. Complete dewatering of the channel was not achieved due to leaks in the head gates at the dam and high water levels below the power house. Survey and relocation efforts were completed on March 27-29, April 1, 2, and 4, 2019. In total, 233 mussels representing 11 species were relocated from the head race channel into the adjacent main river channel downstream of the dam. One species relocated is listed as threatened by the state (purple wartyback) and four species are listed as species of special concern (elktoe, fluted shell, round Pigtoe, and paper pondshell). Listed mussel species accounted for 30% of individuals relocated during the effort. A total of 930 fish, representing 21 species were relocated from the head race channel and released upstream of the dam at the public boat launch area. None of the fish species collected during the effort were assigned a special conservation status by the state. Overall, a variety of gamefish were collected in addition to sucker and darter species.

Stranded Fish and Mussel Survey Report, Constantine Dam Head Race, St. Joseph River

APPENDIX A

MICHIGAN SCIENTIFIC COLLECTORS PERMIT AND MICHIGAN THREATENED AND ENDANGERGED SPECIES PERMIT

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES
LANSING

GRETCHEN WHITMER
GOVERNOR

DANIEL EICHINGER
DIRECTOR

Date Issued: 3/15/2019

SCIENTIFIC COLLECTOR'S PERMIT
Fish, Crustacean, and Mollusk

Under the provisions of Part 487, Act 451, P.A. 1994, as amended, being section 324.48735, permission is hereby granted to:

Name: Thomas L Estrem — Driver's License No.: 4810021248 IN
John B Richardson — 3920156789 IN

Address: Cardno JFNew
708 Roosevelt Rd.
Walkerton, IN 46574

to take, catch, or kill and possess the aquatic species from the waters and land within the jurisdiction of this state, as specified below in the special provisions section. This permit limits the take of aquatic species to the **minimum** number needed.

Prior to field activities occurring on any stream, public lake or public lands under this permit, the permittee **must notify** the local fish biologist or Fisheries Division supervisor of the Management Unit where collections will occur. This contact must be made at least 48 hours prior to commencing field work and during normal business hours Monday-Friday between 8 a.m. and 5 p.m. If a set work schedule has been established for the field season, providing a copy to the unit may alleviate the need for additional contacts with a single unit. It is also strongly recommended that the permittee notify the District Law Supervisor for the county where the permit is being used. Failure to notify the law supervisor may result in the disruption of field work. Both of these contacts can be initiated by calling the appropriate operational service center (map and phone numbers provided).

Any survey or sampling gear that is authorized by this permit and left on public lands or waters of the state unattended by the permittee must be clearly marked with either the permittee's name or organized affiliation. Failure to properly attach and display ownership, may result in unattended gear being removed by the DNR.

SPECIAL PROVISIONS: Permittees are authorized for a scientific survey to collect, identify, enumerate, and release all fish and mollusk species. The permittee will follow the protocol specified in the document titled "Michigan Freshwater Mussel Survey Protocols and Relocation Procedures" (2018). Relocation of mussels and fish from construction sites to areas immediately outside the area of impact is authorized. No lethal collection is authorized, and no voucher specimens may be retained. Fish may not be marked, clipped, or tagged in any way prior to their release. Should a species listed in Michigan as special concern, threatened, or endangered be encountered while in the field, the permittees must release it outside the area of impact immediately upon identification with as little further handling as possible. Lists of the Michigan's fish and mollusk species as well as their respective health statuses can be found online at www.michigan.gov/scientificcollectorspermit

Due to the high percentage of protected mussel species in Michigan (19 of 45 native mussels are list as T or E), the permittees should discuss their survey plans with the Threatened and Endangered Species Unit in Wildlife Division about the potential need to secure a T&E permit. Please contact Casey Reitz at reitzc@michigan.gov or 517-284-6210.

NOTE: The permittees will also engage in macroinvertebrate sampling.

In response to the VHS virus and other aquatic invasive species in Michigan, the following is required:

1) All equipment coming in contact with water including: boat hulls, boat trailers, buckets, waders, nets, etc. must be visually inspected and cleaned by hand picking any attached plants, sediments, or other debris. This should be done immediately upon leaving the water body being worked on.

2) All equipment coming in contact with water and/or fish and/or specifically working with aquatic invertebrates including: boat hulls, boat trailers, buckets, waders, nets, etc. must be disinfected using a 1 cup of bleach to 10 gallons of water solution at the end of each sampling day or prior to entering each successive water body if more than one is being sampled per day. If long periods of time (week or longer) are anticipated in between sampling events, thorough drying of all equipment in the sun is an acceptable alternative to using the bleach solution.

    a. A 20 min Virkon Aquatic bath can be substituted as a bleach alternative.
    b. A 20 min 100% vinegar bath can be substituted as a bleach alternative.

3) If using a boat, live wells and bilges must be emptied and disinfected with a solution of 1 cup of bleach to 10 gallons of water at the end of each sampling day or prior to entering each successive water body if more than one is sampled per day.

    a. A 20 min Virkon Aquatic bath can be substituted as a bleach alternative.
    b. A 20 min 100% vinegar bath can be substituted as a bleach alternative.

For more information on VHS or invasive species, go to the Fisheries link on the Department of Natural Resources web site at: http://www.michigan.gov/dnr

Permitted collection area: St. Joseph River in Berrien County within the Lake Michigan Basin:

Permitted collection gear: Electrofishing; by hand; kick and dip nets.

A copy of all reports and scientific papers using organisms collected with this permit shall be provided to DNR, Fisheries Division in addition to a Collector's Report form.

GENERAL PROVISIONS: This permit must be in permittee's possession during collection and must be made available upon request of any Department representative. Collection is limited to species not threatened or endangered. This permit is not transferable. This permit does not provide any

authorization to circumvent any federal, state, or local laws and ordinances, including, but not limited to restricted entrance to refuges or other areas closed to the public without written permission of the land administrator. For a complete list of provisions, see Guidelines for Holders of Cultural or Scientific Collector's Permits.

In addition to this permit, separate DNR Public Land Use permits are required from:

1) **Parks and Recreation Division for activities in State Parks and Recreation Areas and at the state boat launches;**
2) **Wildlife Division for activities in State Game Areas; and**
3) **Forest Resources Division for activities in State Forests**

Public Land Use Permit applications can be obtained online at:
http://www.michigan.gov/dnr/0,16077,7-153-30301_31154_35728---,00.html

Permittees are also advised to contact the US Forest Service and National Park Service about any permit requirements for activities occurring in Michigan's National Forests and National Parks, respectively.

Any violation of the conditions of this permit may result in revocation of this permit and misdemeanor penalties of imprisonment for not more than 90 days or a fine of not more than $500 or all of the above. Unless revoked, this permit **expires on 12/31/2019**.

By _____
James L. Dexter, Chief
Fisheries Division

cc: Fisheries Division
Southern Lake Michigan Management Unit
Threatened and Endangered Species Unit, Wildlife Division

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES
LANSING

GRETCHEN WHITMER
GOVERNOR

DANIEL EICHINGER
DIRECTOR

March 26, 2019

Thomas Estrem
Cardno
708 Roosevelt Rd
Walkerton, IN 46574

Dear Mr. Estrem:

This letter is an official attachment to your Threatened and Endangered Species Permit **(TE 150).** Your permit is issued in the *Consultant* category only. Your permit expires on **March 31, 2022**. Renewal information will be sent in December of 2021.

Authorization:
To conduct the scientific activities listed under special conditions on the threatened/endangered species listed below. All activities are subject to the standard permit conditions within this letter.

In addition to the standard requirements listed below:

- Permitted is the collection and temporary holding of mussels for identification for the Constantine Hydroelectric Dam on the St. Joseph River in St. Joseph County.
- The methods described in the June 25, 2018 "Stranded Mussel Survey Report" will be used to relocate mussels found in the work area. Mussels handled must be placed out of harm's way into the nearest suitable habitat to collection site.
- Dead specimens or shells may be collected and salvaged for identification.
- Each state-listed mussel translocated with be identified to species and marked with a GPS point where it is placed.

Standard Permit Conditions

A. All specimens authorized for collection under this Permit shall be deposited in the collection of an approved public educational or research institution prior to Permit expiration.
B. None of the specimens collected shall become part of a private collection or private property.
C. This permit does not allow or grant the right of trespass. Projects shall not take place on any private or public lands without permission from the owner or administrator of such lands.
D. This permit does not provide authorization to circumvent any federal, state, or local laws and ordinances.

E. Additionally, federal permits may be required for activities affecting federally listed threatened or endangered species and/or migratory birds. Contact the U. S. Fish and Wildlife Service at 2651 Coolidge Road, East Lansing, MI 48823.
F. The activities covered under this Permit are not transferable to another person unless specifically authorized.
G. Unless otherwise noted, within 10 days of the expiration of this Permit, the holder is required to file a report detailing the locations of any threatened and endangered species encountered and the number and disposition of specimens handled. Annual reports for multi-year permits are due at the end of each calendar year.
H. A person conducting any activities authorized by this permit shall carry a copy of this permit and shall produce a copy of this permit upon request of a Department of Natural Resources employee or law enforcement officer.

All permits require and annual report unless indicated otherwise. You can use the enclosed report form and submit forms via email to reitzc@michigan.gov. In addition, please report any new occurrences of threatened and endangered species as soon as possible instead of waiting until the end of the year. This will allow new data to be incorporated into the Michigan Natural Features Inventory database sooner, thus ensuring greater protection for these species and their habitats.

Thank you for helping protect our threatened and endangered species. Feel free to contact me with any questions or concerns.

Sincerely,

Casey M Reitz

Casey M. Reitz, Permit Specialist
DNR-Wildlife Division
Phone: 517-284-6210
Fax: 517-335-6604
reitzc@michigan.gov
www.michigan.gov/wildlifepermits

Michigan Department of Natural Resources – Wildlife Division

APPLICATION FOR A THREATENED/ENDANGERED SPECIES APPLICATION AND PERMIT

By the authority of Part 365, Endangered Species Protection, of the Natural Resource and Environmental Protection Act, Act 451 of 1994, and the rules established thereunder, submittal is required to be considered for a permit.

INSTRUCTIONS: Please type or print all information except the signature and mail with attachments to the Wildlife Division. Federal permits may be required for federally listed or migratory species. A proposal letter is required for any new or amended proposals. Instructions for proposals are on the back of this application.

APPLICANT INFORMATION

☐ New Permit ☒ Renewal Permit If Renewal, Permit Number: 2092

☒ Consultant (provide credentials)	☐ Education or Scientific	☐ Development/Management	☐ Live Animal Programs/Salvage

Name of Applicant (First, Last)	Applicant's Title (If applicable)
Thomas Estrem	
Organization Name	**Subpermittee**
Cardno	John Richardson
Address	
708 Roosevelt Road	
City, State, ZIP Code	
Walkerton, IN 46574	
Telephone	**E-Mail Address**
574-229-8764	tom.estrem@cardno.com

SPECIES INFORMATION (PROPOSAL LETTER REQUIRED FOR NEW APPLICANTS)

Species (Scientific or common names)
State listed mussel species

Location (Be specific. Include Michigan county(ies))
Head race upstream of Constantine Hydroelectric Dam, St. Joseph River, St. Joseph County

Time period requested (usually one to three years)
two years

Number of plants and/or animals to be handled, collected, relocated, etc.
Unknown number of mussels. Project involves the relocation of mussels from within the head race for the Constantine Hydroelectric Dam in Constantine MI.

Name and location of public institution where authorized specimens will be placed
No specimens are anticipated to be kept.

Regardless of the category, permit activities are authorized anywhere within the State of Michigan, unless specifically indicated otherwise. This permit does not authorize activities on private or public property without the approval of the land owner or administrator. Permittees and subpermittees shall display this permit, and any required Federal permit, upon the request of any authorized Department personnel

I have read and understand the front and back of this form and agree to abide by the requirements presented, including maintaining any Federal permit that may be required. If I am a new applicant, I have attached a letter of authority prepared in accordance with the instructions on the back of this application. To the best of my knowledge, the information supplied by me is true and correct. I understand this permit does not provide any authorization to circumvent any Federal, State, local zoning, or any other local laws and ordinances. I understand it is my responsibility to know and comply with the requirements of this permit and Federal, State, and local laws

Signature of Applicant	Date 3/14/2019
Thomas Estrem	

Mail completed application and all required attachments to:

PERMIT SPECIALIST - WILDLIFE DIVISION
MICHIGAN DEPARTMENT OF NATURAL RESOURCES
PO BOX 30444
LANSING MI 48909-7944
Or reitzc@michigan.gov, FAX: 517-335-6604

For DNR Use Only

Permit Number	Issue Date	Expiration Date
TE 150	3/26/19	3/31/22

Permit Specialist's Signature of Approval — Date 3/26/19

PR2013 (Rev. 12/12/2018)

Stranded Fish and Mussel Survey Report, Constantine Dam Head Race, St. Joseph River

APPENDIX B

REPRESENTATIVE MUSSEL SPECIES PHOTOS

Actinonaias ligamentina, Mucket, right valve

Alasmidonta marginata, Elktoe, right valve

Cyclonaias tuberculata, Purple Wartyback, left valve

Fusconaia flava, Wabash Pigtoe, right valve

Elliptio dilatata, Spike, beak sculpture

Elliptio dilatata, Spike, right valve

Lampsilis cardium, Plain Pocketbook, right valve

Lasmigonia costata, Fluted shell, right valve

Pleurobema sintoxia, Round Pigtoe, right valve

Quadrula pustulosa, Pimpleback, right valve

Strophitus undulatus, Creeper, left valve

Utterbackia imbecillis, Paper Pondshell, right valve

Cardno
Shaping the Future
708 Roosevelt Road, Walkerton, IN, 46574 USA
Phone 574-586-3400 www.cardno.com

FOREST COUNTY POTAWATOMI
CULTURAL PRESERVATION DIVISION

8130 Mish ko swen Drive
PO Box 340
Crandon, WI 54520

May 14, 2020

Jonathan M. Magalski
Environmental Specialist Consultant
American Electric Power Services Corporation, Environmental Services
1 Riverside Plaza
Columbus, Ohio 43215

Re: Project Number 10661-050-MI, Constantine Hydroelectric Project in the Village of Constantine, St. Joseph County, Michigan.

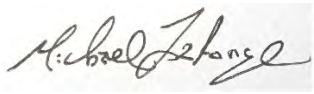
Dear Mr. Magalski,

Pursuant to consultation under Section 106 of the National Historic Preservation Act (1966 as amended) the Forest County Potawatomi Community, a Federally Recognized Native American Tribe, reserves the right to comment on Federal undertakings, as defined under the act.

This response is regarding the project mention above. The Tribal Historic Preservation Office has reviewed the Initial Study Report posted April 14, 2020. The THPO appreciates the information regarding the processes used to create the archaeology report and certainly understand the need for such information to be restricted. However, the Tribe requires a copy of the archaeological survey report for the project in order to make a determination as to its adequacy and accuracy. Please supply us with an electronic copy of the report so we may complete our review and make substantive comments on the relicensing.

Your interest in protecting Michigan's cultural and historic properties is appreciated. If you have any questions or concerns, please contact me at the email or number listed below.

Respectfully,



Michael LaRonge
Tribal Historic Preservation Officer
Cultural Preservation Division
Forest County Potawatomi Community
8130 Mish ko Swen Drive
P.O. Box 340

FOREST COUNTY POTAWATOMI
CULTURAL PRESERVATION DIVISION

8130 Mish ko swen Drive
PO Box 340
Crandon, WI 54520

Crandon, Wisconsin 54520
Phone: 715-478-7354
Email: Michael.LaRonge@FCPotawatomi-nsn.gov

Yayac, Maggie

Subject: FW: I&M Constantine Hydroelectric Project (FERC No. P-10661) - Cultural Resources Study Report

From: Jonathan M Magalski [mailto:jmmagalski@aep.com]
Sent: Tuesday, May 19, 2020 8:09 AM
To: Michael.LaRonge@FCPotawatomi-nsn.gov
Cc: Hanson, Danielle <Danielle.Hanson@hdrinc.com>; Elizabeth B Parcell <ebparcell@aep.com>
Subject: I&M Constantine Hydroelectric Project (FERC No. P-10661) - Cultural Resources Study Report

Dear Mr. LaRonge,

Per your letter dated May 14, 2020, please find attached an electronic copy of the Cultural Resources Report that was completed in support of the FERC relicensing of Indiana Michigan Power Company's Constantine Hydroelectric Project (FERC No. P10661). The subject report was filed with FERC as privileged. Due to file size, please confirm receipt. We appreciate your review and look forward to your comments. If you have any questions or require additional information, please feel free to contact me. Thank you…Jon

JONATHAN M MAGALSKI | **ENVIRONMENTAL SPEC CONSULT**
JMMAGALSKI@AEP.COM | D:614.716.2240
1 RIVERSIDE PLAZA, COLUMBUS, OH 43215

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426
June 9, 2020

OFFICE OF ENERGY PROJECTS

Project No. 10661-050-Michigan
Constantine Hydroelectric Project
Indiana Michigan Power Company

VIA FERC Services

Jonathan Magalski
Environmental Consultant Specialist
Indiana Michigan Power Company
1 Riverside Plaza
Columbus, OH 43215

Reference: Staff Comments on the Initial Study Report and Initial Study Report Meeting Summary for the Constantine Hydroelectric Project

Dear Mr. Magalski:

We have reviewed Indiana Michigan Power Company's (I&M) Initial Study Report filed on April 14, 2020, participated in the Initial Study Report Meeting on April 14, 2020, and reviewed the Initial Study Report Meeting Summary filed on May 8, 2020. Based on our review of the documents and participation in the meeting, we are providing comments pursuant to 18 C.F.R. section 5.15(c)(4).

Our comments are provided in Appendix A. Please address the comments in I&M's Responses to Disputes, which must be filed by July 13, 2020.

If you have any questions, please contact Lee Emery at (202) 502-8379, or lee.emery@ferc.gov.

Sincerely,

Janet Hutzel, Chief
Midwest Branch
Division of Hydropower Licensing

Enclosure: Appendix A—Staff's Comments on the Meeting Summary and Initial Study Report

APPENDIX A

Staff's Comments on the Meeting Summary and Initial Study Report

Water Quality Study

(1) The water quality data collected in the project bypassed reach indicated that dissolved oxygen (DO) levels were not consistent at various times during the sampling period with the state water quality standards for DO. The exceedances of state standards for DO occurred at sampling sites located upstream and downstream of the confluence of the Fawn River in the bypassed reach.

There were 37 days from August 20 to September 25, 2019, when exceedances of DO levels persisted on and off. Many of the DO exceedances observed during the Water Quality Study correspond to times when water was diverted out of the bypassed reach and into the power canal. For example, on August 29, 2019, and September 26 to 28, 2019, when field crews were collecting water sampling data and also fish samples, respectively, they observed that the water surface elevation of the Constantine Reservoir was below the top of the dam.

To help us better understand the nexus between project operation and water flows in the bypassed reach, please identify frequency and duration of instances when project operation cause water levels in the reservoir to fall below the top of the Constantine Dam. Please also provide an estimate in the drop in water levels (in feet and inches) that occurred in the bypassed reach during these periods of no flows entering the bypassed reach from the Constantine dam.

Fishery Survey and Mussel Survey

(2) Section 2.8 of the survey, states that the estimated point of collecting intake velocities for the project trashracks was located about 100 feet upstream from the trashracks. In the initial study report meeting, Indiana Michigan Power Company (I&M) stated that it was going to check to determine if the 100-foot estimate was correct; however, this information was not provided in the meeting summary. Please provide the correct distance to the intake velocity collection site for the power canal. The information would help us to verify intake velocity estimates with other intake velocity measurements made in the past at the project and with those recently made in the power canal.

(3) The Mussel Survey portion of the meeting summary states that the project bypassed reach had been "recently dredged." Please identify when this dredging occurred and the depths the bypassed channel was dredged to.

(4) For the Mussel Survey, the mussel sampling protocols stated that methods used to collect mussels was supposed to include water depths at each sampling site, as well as several other habitat parameters. However, no information was

given on the water depths at the mussel survey sites in the bypassed reach. For example, Digital image 5 (Downstream Portion of Site 2, substrate) and Digital image 50 (Site 3 substrate) in the Mussel Survey report appear to show mussel sampling sites that are very shallow, but no water depth is provided. Please provide water depths for the mussel sampling sites in the bypassed reach.

Cultural Resources

(6) In the *Methods* section of the Cultural Resources Study titled Archaeology Survey for the Constantine Hydroelectric Project Relicensing (FERC No. 10661), St. Joseph County, Michigan, I&M states that a "Stream Bank Inventory Schema" was implemented to determine shoreline erosion. However, the locations on the shoreline where this schema was implemented and the results of said method were not included in the study. Please provide this information.

Furthermore, in the *Methods* section, I&M states a combination of pedestrian transects and excavation of shovel test pits were conducted. Please provide a map depicting the locations of these transects including positions of the excavated shovel test pits, the number of shovel test pits excavated, any soil information collected during excavation of the shovel test pits, and any photographs and/or drawings of excavated shovel test pits in plan and profile perspective. Please file the information as privileged.

Yayac, Maggie

Subject: FW: Constantine Hydroelectric Project (FERC No. 10661) -- Filing of Fifth Quarterly Study Progress Report
Attachments: 20200709 Constantine 5th Quarterly Study Progress Report.pdf

From: Hanson, Danielle
Sent: Thursday, July 9, 2020 3:40 PM
To: 'Advisory Council on Historic Preservation' <jeddins@achp.gov>; 'Cass County Conservation District' <korie.blyveis@macd.org>; 'Forest County Potawatomi Community' <michael.laronge@fcpotawatomi-nsn.gov>; 'Friends of the St. Joe River Association Inc.' <fotsjr.outreach@gmail.com>; 'Michigan Department of Environmental Quality' <antieauc@michigan.gov>; 'Michigan Department of Natural Resources' <KRUGERK@michigan.gov>; 'Michigan DNR' <MistakJ@michigan.gov>; 'Michigan DNR' <ThiamkeelakulK@michigan.gov>; 'Michigan Hydropower Relicensing Coalition' <stuberbob@gmail.com>; 'NOAA' <Michael.Pentony@noaa.gov>; 'Pokagon Band of Potawatomi Indians' <kelly.curran@pokagonband-nsn.gov>; 'St. Joseph River Basin Commission' <paddleheadz@gmail.com>; 'US Deparment of the Interior' <Mary.Manydeeds@bia.gov>; 'US Department of Agriculture' <martin.rosek@mi.usda.gov>; 'US Environmental Protection Agency' <pelloso.elizabeth@epa.gov>; 'US Environmental Protection Agency' <westlake.kenneth@epa.gov>; 'US Fish and Wildlife Service' <Jack_Dingledine@fws.gov>; 'USGS MI Water Science Center' <tlweaver@usgs.gov>; 'USGS MI Water Science Center' <dhubbell@usgs.gov>; 'Village of Constantine' <skelton-m@comcast.net>; 'Village of Constantine, Village Manager' <mhoneysett@comcast.net>; 'Village of White Pigeon' <whitepigeonvillage@comcast.net>
Cc: 'Jonathan M Magalski (jmmagalski@aep.com)' <jmmagalski@aep.com>; Elizabeth B Parcell <ebparcell@aep.com>; Quiggle, Robert <Robert.Quiggle@hdrinc.com>
Subject: Constantine Hydroelectric Project (FERC No. 10661) -- Filing of Fifth Quarterly Study Progress Report

Constantine Hydroelectric Project Stakeholders:

Indiana Michigan Power Company (I&M), a unit of American Electric Power (AEP), is the licensee, owner and operator of the Constantine Hydroelectric Project (FERC No. 10661) (Project) located on the St. Joseph River in St. Joseph County, Michigan. The Project is operated under a license issued by the Federal Energy Regulatory Commission (FERC). The existing FERC license for the Project expires on September 30, 2023. I&M is pursuing a new license for the continued operation of the Project in accordance with FERC's Integrated Licensing Process (ILP). As proposed in I&M's March 15, 2019 Revised Study Plan and approved in FERC's April 9, 2019 Study Plan Determination (SPD), I&M filed the Fifth Quarterly Study Progress Report for the Project on July 9, 2020. The progress report describes the activities that have been performed since FERC's SPD as well as ILP activities that are generally expected to be conducted during quarter 3 of 2020.

On behalf of I&M, we are notifying stakeholders of the availability of the progress report. For your convenience, a copy of the progress report is attached.

Should you have any questions regarding this filing, please contact Jon Magalski with AEP at (614) 716-2240 or jmmagalski@aep.com.

Thank you,

Danielle Hanson
Environmental Scientist

HDR
M 315.729.4745
Danielle.Hanson@hdrinc.com

hdrinc.com/follow-us

American Electric Power
1 Riverside Plaza
Columbus, OH 43215
aep.com

Via Electronic Filing

July 9, 2020

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

Subject: Constantine Hydroelectric Project (FERC No. 10661)
Fifth Quarterly Study Progress Report

Dear Secretary Bose:

Indiana Michigan Power Company (I&M), a unit of American Electric Power (AEP), hereby submits the Fifth Quarterly Study Progress Report for the Constantine Hydroelectric Project (Project) (FERC Project No. 10661) relicensing.

I&M has elected to utilize the Integrated Licensing Process (ILP) for the relicensing of the Project as defined in 18 Code of Federal Regulations (C.F.R.) Part 5. As proposed in I&M's March 15, 2019 Revised Study Plan (RSP) and approved in the Commission's April 9, 2019 Study Plan Determination (SPD), I&M is hereby filing the Fifth Quarterly Study Progress Report for the Project. This progress report describes the activities performed since the SPD, as well as ILP activities generally expected to be conducted in quarter 3 (Q3) of 2020.

Relicensing Studies Update

Unless otherwise described in the study reports, I&M conducted the following eight studies in conformance with the approved RSP and the Commission's SPD: (1) Botanical Resources Study, (2) Shoreline Stability Assessment Study, (3) Water Quality Study, (4) Fisheries Survey, (5) Mussel Survey, (6) Wetlands Study, (7) Recreation Study, and (8) Cultural Resources Study. Technical study reports for each of the studies were included as appendices to the Initial Study Report (ISR) that was filed with FERC on April 14, 2020.

As part of the Fisheries Survey, I&M proposed to collect fish tissue samples to test for contaminants. Although, fish tissue samples were not required by FERC's SPD, I&M decided to collect them anyways based on I&M's experience at other projects (i.e., Mottville Project) and the resource agencies' interest in these data. At the time that the ISR was filed, I&M had not yet received the results from the laboratory for the fish tissue analyses. I&M is hereby providing the results of the fish tissue sampling in the attachment to this filing.

Initial Study Report and Meeting

As previously mentioned, I&M's ISR was filed with FERC on April 14, 2020. In accordance with the Commission's regulations at 18 C.F.R. § 5.15(c), I&M held an Initial Study Report Meeting (ISR Meeting) with participants and FERC staff via Webex on April 23, 2020. An ISR Meeting

summary was filed with FERC on May 8, 2020. The deadline to submit any disputes or requests to amend studies was June 13, 2020. The only comment letter received was from FERC, dated June 9, 2020. I&M is currently addressing FERC's comments and will file a response by July 13, 2020.

Study Program Update

I&M completed all of the relicensing studies during the 2019 study season and has now provided all remaining study data via this progress report. Additionally, no disputes or requests to revise any of the studies have been proposed by stakeholders or FERC. Therefore, I&M is proposing that this will be the last quarterly progress report submitted for the Project.

If there are any questions regarding this progress report, please do not hesitate to contact me at (614) 716-2240 or jmmagalski@aep.com.

Sincerely,

Jonathan M. Magalski
Environmental Specialist Consultant
American Electric Power Services Corporation, Environmental Services

Attachment

Cc: Distribution List
Liz Parcell (AEP)
Rob Quiggle (HDR)

Constantine Hydroelectric Project (FERC No. 10661)
Distribution List

Federal Agencies

Mr. John Eddins
Office of Federal Agency Programs
Advisory Council on Historic Preservation
401 F Street NW, Suite 308
Washington, DC 20001-2637

Ms. Kimberly Bose
Secretary
Federal Energy Regulatory Commission
888 1st St NE
Washington, DC 20426

FEMA Region 5
536 South Clark Street, 6th Floor
Chicago, IL 60605

Mr. Michael Pentony
Regional Administrator
NOAA Fisheries Service
Greater Atlantic Regional Fisheries Office
55 Great Republic Drive
Gloucester, MA 01930-2276

Mr. Martin J. Rosek
State Soil Scientist
US Department of Agriculture
Natural Resources Conservation Service
3001 Coolidge Road, Suite 250
East Lansing, MI 48823

Ms. Mary Manydeeds
Bureau of Indian Affairs, Midwest Region
US Department of the Interior
Norman Pointe II Building
5600 W. American Boulevard, Suite 500
Bloomington, MN 55437

Office of the Solicitor
US Department of the Interior
1849 C Street, NW
Washington, DC 20240

Mr. Lindy Nelson
Regional Environmental Officer, Office of
Environmental Policy & Compliance
US Department of the Interior
Philadelphia Region
Custom House, Room 244
200 Chestnut Street
Philadelphia, PA 19106

Ms. Liz Pelloso
Wetland/Environmental Scientist, Region 5
US Environmental Protection Agency
77 West Jackson Boulevard (E19-J)
Chicago, IL 60604

Mr. Ken Westlake
Chief, NEPA Implementation Section - Region 5
US Environmental Protection Agency
77 West Jackson Boulevard (E19-J)
Chicago, IL 60604

Mr. Jack Dingledine
Assistant Field Office Supervisor/Michigan
Ecological Services Field Office
US Fish and Wildlife Service
2652 Coolidge Road, #101
East Lansing, MI 48823

Ms. Alisa Shull
Chief, Endangered Species - Midwest Region
(Region 3)
US Fish and Wildlife Service
5600 American Boulevard West, Suite 990
Bloomington, MN 55437-1458

Mr. Derrick Hubbell
Michigan Water Science Center
US Geological Survey
6520 Mercantile Way, Suite 5
Lansing, MI 48911-5991

Mr. Tom Weaver
Michigan Water Science Center
US Geological Survey
6520 Mercantile Way, Suite 5
Lansing, MI 48911-5991

US Geological Survey
1451 Green Road
Ann Arbor, MI 48105

Hon. Aaron Miller
US Congressman, 59th District
US House of Representatives
N-993 House Office Building
PO Box 30014
Lansing, MI 48909

Constantine Hydroelectric Project (FERC No. 10661)
Distribution List

Mr. Michael Reynolds
Acting Director, Headquarters
US National Park Service
1849 C Street, NW
Washington, DC 20240

Hon. Gary Peters
US Senate
Hart Senate Office Building
Washington, DC 20510

Hon. Debbie Stabenow
US Senate
713 Hart Senate Office Building
Washington, DC 20510-2204

State Agencies

Michigan Department of Agriculture
525 West Allegan Street
Lansing, MI 48933

Mr. Chris Antieau
Great Lakes Shorelands Unit - Water Resources Division
Michigan Department of Environmental Quality
525 West Allegan Street
PO Box 30473
Lansing, MI 48909-7973

Kalamazoo District Office
Michigan Department of Environmental Quality
7953 Adobe Road
Kalamazoo, MI 49009-5025

Ms. Jessica Mistak
Michigan Department of Natural Resources
PO Box 30028
Lansing, MI 48909

Mr. Kyle Kruger
Senior Fisheries Biologist
Michigan Department of Natural Resources
Mio Field Office
191 S. Mt. Tom Road
Mio, MI 48647

Ms. Kesiree Thiamkeelakul
Michigan Department of Natural Resources
Mio Field Office
191 S. Mt. Tom Road
Mio, MI 48647

Mr. Brian D. Conway
State Historic Preservation Officer, Lansing Office
State Historic Preservation Office
735 East Michigan Avenue
PO Box 30044
Lansing, MI 48909

Local Governments

Ms. Korie Blyveis
District Manager
Cass County Conservation District
1127 East State St.
Cassopolis, MI 49031

Mr. Robert Hile
Mayor
City of Sturgis
130 North Nottawa
Sturgis, MI 49091

Friends of the St. Joe River Association, Inc.
PO Box 1794
South Bend, IN 46634

St. Joseph County
PO Box 189
Centreville, MI 49032

Ms. Carolyn Grace
Administrator
St. Joseph County Conservation District
693 E. Main Street
Centerville, MI 49032

Mr. Mark R. Brown
Supervisor
Township of Constantine
425 Centreville Street
Constantine, MI 49042

Constantine Hydroelectric Project (FERC No. 10661)
Distribution List

Mr. George E. Morse
Supervisor
Township of Sturgis
70669 Stubey Road
Sturgis, MI 49091

Mr. Donald E. Gloy, Jr.
Supervisor
Township of White Pigeon
16825 Tomahawk Trail
White Pigeon, MI 49099

Mr. Mark Honeysett
Village Manager
Village of Constantine
115 White Pigeon Street
Constantine, MI 49042

Ms. Marcia Skelton
Village of Constantine
115 White Pigeon Street
Constantine, MI 49042

Mr. Tyler Royce
President
Village of White Pigeon
103 South Kalamazoo
PO Box 621
White Pigeon, MI 49099

Tribes

Mr. Michael LaRonge
Tribal Historic Preservation Officer
Forest County Potawatomi Community
5320 Wensaut Lane
PO Box 340
Crandon, WI 54520

Ms. Kelly Curran
Pokagon Band of Potawatomi Indians
58620 Sink Road
PO Box 180
Dowagiac, MI 49047

Nottawaseppi Huron Band of the Potawatomi
1485 Mno-Bmadzewen Way
Fulton, MI 49052

Non-governmental Organizations

Mr. John Seebach
American Rivers
1104 14th St NW, Suite 1400
Washington, DC 20005

Mr. Kevin Richard Colburn
National Stewardship Director
American Whitewater
PO Box 1540
Cullowhee, NC 28779

Michigan Audubon Society
2311 Science Parkway, Suite 200
Okemos, MI 48864

Michigan Citizens for Water Conservation
PO Box 1
Mecosta, MI 49332

Michigan Environmental Council
602 West Ionia Street
Lansing, MI 48933

Mr. Bob Stuber
Fisheries Biologist
Michigan Hydropower Relicensing Coalition
1620 High Street
Traverse City, MI 49684

Michigan Loon Preservation Association
10181 Sheridan Road
Millington, MI 48746

Michigan Nature Association
2310 Science Parkway, Suite 100
Okemos, MI 48864

Mr. Matt Meersman
Director
St. Joseph River Basin Commission
227 West Jefferson Boulevard
1120 County-City Boulevard
South Bend, IN 46601

Great Lakes Environmental Center

Summary of Results from the Analysis of Fish Samples
May 8, 2020

Twenty whole fish, 10 large mouth bass (LMB) and 10 shorthead redhorse (SHRD) were collected from the impoundment at the Constantine Hydroelectric Power Plant on December 4, 2019. The individuals were grouped into three composite samples as follows:

- Group 1 – LMB, length greater than 350mm, 5 individuals
- Group 2 – LMB, length less than or equal to 350mm, 5 individuals
- Group 3 – SHRD, all 10 individuals.

Tissue homogenates were prepared for analysis from skin-on fillets. The homogenate samples were submitted to Pace Analytical for analysis of % moisture, % lipid, total mercury, congener specific polychlorinated biphenyls and Aroclors.

1. Results

The results are summarized in Tables 1 through 4. The result with a J flag (J) indicates a value below the reporting limit (RL) but above the method detection limit (MDL). The result with an I flag (I) indicates the presence of interference in the mass spectrum. J and I flagged results should be considered estimates. Chemical analyte results are reported on a wet weight basis; the Table 1 results may be used to convert these to a dry weight or percent lipid basis. Empty cells indicate the chemical was not detected in the associated sample.

Table 1. Percent solids and lipids

Analyte	Group 1	Group 2	Group 3
Solids	79.5%	79.6%	78.8%
Lipids	0.61%	0.45%	2.3%

Table 2. Results from the analysis of mercury

	Concentration (µg/kg wet weight)		
Analyte	**Group 1**	**Group 2**	**Group 3**
Total Mercury	340	200	190

Table 3. Results from the analysis of polychlorinated biphenyls (PCBs)

	Concentration (ng/kg wet weight)		
Analyte	**Group 1**	**Group 2**	**Group 3**
Chlorination 1			
PCB 1	None	None	None
PCB 2			
PCB 3			
Chlorination 2			
PCB 4	None	None	
PCB 5			
PCB 6			
PCB 7			
PCB 8			29.5
PCB 9			
PCB 10			

Analyte	Concentration (ng/kg wet weight)		
	Group 1	**Group 2**	**Group 3**
PCB 11	None	None	
PCB 12/13			
PCB 14			
PCB 15			
Chlorination 3			
PCB 16	None	None	
PCB 17			37.2
PCB 18/30			
PCB 19			
PCB 20/28			150
PCB 21/33			
PCB 22			
PCB 23			
PCB 24			
PCB 25			42.1
PCB 26/29			75
PCB 27			
PCB 31			135
PCB 32			
PCB 34			
PCB 35			
PCB 36			
PCB 37			
PCB 38			
PCB 39			
Chlorination 4			
PCB 40/41/71	None		
PCB 42			72.7
PCB 43/73			
PCB 44/47/65			431
PCB 45/51			
PCB 46			
PCB 48			
PCB 49/69		112	450
PCB 50			
PCB 52		181	316
PCB 53			
PCB 54			
PCB 55			
PCB 56			102
PCB 57			
PCB 58			
PCB 59/62/75			
PCB 60			70.5
PCB 61/70/74/76			760
PCB 63			
PCB 64			192

Analyte	Concentration (ng/kg wet weight)		
	Group 1	**Group 2**	**Group 3**
PCB 66		81.2	437
PCB 67			
PCB 68			
PCB 72			
PCB 77			
PCB 78			
PCB 79			
PCB 80			
PCB 81			
Chlorination 5			
PCB 82			78.4
PCB 83			
PCB 84			130
PCB 85/116/117			273
PCB 86/87/97/108/119/125			759
PCB 88/91			152
PCB 89			
PCB 90/101/113	145	229	980
PCB 91			
PCB 92			147
PCB 93/98/100/102			
PCB 94			
PCB 95			398
PCB 96			
PCB 99	108	169	883
PCB 103			
PCB 104			
PCB 105	60.9	85.7	498
PCB 106			
PCB 107/124			
PCB 109			120
PCB 110/115	129	238	1,370
PCB 111			
PCB 112			
PCB 114			
PCB 118	172	247	1,430
PCB 120			
PCB 121			
PCB 122			
PCB 123			
PCB 126			
PCB 127			
Chlorination 6			
PCB 128/166			304
PCB 129/138/163	311	403	2,270
PCB 130			78.4

Analyte	Concentration (ng/kg wet weight)		
	Group 1	**Group 2**	**Group 3**
PCB 131			
PCB 132			264
PCB 133			
PCB 134/143			
PCB 135/151			252
PCB 136			65.1
PCB 137			120
PCB 139/140			
PCB 141			115
PCB 142			
PCB 144			
PCB 145			
PCB 146	49.4 (I)	59.7	340
PCB 147/149	106	164	773
PCB 148			
PCB 150			
PCB 152			
PCB 153/168	302	352	2,060
PCB 154			
PCB 155			
PCB 156/157			220
PCB 158			179
PCB 159			
PCB 160			
PCB 161			
PCB 162			
PCB 164			92.2
PCB 165			
PCB 167			91.4
PCB 169			
Chlorination 7			
PCB 170		50.2	272
PCB 171/173			
PCB 172			66.6
PCB 174			126
PCB 175			
PCB 176			
PCB 177			96.5
PCB 178			82.3
PCB 179			65.9
PCB 180/193	116	127	688
PCB 181			
PCB 182			
PCB 183/185			228
PCB 184			
PCB 186			
PCB 187	115	110	532

Analyte	Concentration (ng/kg wet weight)		
	Group 1	**Group 2**	**Group 3**
PCB 188			
PCB 189			
PCB 190			60.6
PCB 191			
PCB 192			
Chlorination 8			
PCB 194		None	139
PCB 195			
PCB 196			
PCB 197/200			
PCB 198/199			221
PCB 201			
PCB 202			
PCB 203			159
PCB 204			
PCB 205			
Chlorination 9			
PCB 206	None	None	165
PCB 207			
PCB 208			
Chlorination 10			
PCB 209	None	None	78.5
PCB Homologs			
Chlorination 1			
Chlorination 2			29.5
Chlorination 3			440
Chlorination 4		374	2,830
Chlorination 5	615	970	7,220
Chlorination 6	719	978	7,220
Chlorination 7	231	287	2,220
Chlorination 8			519
Chlorination 9			165
Chlorination 10			78.5
Aroclors			
Aroclor 1016	None	None	
Aroclor 1221			
Aroclor 1232			
Aroclor 1242			
Aroclor 1248			
Aroclor 1254			14,600 (J)
Aroclor 1260			
Total PCBs			
Total of all congeners	1,570	2,610	20,700

2. Discussion

The three fish samples were successfully analyzed for the chemicals listed in the above tables. Mercury was found in all three samples with Group 1 having the highest concentration while Group 3 had the lowest.

PCB congeners were found in all three samples. Specifically,

- Group 1 – 11 congeners, total concentration = 1,570 ng/kg
- Group 2 – 15 congeners, total concentration = 2,610 ng/kg
- Group 3 – 58 congeners, total concentration = 20,700 ng/kg

The data show that the SHRD sample (Group 3) had a significantly higher PCB concentration than either of the two LMB samples. Additionally, the Group 3 sample had a 14,600 ng/kg estimated concentration of Aroclor 1254; the estimated concentration was below the reporting limit but above the method limit (J flagged).

Table 4 presents a comparison of sample results to published screening values. The EPA document "*Guidance for Assessing Chemical Contaminant Data for use in Fish Advisories: Volume 2 Risk Assessment and Fish Consumption Limits, 3rd Edition*" lists screening values for tissue concentrations of particular chemicals in recreational and subsistence fisheries. These screening values represent tissue contaminant levels that pose a potential public health concern. The mercury results are of note when compared to the published values. The results from all three groups are below the subsistence fishery value but above the recreational fisheries value.

The total PCB concentration (from the congener specific analysis) in the Group 2 and Group 3 samples were also below the subsistence fishery value but above the recreational fisheries value. The total PCB concentration in Group 1 is below both the subsistence and recreational screening values.

Table 4. Comparison of Sample Results to Published Screening Values

Compound	EPA Recreational Fishery Screening Value (ppb)[a,b]	EPA Subsistence Fishery Screening Value (ppb)[a,b]	Group 1 Result (µg/kg wet weight)	Group 2 Result (µg/kg wet weight)	Group 3 Result (µg/kg wet weight)
Mercury	400	49	340	200	190
Total PCBs (congeners)	20	2.45	1.57	2.62	20.1

[a] Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 2, Third Edition. November 2000. US EPA Office of Water. https://www.epa.gov/sites/production/files/2018-11/documents/guidance-assess-chemical-contaminant-vol2-third-edition.pdf

[b] Screening values listed as parts per billion (ppb), which is equivalent to µg/kg, but not specified as being on a wet weight or dry weight basis.

American Electric Power
1 Riverside Plaza
Columbus, OH 43215
aep.com

Via Electronic Filing

July 13, 2020

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

Subject: Constantine Hydroelectric Project (FERC No. 10661)
Response to Comments on the Initial Study Report

Dear Secretary Bose:

Indiana Michigan Power Company (I&M), a unit of American Electric Power (AEP), is the licensee, owner, and operator of the Constantine Hydroelectric Project (Project) (FERC Project No. 10661), located on the St. Joseph River in St. Joseph County, Michigan. The Project is operated under a license issued by the Federal Energy Regulatory Commission (FERC or Commission). The existing FERC license for the Project expires on September 30, 2023.

I&M has elected to utilize the Integrated Licensing Process (ILP) for the relicensing of the Project as defined in 18 Code of Federal Regulations (C.F.R.) Part 5. In accordance with the Commission's regulations at 18 C.F.R. § 5.15 and the Commission's April 9, 2019 Study Plan Determination (SPD), I&M filed the Initial Study Report (ISR) with FERC on April 14, 2020. Additionally, I&M held an Initial Study Report Meeting (ISR Meeting) with participants and FERC staff via Webex on April 23, 2020. An ISR Meeting summary was filed with FERC on May 8, 2020. The deadline to submit any disputes or requests to amend studies was June 13, 2020. The only comment letter received was from FERC, dated June 9, 2020. I&M is hereby providing responses to FERC's comments on the ISR.

Water Quality Study

FERC's Comment:

(1) The water quality data collected in the project bypassed reach indicated that dissolved oxygen (DO) levels were not consistent at various times during the sampling period with the state water quality standards for DO. The exceedances of state standards for DO occurred at sampling sites located upstream and downstream of the confluence of the Fawn River in the bypassed reach.

There were 37 days from August 20 to September 25, 2019, when exceedances of DO levels persisted on and off. Many of the DO exceedances observed during the Water Quality Study correspond to times when water was diverted out of the bypassed reach and into the power canal. For example, on August 29, 2019, and September 26 to 28, 2019, when field crews were collecting water sampling data and also fish samples, respectively, they observed that the water surface elevation of the Constantine Reservoir was below the top of the dam.

To help us better understand the nexus between project operation and water flows in the bypassed reach, please identify frequency and duration of instances when project operation cause water levels in the reservoir to fall below the top of the Constantine Dam. Please also provide an estimate in the drop in water levels (in feet and inches) that occurred in the bypassed reach during these periods of no flows entering the bypassed reach from the Constantine dam.

I&M's Response:

I&M is still in the process of compiling and analyzing Project operations data. I&M will provide the results of their analyses to FERC within 14 days from the date of this filing.

Fishery Survey

FERC's Comment:

(2) Section 2.8 of the survey, states that the estimated point of collecting intake velocities for the project trashracks was located about 100 feet upstream from the trashracks. In the initial study report meeting, Indiana Michigan Power Company (I&M) stated that it was going to check to determine if the 100-foot estimate was correct; however, this information was not provided in the meeting summary. Please provide the correct distance to the intake velocity collection site for the power canal. The information would help us to verify intake velocity estimates with other intake velocity measurements made in the past at the project and with those recently made in the power canal.

I&M's Response:

The estimated distance from the trashrack structure to Transect #2 (the first intake velocity transect upstream of the trashracks) is approximately 136 feet. The average current velocity at Transect #2, as reported in the Fisheries Survey Report, was 1.33 feet per second (fps). Using Project-specific information, including the total maximum hydraulic capacity of the units and the cross sectional area one foot upstream of the trashrack structure, I&M's consultant (HDR) calculated the intake velocity one foot upstream of the trashracks to be approximately 2.07 fps. The formula used for this calculation was Q=VA, where Q equals the total maximum hydraulic capacity of the 4 units (cfs); V equals velocity (fps); and A equals cross sectional area one foot upstream of the trashracks.

Mussel Survey

FERC's Comments:

(3) The Mussel Survey portion of the meeting summary states that the project bypassed reach had been "recently dredged." Please identify when this dredging occurred and the depths the bypassed channel was dredged to.

(4) For the Mussel Survey, the mussel sampling protocols stated that methods used to collect mussels was supposed to include water depths at each sampling site, as well as several other habitat parameters. However, no information was given on the water depths at the mussel survey sites in the bypassed reach. For example, Digital image 5 (Downstream Portion of Site 2, substrate) and Digital image 50 (Site 3 substrate) in the Mussel Survey report appear to show mussel sampling sites that are very shallow, but no water depth is provided. Please provide water depths for the mussel sampling sites in the bypassed reach.

I&M's Responses:

(3) During the ISR Meeting it was mentioned that another contractor (Cardno) conducted a Stranded Fish and Mussel Survey in the Project's power canal in March and April of 2019 to support dewatering of the canal. The purpose of the dewatering was to allow for inspection of the intake screens. Cardno surveyed the area for stranded fish and mussels as the canal was being dewatered and relocated all stranded fish and mussels to the bypass reach. The full report was filed with FERC as Attachment B of ISR Meeting summary on May 8, 2020 which includes information regarding species collected and relocated. While the power canal was dewatered, approximately 163 cubic yards of accumulated sediment was removed in front of the screens to help facilitate inspection and remove logs that were pinned against the screens that likely caused some of the sediment deposition. The depth to which the sediment was removed match those of original contours.

(4) Figures have been developed that detail the water depth and substrate type for each of the Mussel Survey sampling locations. The figures are included in Attachment A of this filing.

Cultural Resources Study

FERC's Comment:

(6) In the *Methods* section of the Cultural Resources Study titled Archaeology Survey for the Constantine Hydroelectric Project Relicensing (FERC No. 10661), St. Joseph County, Michigan, I&M states that a "Stream Bank Inventory Schema" was implemented to determine shoreline erosion. However, the locations on the shoreline where this schema was implemented and the results of said method were not included in the study. Please provide this information.

Furthermore, in the *Methods* section, I&M states a combination of pedestrian transects and excavation of shovel test pits were conducted. Please provide a map depicting the locations of these transects including positions of the excavated shovel test pits, the number of shovel test pits excavated, any soil information collected during excavation of the shovel test pits, and any photographs and/or drawings of excavated shovel test pits in plan and profile perspective. Please file the information as privileged.

I&M's Response:

Based on the visual assessment of the Project area conducted by Commonwealth Heritage Group, no shovel testing or formal pedestrian transects were required. The methods and results section of the Archaeology Survey Report has been revised for clarification. The revised report is included in Attachment B of this filing and is being filed with FERC as privileged.

If there are any questions regarding this filing, please do not hesitate to contact me at (614) 716-2240 or jmmagalski@aep.com.

Sincerely,

Jonathan M. Magalski
Environmental Specialist Consultant
American Electric Power Services Corporation, Environmental Services

Attachments:
Attachment A - Mussel Survey Figures
Attachment B - Archaeology Survey Report (filed as privileged)

Cc: Distribution List
Liz Parcell (AEP)
Rob Quiggle (HDR)

Constantine Hydroelectric Project (FERC No. 10661)
Distribution List

Federal Agencies

Mr. John Eddins
Office of Federal Agency Programs
Advisory Council on Historic Preservation
401 F Street NW, Suite 308
Washington, DC 20001-2637

Ms. Kimberly Bose
Secretary
Federal Energy Regulatory Commission
888 1st St NE
Washington, DC 20426

FEMA Region 5
536 South Clark Street, 6th Floor
Chicago, IL 60605

Mr. Michael Pentony
Regional Administrator
NOAA Fisheries Service
Greater Atlantic Regional Fisheries Office
55 Great Republic Drive
Gloucester, MA 01930-2276

Mr. Martin J. Rosek
State Soil Scientist
US Department of Agriculture
Natural Resources Conservation Service
3001 Coolidge Road, Suite 250
East Lansing, MI 48823

Ms. Mary Manydeeds
Bureau of Indian Affairs, Midwest Region
US Department of the Interior
Norman Pointe II Building
5600 W. American Boulevard, Suite 500
Bloomington, MN 55437

Office of the Solicitor
US Department of the Interior
1849 C Street, NW
Washington, DC 20240

Mr. Lindy Nelson
Regional Environmental Officer, Office of
Environmental Policy & Compliance
US Department of the Interior
Philadelphia Region
Custom House, Room 244
200 Chestnut Street
Philadelphia, PA 19106

Ms. Liz Pelloso
Wetland/Environmental Scientist, Region 5
US Environmental Protection Agency
77 West Jackson Boulevard (E19-J)
Chicago, IL 60604

Mr. Ken Westlake
Chief, NEPA Implementation Section - Region 5
US Environmental Protection Agency
77 West Jackson Boulevard (E19-J)
Chicago, IL 60604

Mr. Jack Dingledine
Assistant Field Office Supervisor/Michigan
Ecological Services Field Office
US Fish and Wildlife Service
2652 Coolidge Road, #101
East Lansing, MI 48823

Ms. Alisa Shull
Chief, Endangered Species - Midwest Region
(Region 3)
US Fish and Wildlife Service
5600 American Boulevard West, Suite 990
Bloomington, MN 55437-1458

Mr. Derrick Hubbell
Michigan Water Science Center
US Geological Survey
6520 Mercantile Way, Suite 5
Lansing, MI 48911-5991

Mr. Tom Weaver
Michigan Water Science Center
US Geological Survey
6520 Mercantile Way, Suite 5
Lansing, MI 48911-5991

US Geological Survey
1451 Green Road
Ann Arbor, MI 48105

Hon. Aaron Miller
US Congressman, 59th District
US House of Representatives
N-993 House Office Building
PO Box 30014
Lansing, MI 48909

Constantine Hydroelectric Project (FERC No. 10661)
Distribution List

Mr. Michael Reynolds
Acting Director, Headquarters
US National Park Service
1849 C Street, NW
Washington, DC 20240

Hon. Gary Peters
US Senate
Hart Senate Office Building
Washington, DC 20510

Hon. Debbie Stabenow
US Senate
713 Hart Senate Office Building
Washington, DC 20510-2204

State Agencies

Michigan Department of Agriculture
525 West Allegan Street
Lansing, MI 48933

Mr. Chris Antieau
Great Lakes Shorelands Unit - Water Resources Division
Michigan Department of Environmental Quality
525 West Allegan Street
PO Box 30473
Lansing, MI 48909-7973

Kalamazoo District Office
Michigan Department of Environmental Quality
7953 Adobe Road
Kalamazoo, MI 49009-5025

Ms. Jessica Mistak
Michigan Department of Natural Resources
PO Box 30028
Lansing, MI 48909

Mr. Kyle Kruger
Senior Fisheries Biologist
Michigan Department of Natural Resources
Mio Field Office
191 S. Mt. Tom Road
Mio, MI 48647

Ms. Kesiree Thiamkeelakul
Michigan Department of Natural Resources
Mio Field Office
191 S. Mt. Tom Road
Mio, MI 48647

Mr. Brian D. Conway
State Historic Preservation Officer, Lansing Office
State Historic Preservation Office
735 East Michigan Avenue
PO Box 30044
Lansing, MI 48909

Local Governments

Ms. Korie Blyveis
District Manager
Cass County Conservation District
1127 East State St.
Cassopolis, MI 49031

Mr. Robert Hile
Mayor
City of Sturgis
130 North Nottawa
Sturgis, MI 49091

Friends of the St. Joe River Association, Inc.
PO Box 1794
South Bend, IN 46634

St. Joseph County
PO Box 189
Centreville, MI 49032

Ms. Carolyn Grace
Administrator
St. Joseph County Conservation District
693 E. Main Street
Centerville, MI 49032

Mr. Mark R. Brown
Supervisor
Township of Constantine
425 Centreville Street
Constantine, MI 49042

Constantine Hydroelectric Project (FERC No. 10661)
Distribution List

Mr. George E. Morse
Supervisor
Township of Sturgis
70669 Stubey Road
Sturgis, MI 49091

Mr. Donald E. Gloy, Jr.
Supervisor
Township of White Pigeon
16825 Tomahawk Trail
White Pigeon, MI 49099

Mr. Mark Honeysett
Village Manager
Village of Constantine
115 White Pigeon Street
Constantine, MI 49042

Ms. Marcia Skelton
Village of Constantine
115 White Pigeon Street
Constantine, MI 49042

Mr. Tyler Royce
President
Village of White Pigeon
103 South Kalamazoo
PO Box 621
White Pigeon, MI 49099

Tribes

Mr. Michael LaRonge
Tribal Historic Preservation Officer
Forest County Potawatomi Community
5320 Wensaut Lane
PO Box 340
Crandon, WI 54520

Ms. Kelly Curran
Pokagon Band of Potawatomi Indians
58620 Sink Road
PO Box 180
Dowagiac, MI 49047

Nottawaseppi Huron Band of the Potawatomi
1485 Mno-Bmadzewen Way
Fulton, MI 49052

Non-governmental Organizations

Mr. John Seebach
American Rivers
1104 14th St NW, Suite 1400
Washington, DC 20005

Mr. Kevin Richard Colburn
National Stewardship Director
American Whitewater
PO Box 1540
Cullowhee, NC 28779

Michigan Audubon Society
2311 Science Parkway, Suite 200
Okemos, MI 48864

Michigan Citizens for Water Conservation
PO Box 1
Mecosta, MI 49332

Michigan Environmental Council
602 West Ionia Street
Lansing, MI 48933

Mr. Bob Stuber
Fisheries Biologist
Michigan Hydropower Relicensing Coalition
1620 High Street
Traverse City, MI 49684

Michigan Loon Preservation Association
10181 Sheridan Road
Millington, MI 48746

Michigan Nature Association
2310 Science Parkway, Suite 100
Okemos, MI 48864

Mr. Matt Meersman
Director
St. Joseph River Basin Commission
227 West Jefferson Boulevard
1120 County-City Boulevard
South Bend, IN 46601

ATTACHMENT A
MUSSEL SURVEY FIGURES

Water Depth (ft.)
1
1.5
2
2.5
3
4
5
6
7
8

Site 1
Site 4
Site 2 Subreach 1
Site 2 Subreach 2
Site 2 Subreach 3
Site 3 Subreach 1
Site 3 Subreach 2
Site 3 Subreach 3
St Joseph River
US-131
US-131 N
M-152
Broad St
Garden St
Race St
Canal St
Birch St
Locust St
N Washington St
US-131N Washington St
US-131S Washington St
Spring St
E Water St
W Water St
White Pigeon St
Mill St
E 2nd St

Figure 4. River Depth within Each 10 Minute Search Spot. Constantine Hydroelectric Project (FERC NO. 10661)
Relicensing Studies: Mussel Survey.
Constantine, St. Joseph County, Michigan, 2019.

Survey Area Cell (10m x 10m)
Project Boundary

0 75 150 300 Feet
0 25 50 100 Meters

EnviroScience
Excellence In Any Environment

Date: 7/11/2020 Path: C:\Users\Gregory Hocevar\Desktop\12072_GIS\Map4_Depth.mxd

Basemap courtesy of Esri.

Figure 5. Substrates within Each 10 Minute Search Spot. Constantine Hydroelectric Project (FERC NO. 10661) Relicensing Studies: Mussel Survey. Constantine, St. Joseph County, Michigan, 2019.

EnviroScience Excellence In Any Environment

Date: 7/11/2020 Path: C:\Users\Gregory Hocevar\Desktop\12072_GIS\Map5_Substrate.mxd

Basemap courtesy of Esri.

ATTACHMENT B
ARCHAEOLOGY SURVEY REPORT
(Filed as privileged)

Yayac, Maggie

Subject: FW: Constantine Hydroelectric Project (FERC No. 10661) -- Response to Initial Study Report Comments
Attachments: 20200713 Constantine Response to ISR Comments.pdf

From: Hanson, Danielle
Sent: Tuesday, July 14, 2020 4:50 PM
To: 'Advisory Council on Historic Preservation' <jeddins@achp.gov>; 'Cass County Conservation District' <korie.blyveis@macd.org>; 'Forest County Potawatomi Community' <michael.laronge@fcpotawatomi-nsn.gov>; 'Friends of the St. Joe River Association Inc.' <fotsjr.outreach@gmail.com>; 'Michigan Department of Environmental Quality' <antieauc@michigan.gov>; 'Michigan Department of Natural Resources' <KRUGERK@michigan.gov>; 'Michigan DNR' <MistakJ@michigan.gov>; 'Michigan DNR' <ThiamkeelakulK@michigan.gov>; 'Michigan Hydropower Relicensing Coalition' <stuberbob@gmail.com>; 'NOAA' <Michael.Pentony@noaa.gov>; 'Pokagon Band of Potawatomi Indians' <kelly.curran@pokagonband-nsn.gov>; 'St. Joseph River Basin Commission' <paddleheadz@gmail.com>; 'US Deparment of the Interior' <Mary.Manydeeds@bia.gov>; 'US Department of Agriculture' <martin.rosek@mi.usda.gov>; 'US Environmental Protection Agency' <pelloso.elizabeth@epa.gov>; 'US Environmental Protection Agency' <westlake.kenneth@epa.gov>; 'US Fish and Wildlife Service' <Jack_Dingledine@fws.gov>; 'USGS MI Water Science Center' <tlweaver@usgs.gov>; 'USGS MI Water Science Center' <dhubbell@usgs.gov>; 'Village of Constantine' <skelton-m@comcast.net>; 'Village of Constantine, Village Manager' <mhoneysett@comcast.net>; 'Village of White Pigeon' <whitepigeonvillage@comcast.net>
Cc: 'Jonathan M Magalski (jmmagalski@aep.com)' <jmmagalski@aep.com>; Elizabeth B Parcell <ebparcell@aep.com>; Quiggle, Robert <Robert.Quiggle@hdrinc.com>
Subject: Constantine Hydroelectric Project (FERC No. 10661) -- Response to Initial Study Report Comments

Constantine Hydroelectric Project Stakeholders:

Indiana Michigan Power Company (I&M), a unit of American Electric Power (AEP), is the licensee, owner and operator of the Constantine Hydroelectric Project (FERC No. 10661) (Project) located on the St. Joseph River in St. Joseph County, Michigan. The Project is operated under a license issued by the Federal Energy Regulatory Commission (FERC). The existing FERC license for the Project expires on September 30, 2023. I&M is pursuing a new license for the continued operation of the Project in accordance with FERC's Integrated Licensing Process (ILP).

In accordance with the Commission's regulations at 18 C.F.R. § 5.15 and the Commission's April 9, 2019 Study Plan Determination (SPD), I&M filed the Initial Study Report (ISR) with FERC on April 14, 2020. Additionally, I&M held an Initial Study Report Meeting (ISR Meeting) with participants and FERC staff via Webex on April 23, 2020. An ISR Meeting summary was filed with FERC on May 8, 2020. The deadline to submit any disputes or requests to amend studies was June 13, 2020. The only comment letter received was from FERC, dated June 9, 2020. I&M filed responses to FERC's comments on the ISR on July 13, 2020.

On behalf of I&M, we are notifying stakeholders of the availability of this filing. For your convenience, a copy of the response to ISR comments is attached.

Should you have any questions regarding this filing, please contact Jon Magalski with AEP at (614) 716-2240 or jmmagalski@aep.com.

Thank you,

Danielle Hanson
Environmental Scientist

HDR
M 315.729.4745
Danielle.Hanson@hdrinc.com

Yayac, Maggie

Subject: FW: Constantine Hydro updated reports - email 2 of 2

From: Brandon Gabler [mailto:bgabler@chg-inc.com]
Sent: Friday, July 24, 2020 9:02 AM
To: Michael.LaRonge@fcpotawatomi-nsn.gov
Cc: Hanson, Danielle <Danielle.Hanson@hdrinc.com>; Quiggle, Robert <Robert.Quiggle@hdrinc.com>
Subject: Constantine Hydro updated reports - email 2 of 2

Mr. LaRonge, here is the above-ground report.

Thanks, and enjoy your weekend!

Brandon

Brandon M. Gabler, PhD, RPA, Regional Director/VP of Operations
c: (571) 488-5912
e: bgabler@chg-inc.com
Click here to learn more about the Section 106 process!

From: Brandon Gabler
Sent: Friday, July 24, 2020 12:00 PM
To: 'Michael.LaRonge@fcpotawatomi-nsn.gov' <Michael.LaRonge@fcpotawatomi-nsn.gov>
Cc: 'Hanson, Danielle' <Danielle.Hanson@hdrinc.com>; Quiggle, Robert <robert.quiggle@hdrinc.com>
Subject: Constantine Hydro updated reports - email 1 of 2

Good afternoon, Mr. LaRonge,
I have attached copies of our updated archaeology and above-ground reports (two emails; this one has the archaeology report; the next will have above-ground) for the Constantine Hydro project; the reports were mailed separately in hard copy and CD, but I wanted to make sure we delivered them to you for your review.

If you could, please let me know that you have received both reports.
Thank you,

Brandon

COMMONWEALTH
HERITAGE GROUP
Brandon M. Gabler, PhD, RPA, Regional Director/VP of Operations
3215 Central Street, Dexter, MI 48130
c: (571) 488-5912
e: bgabler@chg-inc.com
commonwealthheritagegroup.com

American Electric Power
1 Riverside Plaza
Columbus, OH 43215
aep.com

Via Electronic Filing

July 27, 2020

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

Subject: Constantine Hydroelectric Project (FERC No. 10661)
Additional Response to Comments on the Initial Study Report

Dear Secretary Bose:

Indiana Michigan Power Company (I&M), a unit of American Electric Power (AEP), is the licensee, owner, and operator of the Constantine Hydroelectric Project (Project) (FERC Project No. 10661), located on the St. Joseph River in St. Joseph County, Michigan. The Project is operated under a license issued by the Federal Energy Regulatory Commission (FERC or Commission). The existing FERC license for the Project expires on September 30, 2023.

I&M has elected to utilize the Integrated Licensing Process (ILP) for the relicensing of the Project as defined in 18 Code of Federal Regulations (C.F.R.) Part 5. In accordance with the Commission's regulations at 18 C.F.R. § 5.15 and the Commission's April 9, 2019 Study Plan Determination (SPD), I&M filed the Initial Study Report (ISR) with FERC on April 14, 2020. Additionally, I&M held an Initial Study Report Meeting (ISR Meeting) with participants and FERC staff via Webex on April 23, 2020. An ISR Meeting summary was filed with FERC on May 8, 2020. The deadline to submit any disputes or requests to amend studies was June 13, 2020. The only comment letter received was from FERC, dated June 9, 2020. I&M provided responses to FERC's comments on the ISR on July 13, 2020. In their response letter, I&M requested an additional 14 days to further analyze Project operational data to provide a response to FERC's question related to water quality. Additionally, FERC requested clarification on I&M's response to the statement regarding dredging in the bypass reach in the Mussel Survey Report. I&M is hereby providing their responses below.

Water Quality Study

FERC's Comment:

(1) The water quality data collected in the Project bypassed reach indicated that dissolved oxygen (DO) levels were not consistent at various times during the sampling period with the state water quality standards for DO. The exceedances of state standards for DO occurred at sampling sites located upstream and downstream of the confluence of the Fawn River in the bypassed reach.

There were 37 days from August 20 to September 25, 2019, when exceedances of DO levels persisted on and off. Many of the DO exceedances observed during the Water Quality Study correspond to times when water was diverted out of the bypassed reach and into the power canal.

For example, on August 29, 2019, and September 26 to 28, 2019, when field crews were collecting water sampling data and also fish samples, respectively, they observed that the water surface elevation of the Constantine Reservoir was below the top of the dam.

To help us better understand the nexus between Project operation and water flows in the bypassed reach, please identify frequency and duration of instances when Project operation cause water levels in the reservoir to fall below the top of the Constantine Dam. Please also provide an estimate in the drop in water levels (in feet and inches) that occurred in the bypassed reach during these periods of no flows entering the bypassed reach from the Constantine dam.

I&M's Response:

I&M has reviewed available Project operations data and compared it to the instances where low dissolved oxygen (DO) levels were recorded during the 2019 study season. The fixed crest of the spillway structure is elevation 781.96 feet and the crest elevation when the flashboards are in place is 782.90 feet. The flashboards were installed around August 13, 2019 and remained in place for the remainder of the 2019 water quality monitoring period. The attached spreadsheet highlights in red, times where the reservoir elevations were below the flashboard elevation of 782.90 feet.

Based on I&M's review of water quality and reservoir elevation data collected during the 2019 study season, it appears that there were times where there was little to no flow over the spillway/flashboards that coincides with dates where low DO values were recorded in the bypass reach. Conversely, there were also times where there was little to no flow over the spillway/flashboards where there were no recorded issues of low DO during the 2019 study season. In reviewing the existing data, there does not appear to be a clear correlation between flow over the spillway/flashboards and low DO readings. I&M believes that multiple factors, such as weather conditions (i.e., high temperatures concurrent with low flows) and low DO water coming into the Project from upstream that may be impacted by nutrient loading from agricultural runoff within the river basin, are likely contributing to the low DO readings in the Project area. The currently available data does not provide sufficient information to suggest that the Project operations may be impacting DO in the bypass reach. Additionally, water levels in the bypass reach are not monitored and therefore, I&M does not have information to review as it relates to depth in the bypass channel during times of depressed DO.

<u>Mussel Survey</u>

FERC's Comment:

(3) The Mussel Survey portion of the meeting summary states that the project bypassed reach had been "recently dredged." Please identify when this dredging occurred and the depths the bypassed channel was dredged to.

I&M's Response:

(3) During the ISR Meeting it was mentioned that another contractor (Cardno) conducted a Stranded Fish and Mussel Survey in the Project's power canal in March and April of 2019 to support dewatering of the canal. The purpose of the dewatering was to allow for inspection of the intake screens. Cardno surveyed the area for stranded fish and mussels as the canal was being dewatered and relocated all stranded fish and mussels to the bypass reach. The full report was filed with FERC as Attachment B of ISR Meeting summary on May 8, 2020 which includes information regarding species collected and relocated. While the power canal was dewatered, approximately 163 cubic yards of accumulated sediment was removed in front of the screens to help facilitate inspection and remove logs that were pinned against the screens that likely caused some of the sediment deposition. The depth to which the sediment was removed match those of original contours.

In addition to the previous response above, I&M would like to clarify that the Mussel Survey Report incorrectly stated that the bypass reach was recently dredged. The dredging referred to in the report was actually the dredging and associated Project maintenance work described above.

If there are any questions regarding this filing, please do not hesitate to contact me at (614) 716-2240 or jmmagalski@aep.com.

Sincerely,

Jonathan M. Magalski
Environmental Specialist Consultant
American Electric Power Services Corporation, Environmental Services

Attachment – Reservoir Elevation Data

Cc: Distribution List
Liz Parcell (AEP)
Rob Quiggle (HDR)

Constantine Hydroelectric Project (FERC No. 10661)
Distribution List

Federal Agencies

Mr. John Eddins
Office of Federal Agency Programs
Advisory Council on Historic Preservation
401 F Street NW, Suite 308
Washington, DC 20001-2637

Ms. Kimberly Bose
Secretary
Federal Energy Regulatory Commission
888 1st St NE
Washington, DC 20426

FEMA Region 5
536 South Clark Street, 6th Floor
Chicago, IL 60605

Mr. Michael Pentony
Regional Administrator
NOAA Fisheries Service
Greater Atlantic Regional Fisheries Office
55 Great Republic Drive
Gloucester, MA 01930-2276

Mr. Martin J. Rosek
State Soil Scientist
US Department of Agriculture
Natural Resources Conservation Service
3001 Coolidge Road, Suite 250
East Lansing, MI 48823

Ms. Mary Manydeeds
Bureau of Indian Affairs, Midwest Region
US Department of the Interior
Norman Pointe II Building
5600 W. American Boulevard, Suite 500
Bloomington, MN 55437

Office of the Solicitor
US Department of the Interior
1849 C Street, NW
Washington, DC 20240

Mr. Lindy Nelson
Regional Environmental Officer, Office of
Environmental Policy & Compliance
US Department of the Interior
Philadelphia Region
Custom House, Room 244
200 Chestnut Street
Philadelphia, PA 19106

Ms. Liz Pelloso
Wetland/Environmental Scientist, Region 5
US Environmental Protection Agency
77 West Jackson Boulevard (E19-J)
Chicago, IL 60604

Mr. Ken Westlake
Chief, NEPA Implementation Section - Region 5
US Environmental Protection Agency
77 West Jackson Boulevard (E19-J)
Chicago, IL 60604

Mr. Jack Dingledine
Assistant Field Office Supervisor/Michigan
Ecological Services Field Office
US Fish and Wildlife Service
2652 Coolidge Road, #101
East Lansing, MI 48823

Ms. Alisa Shull
Chief, Endangered Species - Midwest Region
(Region 3)
US Fish and Wildlife Service
5600 American Boulevard West, Suite 990
Bloomington, MN 55437-1458

Mr. Derrick Hubbell
Michigan Water Science Center
US Geological Survey
5840 Enterprise Drive
Lansing, MI 48911

Mr. Tom Weaver
Michigan Water Science Center
US Geological Survey
5840 Enterprise Drive
Lansing, MI 48911

US Geological Survey
1451 Green Road
Ann Arbor, MI 48105

Hon. Aaron Miller
US Congressman, 59th District
US House of Representatives
N-993 House Office Building
PO Box 30014
Lansing, MI 48909

Constantine Hydroelectric Project (FERC No. 10661)
Distribution List

Mr. Michael Reynolds
Acting Director, Headquarters
US National Park Service
1849 C Street, NW
Washington, DC 20240

Hon. Gary Peters
US Senate
Hart Senate Office Building
Washington, DC 20510

Hon. Debbie Stabenow
US Senate
713 Hart Senate Office Building
Washington, DC 20510-2204

State Agencies

Michigan Department of Agriculture
525 West Allegan Street
Lansing, MI 48933

Mr. Chris Antieau
Great Lakes Shorelands Unit - Water Resources Division
Michigan Department of Environmental Quality
525 West Allegan Street
PO Box 30473
Lansing, MI 48909-7973

Kalamazoo District Office
Michigan Department of Environmental Quality
7953 Adobe Road
Kalamazoo, MI 49009-5025

Ms. Jessica Mistak
Michigan Department of Natural Resources
PO Box 30028
Lansing, MI 48909

Mr. Kyle Kruger
Senior Fisheries Biologist
Michigan Department of Natural Resources
Mio Field Office
191 S. Mt. Tom Road
Mio, MI 48647

Ms. Kesiree Thiamkeelakul
Michigan Department of Natural Resources
Mio Field Office
191 S. Mt. Tom Road
Mio, MI 48647

Mr. Brian D. Conway
State Historic Preservation Officer, Lansing Office
State Historic Preservation Office
735 East Michigan Avenue
PO Box 30044
Lansing, MI 48909

Local Governments

Ms. Korie Blyveis
District Manager
Cass County Conservation District
1127 East State St.
Cassopolis, MI 49031

Mr. Robert Hile
Mayor
City of Sturgis
130 North Nottawa
Sturgis, MI 49091

Friends of the St. Joe River Association, Inc.
PO Box 1794
South Bend, IN 46634

St. Joseph County
PO Box 189
Centreville, MI 49032

Ms. Carolyn Grace
Administrator
St. Joseph County Conservation District
693 E. Main Street
Centerville, MI 49032

Mr. Mark R. Brown
Supervisor
Township of Constantine
425 Centreville Street
Constantine, MI 49042

Constantine Hydroelectric Project (FERC No. 10661)
Distribution List

Mr. George E. Morse
Supervisor
Township of Sturgis
70669 Stubey Road
Sturgis, MI 49091

Mr. Donald E. Gloy, Jr.
Supervisor
Township of White Pigeon
16825 Tomahawk Trail
White Pigeon, MI 49099

Mr. Mark Honeysett
Village Manager
Village of Constantine
115 White Pigeon Street
Constantine, MI 49042

Ms. Marcia Skelton
Village of Constantine
115 White Pigeon Street
Constantine, MI 49042

Mr. Tyler Royce
President
Village of White Pigeon
103 South Kalamazoo
PO Box 621
White Pigeon, MI 49099

Tribes

Mr. Michael LaRonge
Tribal Historic Preservation Officer
Forest County Potawatomi Community
5320 Wensaut Lane
PO Box 340
Crandon, WI 54520

Ms. Kelly Curran
Pokagon Band of Potawatomi Indians
58620 Sink Road
PO Box 180
Dowagiac, MI 49047

Nottawaseppi Huron Band of the Potawatomi
1485 Mno-Bmadzewen Way
Fulton, MI 49052

Non-governmental Organizations

Mr. John Seebach
American Rivers
1104 14th St NW, Suite 1400
Washington, DC 20005

Mr. Kevin Richard Colburn
National Stewardship Director
American Whitewater
PO Box 1540
Cullowhee, NC 28779

Michigan Audubon Society
2311 Science Parkway, Suite 200
Okemos, MI 48864

Michigan Citizens for Water Conservation
PO Box 1
Mecosta, MI 49332

Michigan Environmental Council
602 West Ionia Street
Lansing, MI 48933

Mr. Bob Stuber
Fisheries Biologist
Michigan Hydropower Relicensing Coalition
1620 High Street
Traverse City, MI 49684

Michigan Loon Preservation Association
10181 Sheridan Road
Millington, MI 48746

Michigan Nature Association
2310 Science Parkway, Suite 100
Okemos, MI 48864

Mr. Matt Meersman
Director
St. Joseph River Basin Commission
227 West Jefferson Boulevard
1120 County-City Boulevard
South Bend, IN 46601

ATTACHMENT
RESERVOIR ELEVATION DATA

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

All cells highlighted in red are below the flashboard elevation of 782.90 feet. Flashboards were installed on August 13, 2019.

Date	Constantine Forebay
6/1/19 1:00	783.34
6/1/19 2:00	783.35
6/1/19 3:00	783.34
6/1/19 4:00	783.34
6/1/19 5:00	783.34
6/1/19 6:00	783.34
6/1/19 7:00	783.34
6/1/19 8:00	783.34
6/1/19 9:00	783.34
6/1/19 10:00	783.34
6/1/19 11:00	783.34
6/1/19 12:00	783.34
6/1/19 13:00	783.34
6/1/19 14:00	783.33
6/1/19 15:00	783.33
6/1/19 16:00	783.32
6/1/19 17:00	783.32
6/1/19 18:00	783.31
6/1/19 19:00	783.31
6/1/19 20:00	783.31
6/1/19 21:00	783.31
6/1/19 22:00	783.31
6/1/19 23:00	783.3
6/2/19 0:00	783.3
6/2/19 1:00	783.29
6/2/19 2:00	783.28
6/2/19 3:00	783.28
6/2/19 4:00	783.27
6/2/19 5:00	783.27
6/2/19 6:00	783.26
6/2/19 7:00	783.26
6/2/19 8:00	783.26
6/2/19 9:00	783.25
6/2/19 10:00	783.26

Date	Daily Average Elevation
6/1/2019	783.33
6/2/2019	783.27
6/3/2019	783.21
6/4/2019	783.21
6/5/2019	783.21
6/6/2019	783.20
6/7/2019	783.20
6/8/2019	783.17
6/9/2019	783.12
6/10/2019	783.16
6/11/2019	783.14
6/12/2019	783.15
6/13/2019	783.16
6/14/2019	783.16
6/15/2019	783.19
6/16/2019	783.23
6/17/2019	783.17
6/18/2019	783.18
6/19/2019	783.17
6/20/2019	783.29
6/21/2019	783.37
6/22/2019	783.47
6/23/2019	783.48
6/24/2019	783.45
6/25/2019	783.43
6/26/2019	783.39
6/27/2019	783.31
6/28/2019	783.26
6/29/2019	783.22
6/30/2019	783.12
7/1/2019	783.08
7/2/2019	783.02
7/3/2019	782.95
7/4/2019	782.90

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

6/2/19 11:00	783.26
6/2/19 12:00	783.27
6/2/19 13:00	783.27
6/2/19 14:00	783.28
6/2/19 15:00	783.28
6/2/19 16:00	783.28
6/2/19 17:00	783.28
6/2/19 18:00	783.28
6/2/19 19:00	783.28
6/2/19 20:00	783.28
6/2/19 21:00	783.27
6/2/19 22:00	783.26
6/2/19 23:00	783.26
6/3/19 0:00	783.25
6/3/19 1:00	783.24
6/3/19 2:00	783.24
6/3/19 3:00	783.23
6/3/19 4:00	783.22
6/3/19 5:00	783.21
6/3/19 6:00	783.21
6/3/19 7:00	783.21
6/3/19 8:00	783.2
6/3/19 9:00	783.2
6/3/19 10:00	783.2
6/3/19 11:00	783.2
6/3/19 12:00	783.2
6/3/19 13:00	783.2
6/3/19 14:00	783.2
6/3/19 15:00	783.2
6/3/19 16:00	783.2
6/3/19 17:00	783.2
6/3/19 18:00	783.21
6/3/19 19:00	783.21
6/3/19 20:00	783.22
6/3/19 21:00	783.22
6/3/19 22:00	783.22
6/3/19 23:00	783.22
6/4/19 0:00	783.22
6/4/19 1:00	783.23

7/5/2019	782.90
7/6/2019	782.92
7/7/2019	782.93
7/8/2019	782.95
7/9/2019	782.97
7/10/2019	782.96
7/11/2019	782.93
7/12/2019	782.91
7/13/2019	782.90
7/14/2019	782.90
7/15/2019	782.99
7/16/2019	783.13
7/17/2019	783.14
7/18/2019	783.02
7/19/2019	782.90
7/20/2019	782.92
7/21/2019	782.91
7/22/2019	782.91
7/23/2019	782.90
7/24/2019	782.91
7/25/2019	782.90
7/26/2019	782.92
7/27/2019	782.91
7/28/2019	782.90
7/29/2019	782.90
7/30/2019	782.90
7/31/2019	782.90
8/1/2019	782.89
8/2/2019	782.87
8/3/2019	782.85
8/4/2019	782.87
8/5/2019	782.87
8/6/2019	782.89
8/7/2019	782.90
8/8/2019	782.90
8/9/2019	782.88
8/10/2019	782.85
8/11/2019	782.78
8/12/2019	782.61

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

6/4/19 2:00	783.23
6/4/19 3:00	783.23
6/4/19 4:00	783.23
6/4/19 5:00	783.23
6/4/19 6:00	783.23
6/4/19 7:00	783.23
6/4/19 8:00	783.22
6/4/19 9:00	783.22
6/4/19 10:00	783.21
6/4/19 11:00	783.21
6/4/19 12:00	783.21
6/4/19 13:00	783.2
6/4/19 14:00	783.2
6/4/19 15:00	783.2
6/4/19 16:00	783.2
6/4/19 17:00	783.2
6/4/19 18:00	783.2
6/4/19 19:00	783.2
6/4/19 20:00	783.2
6/4/19 21:00	783.19
6/4/19 22:00	783.19
6/4/19 23:00	783.19
6/5/19 0:00	783.19
6/5/19 1:00	783.2
6/5/19 2:00	783.2
6/5/19 3:00	783.2
6/5/19 4:00	783.2
6/5/19 5:00	783.2
6/5/19 6:00	783.2
6/5/19 7:00	783.2
6/5/19 8:00	783.2
6/5/19 9:00	783.2
6/5/19 10:00	783.2
6/5/19 11:00	783.2
6/5/19 12:00	783.2
6/5/19 13:00	783.2
6/5/19 14:00	783.2
6/5/19 15:00	783.2
6/5/19 16:00	783.2

8/13/2019	782.51
8/14/2019	782.86
8/15/2019	782.96
8/16/2019	782.98
8/17/2019	783.03
8/18/2019	782.90
8/19/2019	782.86
8/20/2019	782.86
8/21/2019	782.98
8/22/2019	783.00
8/23/2019	783.00
8/24/2019	782.87
8/25/2019	782.86
8/26/2019	782.86
8/27/2019	782.86
8/28/2019	782.86
8/29/2019	782.86
8/30/2019	782.86
8/31/2019	782.86
9/1/2019	782.86
9/2/2019	782.86
9/3/2019	782.86
9/4/2019	782.86
9/5/2019	782.86
9/6/2019	782.86
9/7/2019	782.86
9/8/2019	782.86
9/9/2019	782.94
9/10/2019	782.86
9/11/2019	782.86
9/12/2019	782.97
9/13/2019	782.86
9/14/2019	782.86
9/15/2019	782.86
9/16/2019	782.86
9/17/2019	782.86
9/18/2019	782.86
9/19/2019	782.86
9/20/2019	782.86

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

6/5/19 17:00	783.2
6/5/19 18:00	783.2
6/5/19 19:00	783.2
6/5/19 20:00	783.2
6/5/19 21:00	783.2
6/5/19 22:00	783.2
6/5/19 23:00	783.2
6/6/19 0:00	783.2
6/6/19 1:00	783.2
6/6/19 2:00	783.2
6/6/19 3:00	783.2
6/6/19 4:00	783.2
6/6/19 5:00	783.2
6/6/19 6:00	783.2
6/6/19 7:00	783.2
6/6/19 8:00	783.2
6/6/19 9:00	783.2
6/6/19 10:00	783.2
6/6/19 11:00	783.2
6/6/19 12:00	783.2
6/6/19 13:00	783.2
6/6/19 14:00	783.2
6/6/19 15:00	783.2
6/6/19 16:00	783.2
6/6/19 17:00	783.2
6/6/19 18:00	783.2
6/6/19 19:00	783.2
6/6/19 20:00	783.2
6/6/19 21:00	783.2
6/6/19 22:00	783.2
6/6/19 23:00	783.2
6/7/19 0:00	783.2
6/7/19 1:00	783.2
6/7/19 2:00	783.2
6/7/19 3:00	783.2
6/7/19 4:00	783.2
6/7/19 5:00	783.2
6/7/19 6:00	783.2
6/7/19 7:00	783.2

9/21/2019	782.86
9/22/2019	782.86
9/23/2019	782.86
9/24/2019	782.86
9/25/2019	782.86
9/26/2019	782.86
9/27/2019	782.86
9/28/2019	783.08
9/29/2019	783.22
9/30/2019	783.22
10/1/2019	783.25
10/2/2019	783.28
10/3/2019	783.40
10/4/2019	783.29
10/5/2019	783.26
10/6/2019	783.35
10/7/2019	783.51
10/8/2019	783.64
10/9/2019	783.82
10/10/2019	783.63
10/11/2019	783.47
10/12/2019	783.69
10/13/2019	783.86
10/14/2019	783.61
10/15/2019	783.38
10/16/2019	783.26
10/17/2019	783.23
10/18/2019	783.36
10/19/2019	783.23
10/20/2019	782.97
10/21/2019	783.25
10/22/2019	783.24
10/23/2019	783.18
10/24/2019	783.15
10/25/2019	783.14
10/26/2019	783.19
10/27/2019	783.42
10/28/2019	783.82
10/29/2019	783.55

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

6/7/19 8:00	783.2
6/7/19 9:00	783.2
6/7/19 10:00	783.2
6/7/19 11:00	783.2
6/7/19 12:00	783.2
6/7/19 13:00	783.2
6/7/19 14:00	783.2
6/7/19 15:00	783.2
6/7/19 16:00	783.2
6/7/19 17:00	783.2
6/7/19 18:00	783.2
6/7/19 19:00	783.2
6/7/19 20:00	783.2
6/7/19 21:00	783.2
6/7/19 22:00	783.2
6/7/19 23:00	783.2
6/8/19 0:00	783.2
6/8/19 1:00	783.2
6/8/19 2:00	783.2
6/8/19 3:00	783.2
6/8/19 4:00	783.2
6/8/19 5:00	783.2
6/8/19 6:00	783.2
6/8/19 7:00	783.2
6/8/19 8:00	783.2
6/8/19 9:00	783.2
6/8/19 10:00	783.2
6/8/19 11:00	783.2
6/8/19 12:00	783.2
6/8/19 13:00	783.2
6/8/19 14:00	783.2
6/8/19 15:00	783.2
6/8/19 16:00	783.2
6/8/19 17:00	783.2
6/8/19 18:00	783.2
6/8/19 19:00	783.2
6/8/19 20:00	783.2
6/8/19 21:00	783.2
6/8/19 22:00	783.2

10/30/2019	783.47
10/31/2019	783.47

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

6/8/19 23:00	783.1
6/9/19 0:00	783.1
6/9/19 1:00	783.1
6/9/19 2:00	783.1
6/9/19 3:00	783.1
6/9/19 4:00	783.1
6/9/19 5:00	783.1
6/9/19 6:00	783.1
6/9/19 7:00	783.1
6/9/19 8:00	783.1
6/9/19 9:00	783.1
6/9/19 10:00	783.1
6/9/19 11:00	783.1
6/9/19 12:00	783.1
6/9/19 13:00	783.1
6/9/19 14:00	783.1
6/9/19 15:00	783.1
6/9/19 16:00	783.1
6/9/19 17:00	783.1
6/9/19 18:00	783.1
6/9/19 19:00	783.1
6/9/19 20:00	783.1
6/9/19 21:00	783.1
6/9/19 22:00	783.1
6/9/19 23:00	783.1
6/10/19 0:00	783.1
6/10/19 1:00	783.1
6/10/19 2:00	783.1
6/10/19 3:00	783.1
6/10/19 4:00	783.2
6/10/19 5:00	783.2
6/10/19 6:00	783.2
6/10/19 7:00	783.2
6/10/19 8:00	783.2
6/10/19 9:00	783.2
6/10/19 10:00	783.2
6/10/19 11:00	783.2
6/10/19 12:00	783.2
6/10/19 13:00	783.2

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

6/10/19 14:00	783.2
6/10/19 15:00	783.2
6/10/19 16:00	783.2
6/10/19 17:00	783.2
6/10/19 18:00	783.2
6/10/19 19:00	783.2
6/10/19 20:00	783.2
6/10/19 21:00	783.2
6/10/19 22:00	783.2
6/10/19 23:00	783.1
6/11/19 0:00	783.1
6/11/19 1:00	783.1
6/11/19 2:00	783.1
6/11/19 3:00	783.1
6/11/19 4:00	783.1
6/11/19 5:00	783.1
6/11/19 6:00	783.1
6/11/19 7:00	783.1
6/11/19 8:00	783.1
6/11/19 9:00	783.1
6/11/19 10:00	783.1
6/11/19 11:00	783.1
6/11/19 12:00	783.1
6/11/19 13:00	783.1
6/11/19 14:00	783.1
6/11/19 15:00	783.1
6/11/19 16:00	783.1
6/11/19 17:00	783.1
6/11/19 18:00	783.1
6/11/19 19:00	783.1
6/11/19 20:00	783.1
6/11/19 21:00	783.1
6/11/19 22:00	783.1
6/11/19 23:00	783.1
6/12/19 0:00	783.1
6/12/19 1:00	783.1
6/12/19 2:00	783.1
6/12/19 3:00	783.1
6/12/19 4:00	783.1

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

6/12/19 5:00	783.1
6/12/19 6:00	783.1
6/12/19 7:00	783.1
6/12/19 8:00	783.1
6/12/19 9:00	783.1
6/12/19 10:00	783.1
6/12/19 11:00	783.1
6/12/19 12:00	783.1
6/12/19 13:00	783.1
6/12/19 14:00	783.1
6/12/19 15:00	783.1
6/12/19 16:00	783.1
6/12/19 17:00	783.1
6/12/19 18:00	783.1
6/12/19 19:00	783.1
6/12/19 20:00	783.1
6/12/19 21:00	783.1
6/12/19 22:00	783.1
6/12/19 23:00	783.1
6/13/19 0:00	783.1
6/13/19 1:00	783.1
6/13/19 2:00	783.1
6/13/19 3:00	783.2
6/13/19 4:00	783.1
6/13/19 5:00	783.2
6/13/19 6:00	783.1
6/13/19 7:00	783.1
6/13/19 8:00	783.1
6/13/19 9:00	783.1
6/13/19 10:00	783.2
6/13/19 11:00	783.2
6/13/19 12:00	783.2
6/13/19 13:00	783.2
6/13/19 14:00	783.2
6/13/19 15:00	783.2
6/13/19 16:00	783.2
6/13/19 17:00	783.2
6/13/19 18:00	783.2
6/13/19 19:00	783.2

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

6/13/19 20:00	783.2
6/13/19 21:00	783.2
6/13/19 22:00	783.2
6/13/19 23:00	783.2
6/14/19 0:00	783.2
6/14/19 1:00	783.2
6/14/19 2:00	783.2
6/14/19 3:00	783.2
6/14/19 4:00	783.2
6/14/19 5:00	783.2
6/14/19 6:00	783.2
6/14/19 7:00	783.2
6/14/19 8:00	783.2
6/14/19 9:00	783.2
6/14/19 10:00	783.2
6/14/19 11:00	783.2
6/14/19 12:00	783.2
6/14/19 13:00	783.2
6/14/19 14:00	783.2
6/14/19 15:00	783.1
6/14/19 16:00	783.1
6/14/19 17:00	783.1
6/14/19 18:00	783.1
6/14/19 19:00	783.1
6/14/19 20:00	783.1
6/14/19 21:00	783.2
6/14/19 22:00	783.2
6/14/19 23:00	783.2
6/15/19 0:00	783.2
6/15/19 1:00	783.2
6/15/19 2:00	783.2
6/15/19 3:00	783.2
6/15/19 4:00	783.2
6/15/19 5:00	783.2
6/15/19 6:00	783.2
6/15/19 7:00	783.2
6/15/19 8:00	783.2
6/15/19 9:00	783.2
6/15/19 10:00	783.2

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

6/15/19 11:00	783.2
6/15/19 12:00	783.2
6/15/19 13:00	783.2
6/15/19 14:00	783.2
6/15/19 15:00	783.2
6/15/19 16:00	783.2
6/15/19 17:00	783.2
6/15/19 18:00	783.2
6/15/19 19:00	783.2
6/15/19 20:00	783.2
6/15/19 21:00	783.2
6/15/19 22:00	783.2
6/15/19 23:00	783.2
6/16/19 0:00	783.2
6/16/19 1:00	783.2
6/16/19 2:00	783.2
6/16/19 3:00	783.2
6/16/19 4:00	783.2
6/16/19 5:00	783.2
6/16/19 6:00	783.2
6/16/19 7:00	783.2
6/16/19 8:00	783.2
6/16/19 9:00	783.2
6/16/19 10:00	783.3
6/16/19 11:00	783.3
6/16/19 12:00	783.2
6/16/19 13:00	783.2
6/16/19 14:00	783.2
6/16/19 15:00	783.2
6/16/19 16:00	783.2
6/16/19 17:00	783.2
6/16/19 18:00	783.2
6/16/19 19:00	783.2
6/16/19 20:00	783.2
6/16/19 21:00	783.2
6/16/19 22:00	783.2
6/16/19 23:00	783.2
6/17/19 0:00	783.2
6/17/19 1:00	783.2

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

6/17/19 2:00	783.2
6/17/19 3:00	783.2
6/17/19 4:00	783.2
6/17/19 5:00	783.2
6/17/19 6:00	783.2
6/17/19 7:00	783.2
6/17/19 8:00	783.2
6/17/19 9:00	783.2
6/17/19 10:00	783.2
6/17/19 11:00	783.2
6/17/19 12:00	783.2
6/17/19 13:00	783.1
6/17/19 14:00	783.1
6/17/19 15:00	783.1
6/17/19 16:00	783.1
6/17/19 17:00	783.1
6/17/19 18:00	783.1
6/17/19 19:00	783.2
6/17/19 20:00	783.2
6/17/19 21:00	783.2
6/17/19 22:00	783.2
6/17/19 23:00	783.2
6/18/19 0:00	783.2
6/18/19 1:00	783.2
6/18/19 2:00	783.2
6/18/19 3:00	783.2
6/18/19 4:00	783.2
6/18/19 5:00	783.2
6/18/19 6:00	783.2
6/18/19 7:00	783.2
6/18/19 8:00	783.2
6/18/19 9:00	783.2
6/18/19 10:00	783.2
6/18/19 11:00	783.2
6/18/19 12:00	783.2
6/18/19 13:00	783.2
6/18/19 14:00	783.2
6/18/19 15:00	783.2
6/18/19 16:00	783.2

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

6/18/19 17:00	783.2
6/18/19 18:00	783.2
6/18/19 19:00	783.2
6/18/19 20:00	783.2
6/18/19 21:00	783.2
6/18/19 22:00	783.1
6/18/19 23:00	783.1
6/19/19 0:00	783.1
6/19/19 1:00	783.1
6/19/19 2:00	783.1
6/19/19 3:00	783.1
6/19/19 4:00	783.1
6/19/19 5:00	783.1
6/19/19 6:00	783.1
6/19/19 7:00	783.1
6/19/19 8:00	783.1
6/19/19 9:00	783.1
6/19/19 10:00	783.1
6/19/19 11:00	783.1
6/19/19 12:00	783.1
6/19/19 13:00	783.1
6/19/19 14:00	783.1
6/19/19 15:00	783.2
6/19/19 16:00	783.4
6/19/19 17:00	783.3
6/19/19 18:00	783.2
6/19/19 19:00	783.2
6/19/19 20:00	783.2
6/19/19 21:00	783.2
6/19/19 22:00	783.2
6/19/19 23:00	783.2
6/20/19 0:00	783.2
6/20/19 1:00	783.2
6/20/19 2:00	783.2
6/20/19 3:00	783.2
6/20/19 4:00	783.2
6/20/19 5:00	783.3
6/20/19 6:00	783.3
6/20/19 7:00	783.3

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

6/20/19 8:00	783.3
6/20/19 9:00	783.3
6/20/19 10:00	783.3
6/20/19 11:00	783.3
6/20/19 12:00	783.3
6/20/19 13:00	783.3
6/20/19 14:00	783.3
6/20/19 15:00	783.3
6/20/19 16:00	783.3
6/20/19 17:00	783.3
6/20/19 18:00	783.3
6/20/19 19:00	783.3
6/20/19 20:00	783.3
6/20/19 21:00	783.3
6/20/19 22:00	783.3
6/20/19 23:00	783.3
6/21/19 0:00	783.3
6/21/19 1:00	783.3
6/21/19 2:00	783.3
6/21/19 3:00	783.3
6/21/19 4:00	783.3
6/21/19 5:00	783.3
6/21/19 6:00	783.3
6/21/19 7:00	783.3
6/21/19 8:00	783.3
6/21/19 9:00	783.4
6/21/19 10:00	783.4
6/21/19 11:00	783.4
6/21/19 12:00	783.4
6/21/19 13:00	783.4
6/21/19 14:00	783.4
6/21/19 15:00	783.4
6/21/19 16:00	783.4
6/21/19 17:00	783.4
6/21/19 18:00	783.4
6/21/19 19:00	783.4
6/21/19 20:00	783.4
6/21/19 21:00	783.4
6/21/19 22:00	783.4

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

6/21/19 23:00	783.4
6/22/19 0:00	783.4
6/22/19 1:00	783.4
6/22/19 2:00	783.4
6/22/19 3:00	783.5
6/22/19 4:00	783.5
6/22/19 5:00	783.5
6/22/19 6:00	783.5
6/22/19 7:00	783.5
6/22/19 8:00	783.5
6/22/19 9:00	783.5
6/22/19 10:00	783.5
6/22/19 11:00	783.5
6/22/19 12:00	783.5
6/22/19 13:00	783.5
6/22/19 14:00	783.5
6/22/19 15:00	783.5
6/22/19 16:00	783.5
6/22/19 17:00	783.5
6/22/19 18:00	783.5
6/22/19 19:00	783.5
6/22/19 20:00	783.5
6/22/19 21:00	783.5
6/22/19 22:00	783.5
6/22/19 23:00	783.5
6/23/19 0:00	783.5
6/23/19 1:00	783.5
6/23/19 2:00	783.5
6/23/19 3:00	783.5
6/23/19 4:00	783.5
6/23/19 5:00	783.5
6/23/19 6:00	783.5
6/23/19 7:00	783.5
6/23/19 8:00	783.5
6/23/19 9:00	783.5
6/23/19 10:00	783.5
6/23/19 11:00	783.5
6/23/19 12:00	783.5
6/23/19 13:00	783.5

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

6/23/19 14:00	783.5
6/23/19 15:00	783.5
6/23/19 16:00	783.5
6/23/19 17:00	783.5
6/23/19 18:00	783.5
6/23/19 19:00	783.5
6/23/19 20:00	783.5
6/23/19 21:00	783.5
6/23/19 22:00	783.5
6/23/19 23:00	783.5
6/24/19 0:00	783.5
6/24/19 1:00	783.5
6/24/19 2:00	783.5
6/24/19 3:00	783.5
6/24/19 4:00	783.5
6/24/19 5:00	783.5
6/24/19 6:00	783.5
6/24/19 7:00	783.4
6/24/19 8:00	783.4
6/24/19 9:00	783.4
6/24/19 10:00	783.4
6/24/19 11:00	783.4
6/24/19 12:00	783.4
6/24/19 13:00	783.4
6/24/19 14:00	783.4
6/24/19 15:00	783.4
6/24/19 16:00	783.4
6/24/19 17:00	783.4
6/24/19 18:00	783.4
6/24/19 19:00	783.4
6/24/19 20:00	783.4
6/24/19 21:00	783.4
6/24/19 22:00	783.4
6/24/19 23:00	783.4
6/25/19 0:00	783.4
6/25/19 1:00	783.4
6/25/19 2:00	783.4
6/25/19 3:00	783.4
6/25/19 4:00	783.4

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

6/25/19 5:00	783.4
6/25/19 6:00	783.4
6/25/19 7:00	783.4
6/25/19 8:00	783.4
6/25/19 9:00	783.4
6/25/19 10:00	783.4
6/25/19 11:00	783.4
6/25/19 12:00	783.4
6/25/19 13:00	783.4
6/25/19 14:00	783.4
6/25/19 15:00	783.4
6/25/19 16:00	783.4
6/25/19 17:00	783.4
6/25/19 18:00	783.4
6/25/19 19:00	783.4
6/25/19 20:00	783.4
6/25/19 21:00	783.4
6/25/19 22:00	783.4
6/25/19 23:00	783.4
6/26/19 0:00	783.4
6/26/19 1:00	783.4
6/26/19 2:00	783.4
6/26/19 3:00	783.4
6/26/19 4:00	783.4
6/26/19 5:00	783.4
6/26/19 6:00	783.4
6/26/19 7:00	783.4
6/26/19 8:00	783.4
6/26/19 9:00	783.4
6/26/19 10:00	783.4
6/26/19 11:00	783.4
6/26/19 12:00	783.4
6/26/19 13:00	783.4
6/26/19 14:00	783.4
6/26/19 15:00	783.4
6/26/19 16:00	783.4
6/26/19 17:00	783.4
6/26/19 18:00	783.4
6/26/19 19:00	783.4

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

6/26/19 20:00	783.4
6/26/19 21:00	783.4
6/26/19 22:00	783.4
6/26/19 23:00	783.3
6/27/19 0:00	783.3
6/27/19 1:00	783.3
6/27/19 2:00	783.3
6/27/19 3:00	783.3
6/27/19 4:00	783.3
6/27/19 5:00	783.3
6/27/19 6:00	783.3
6/27/19 7:00	783.3
6/27/19 8:00	783.3
6/27/19 9:00	783.3
6/27/19 10:00	783.3
6/27/19 11:00	783.3
6/27/19 12:00	783.3
6/27/19 13:00	783.3
6/27/19 14:00	783.3
6/27/19 15:00	783.3
6/27/19 16:00	783.3
6/27/19 17:00	783.3
6/27/19 18:00	783.3
6/27/19 19:00	783.3
6/27/19 20:00	783.3
6/27/19 21:00	783.3
6/27/19 22:00	783.3
6/27/19 23:00	783.3
6/28/19 0:00	783.3
6/28/19 1:00	783.3
6/28/19 2:00	783.3
6/28/19 3:00	783.3
6/28/19 4:00	783.3
6/28/19 5:00	783.3
6/28/19 6:00	783.3
6/28/19 7:00	783.3
6/28/19 8:00	783.3
6/28/19 9:00	783.3
6/28/19 10:00	783.3

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

6/28/19 11:00	783.3
6/28/19 12:00	783.3
6/28/19 13:00	783.3
6/28/19 14:00	783.3
6/28/19 15:00	783.2
6/28/19 16:00	783.2
6/28/19 17:00	783.2
6/28/19 18:00	783.2
6/28/19 19:00	783.2
6/28/19 20:00	783.2
6/28/19 21:00	783.2
6/28/19 22:00	783.2
6/28/19 23:00	783.2
6/29/19 0:00	783.2
6/29/19 1:00	783.2
6/29/19 2:00	783.2
6/29/19 3:00	783.2
6/29/19 4:00	783.2
6/29/19 5:00	783.2
6/29/19 6:00	783.2
6/29/19 7:00	783.2
6/29/19 8:00	783.2
6/29/19 9:00	783.2
6/29/19 10:00	783.2
6/29/19 11:00	783.2
6/29/19 12:00	783.2
6/29/19 13:00	783.2
6/29/19 14:00	783.2
6/29/19 15:00	783.2
6/29/19 16:00	783.2
6/29/19 17:00	783.2
6/29/19 18:00	783.2
6/29/19 19:00	783.2
6/29/19 20:00	783.2
6/29/19 21:00	783.2
6/29/19 22:00	783.2
6/29/19 23:00	783.2
6/30/19 0:00	783.2
6/30/19 1:00	783.2

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

6/30/19 2:00	783.2
6/30/19 3:00	783.2
6/30/19 4:00	783.1
6/30/19 5:00	783.1
6/30/19 6:00	783.1
6/30/19 7:00	783.1
6/30/19 8:00	783.1
6/30/19 9:00	783.1
6/30/19 10:00	783.1
6/30/19 11:00	783.1
6/30/19 12:00	783.1
6/30/19 13:00	783.1
6/30/19 14:00	783.1
6/30/19 15:00	783.1
6/30/19 16:00	783.1
6/30/19 17:00	783.1
6/30/19 18:00	783.1
6/30/19 19:00	783.1
6/30/19 20:00	783.1
6/30/19 21:00	783.1
6/30/19 22:00	783.1
6/30/19 23:00	783.1
7/1/19 0:00	783.1
7/1/19 1:00	783.1
7/1/19 2:00	783.1
7/1/19 3:00	783.1
7/1/19 4:00	783.1
7/1/19 5:00	783.1
7/1/19 6:00	783.1
7/1/19 7:00	783.1
7/1/19 8:00	783.1
7/1/19 9:00	783.1
7/1/19 10:00	783.1
7/1/19 11:00	783.1
7/1/19 12:00	783.1
7/1/19 13:00	783.1
7/1/19 14:00	783.1
7/1/19 15:00	783.1
7/1/19 16:00	783.1

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

7/1/19 17:00	783.1
7/1/19 18:00	783.1
7/1/19 19:00	783.1
7/1/19 20:00	783.1
7/1/19 21:00	783.1
7/1/19 22:00	783.1
7/1/19 23:00	783.1
7/2/19 0:00	783.1
7/2/19 1:00	783.1
7/2/19 2:00	783.1
7/2/19 3:00	783.1
7/2/19 4:00	783.1
7/2/19 5:00	783.1
7/2/19 6:00	783.1
7/2/19 7:00	783.1
7/2/19 8:00	783.1
7/2/19 9:00	783.1
7/2/19 10:00	783.0
7/2/19 11:00	783.0
7/2/19 12:00	783.0
7/2/19 13:00	783.0
7/2/19 14:00	783.0
7/2/19 15:00	783.0
7/2/19 16:00	783.0
7/2/19 17:00	783.0
7/2/19 18:00	783.0
7/2/19 19:00	783.0
7/2/19 20:00	783.0
7/2/19 21:00	783.0
7/2/19 22:00	783.0
7/2/19 23:00	783.0
7/3/19 0:00	782.9
7/3/19 1:00	782.9
7/3/19 2:00	782.9
7/3/19 3:00	782.9
7/3/19 4:00	782.9
7/3/19 5:00	782.9
7/3/19 6:00	782.9
7/3/19 7:00	782.9

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

7/3/19 8:00	782.9
7/3/19 9:00	782.9
7/3/19 10:00	783.0
7/3/19 11:00	783.0
7/3/19 12:00	783.0
7/3/19 13:00	783.0
7/3/19 14:00	783.0
7/3/19 15:00	783.0
7/3/19 16:00	783.0
7/3/19 17:00	783.0
7/3/19 18:00	783.0
7/3/19 19:00	783.0
7/3/19 20:00	783.0
7/3/19 21:00	783.0
7/3/19 22:00	782.9
7/3/19 23:00	782.9
7/4/19 0:00	782.9
7/4/19 1:00	782.9
7/4/19 2:00	782.9
7/4/19 3:00	782.9
7/4/19 4:00	782.9
7/4/19 5:00	782.9
7/4/19 6:00	782.9
7/4/19 7:00	782.9
7/4/19 8:00	782.9
7/4/19 9:00	782.9
7/4/19 10:00	782.9
7/4/19 11:00	782.9
7/4/19 12:00	782.9
7/4/19 13:00	782.9
7/4/19 14:00	782.9
7/4/19 15:00	782.9
7/4/19 16:00	782.9
7/4/19 17:00	782.9
7/4/19 18:00	782.9
7/4/19 19:00	782.9
7/4/19 20:00	782.9
7/4/19 21:00	782.9
7/4/19 22:00	782.9

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

7/4/19 23:00	782.9
7/5/19 0:00	782.9
7/5/19 1:00	782.9
7/5/19 2:00	782.9
7/5/19 3:00	782.9
7/5/19 4:00	782.9
7/5/19 5:00	782.9
7/5/19 6:00	782.9
7/5/19 7:00	782.9
7/5/19 8:00	782.9
7/5/19 9:00	782.9
7/5/19 10:00	782.9
7/5/19 11:00	782.9
7/5/19 12:00	782.9
7/5/19 13:00	782.9
7/5/19 14:00	782.9
7/5/19 15:00	782.9
7/5/19 16:00	782.9
7/5/19 17:00	782.9
7/5/19 18:00	782.9
7/5/19 19:00	782.9
7/5/19 20:00	782.9
7/5/19 21:00	782.9
7/5/19 22:00	782.9
7/5/19 23:00	782.9
7/6/19 0:00	782.9
7/6/19 1:00	782.9
7/6/19 2:00	782.9
7/6/19 3:00	782.9
7/6/19 4:00	782.9
7/6/19 5:00	782.9
7/6/19 6:00	782.9
7/6/19 7:00	782.9
7/6/19 8:00	782.9
7/6/19 9:00	782.9
7/6/19 10:00	782.9
7/6/19 11:00	782.9
7/6/19 12:00	782.9
7/6/19 13:00	782.9

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

7/6/19 14:00	782.9
7/6/19 15:00	782.9
7/6/19 16:00	782.9
7/6/19 17:00	782.9
7/6/19 18:00	782.9
7/6/19 19:00	782.9
7/6/19 20:00	782.9
7/6/19 21:00	782.9
7/6/19 22:00	782.9
7/6/19 23:00	782.9
7/7/19 0:00	782.9
7/7/19 1:00	782.9
7/7/19 2:00	782.9
7/7/19 3:00	782.9
7/7/19 4:00	782.9
7/7/19 5:00	782.9
7/7/19 6:00	782.9
7/7/19 7:00	782.9
7/7/19 8:00	782.9
7/7/19 9:00	782.9
7/7/19 10:00	782.9
7/7/19 11:00	782.9
7/7/19 12:00	782.9
7/7/19 13:00	782.9
7/7/19 14:00	782.9
7/7/19 15:00	782.9
7/7/19 16:00	782.9
7/7/19 17:00	782.9
7/7/19 18:00	782.9
7/7/19 19:00	782.9
7/7/19 20:00	782.9
7/7/19 21:00	782.9
7/7/19 22:00	782.9
7/7/19 23:00	782.9
7/8/19 0:00	782.9
7/8/19 1:00	782.9
7/8/19 2:00	782.9
7/8/19 3:00	782.9
7/8/19 4:00	782.9

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

7/8/19 5:00	782.9
7/8/19 6:00	782.9
7/8/19 7:00	782.9
7/8/19 8:00	782.9
7/8/19 9:00	782.9
7/8/19 10:00	783.0
7/8/19 11:00	783.0
7/8/19 12:00	783.0
7/8/19 13:00	783.0
7/8/19 14:00	783.0
7/8/19 15:00	783.0
7/8/19 16:00	783.0
7/8/19 17:00	783.0
7/8/19 18:00	783.0
7/8/19 19:00	783.0
7/8/19 20:00	783.0
7/8/19 21:00	783.0
7/8/19 22:00	783.0
7/8/19 23:00	783.0
7/9/19 0:00	783.0
7/9/19 1:00	783.0
7/9/19 2:00	783.0
7/9/19 3:00	783.0
7/9/19 4:00	783.0
7/9/19 5:00	783.0
7/9/19 6:00	783.0
7/9/19 7:00	783.0
7/9/19 8:00	783.0
7/9/19 9:00	783.0
7/9/19 10:00	783.0
7/9/19 11:00	783.0
7/9/19 12:00	783.0
7/9/19 13:00	783.0
7/9/19 14:00	783.0
7/9/19 15:00	783.0
7/9/19 16:00	783.0
7/9/19 17:00	783.0
7/9/19 18:00	783.0
7/9/19 19:00	783.0

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

7/9/19 20:00	783.0
7/9/19 21:00	783.0
7/9/19 22:00	783.0
7/9/19 23:00	783.0
7/10/19 0:00	783.0
7/10/19 1:00	783.0
7/10/19 2:00	783.0
7/10/19 3:00	783.0
7/10/19 4:00	783.0
7/10/19 5:00	783.0
7/10/19 6:00	783.0
7/10/19 7:00	783.0
7/10/19 8:00	783.0
7/10/19 9:00	783.0
7/10/19 10:00	783.0
7/10/19 11:00	783.0
7/10/19 12:00	783.0
7/10/19 13:00	783.0
7/10/19 14:00	783.0
7/10/19 15:00	783.0
7/10/19 16:00	783.0
7/10/19 17:00	783.0
7/10/19 18:00	783.0
7/10/19 19:00	783.0
7/10/19 20:00	783.0
7/10/19 21:00	783.0
7/10/19 22:00	782.9
7/10/19 23:00	782.9
7/11/19 0:00	782.9
7/11/19 1:00	782.9
7/11/19 2:00	782.9
7/11/19 3:00	782.9
7/11/19 4:00	782.9
7/11/19 5:00	782.9
7/11/19 6:00	782.9
7/11/19 7:00	782.9
7/11/19 8:00	782.9
7/11/19 9:00	782.9
7/11/19 10:00	782.9

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

7/11/19 11:00	782.9
7/11/19 12:00	782.9
7/11/19 13:00	782.9
7/11/19 14:00	782.9
7/11/19 15:00	782.9
7/11/19 16:00	782.9
7/11/19 17:00	782.9
7/11/19 18:00	782.9
7/11/19 19:00	782.9
7/11/19 20:00	782.9
7/11/19 21:00	782.9
7/11/19 22:00	782.9
7/11/19 23:00	782.9
7/12/19 0:00	782.9
7/12/19 1:00	782.9
7/12/19 2:00	782.9
7/12/19 3:00	782.9
7/12/19 4:00	782.9
7/12/19 5:00	782.9
7/12/19 6:00	782.9
7/12/19 7:00	782.9
7/12/19 8:00	782.9
7/12/19 9:00	782.9
7/12/19 10:00	782.9
7/12/19 11:00	782.9
7/12/19 12:00	782.9
7/12/19 13:00	782.9
7/12/19 14:00	782.9
7/12/19 15:00	782.9
7/12/19 16:00	782.9
7/12/19 17:00	782.9
7/12/19 18:00	782.9
7/12/19 19:00	782.9
7/12/19 20:00	782.9
7/12/19 21:00	782.9
7/12/19 22:00	782.9
7/12/19 23:00	782.9
7/13/19 0:00	782.9
7/13/19 1:00	782.9

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

7/13/19 2:00	782.9
7/13/19 3:00	782.9
7/13/19 4:00	782.9
7/13/19 5:00	782.9
7/13/19 6:00	782.9
7/13/19 7:00	782.9
7/13/19 8:00	782.9
7/13/19 9:00	782.9
7/13/19 10:00	782.9
7/13/19 11:00	782.9
7/13/19 12:00	782.9
7/13/19 13:00	782.9
7/13/19 14:00	782.9
7/13/19 15:00	782.9
7/13/19 16:00	782.9
7/13/19 17:00	782.9
7/13/19 18:00	782.9
7/13/19 19:00	782.9
7/13/19 20:00	782.9
7/13/19 21:00	782.9
7/13/19 22:00	782.9
7/13/19 23:00	782.9
7/14/19 0:00	782.9
7/14/19 1:00	782.9
7/14/19 2:00	782.9
7/14/19 3:00	782.9
7/14/19 4:00	782.9
7/14/19 5:00	782.9
7/14/19 6:00	782.9
7/14/19 7:00	782.9
7/14/19 8:00	782.9
7/14/19 9:00	782.9
7/14/19 10:00	782.9
7/14/19 11:00	782.9
7/14/19 12:00	782.9
7/14/19 13:00	782.9
7/14/19 14:00	782.9
7/14/19 15:00	782.9
7/14/19 16:00	782.9

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

7/14/19 17:00	782.9
7/14/19 18:00	782.9
7/14/19 19:00	782.9
7/14/19 20:00	782.9
7/14/19 21:00	782.9
7/14/19 22:00	782.9
7/14/19 23:00	782.9
7/15/19 0:00	782.9
7/15/19 1:00	782.9
7/15/19 2:00	782.9
7/15/19 3:00	782.9
7/15/19 4:00	782.9
7/15/19 5:00	782.9
7/15/19 6:00	782.9
7/15/19 7:00	782.9
7/15/19 8:00	782.9
7/15/19 9:00	782.9
7/15/19 10:00	782.9
7/15/19 11:00	783.0
7/15/19 12:00	783.0
7/15/19 13:00	783.0
7/15/19 14:00	783.0
7/15/19 15:00	783.0
7/15/19 16:00	783.1
7/15/19 17:00	783.1
7/15/19 18:00	783.1
7/15/19 19:00	783.1
7/15/19 20:00	783.1
7/15/19 21:00	783.1
7/15/19 22:00	783.1
7/15/19 23:00	783.1
7/16/19 0:00	783.1
7/16/19 1:00	783.1
7/16/19 2:00	783.1
7/16/19 3:00	783.1
7/16/19 4:00	783.1
7/16/19 5:00	783.1
7/16/19 6:00	783.1
7/16/19 7:00	783.1

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

7/16/19 8:00	783.1
7/16/19 9:00	783.1
7/16/19 10:00	783.1
7/16/19 11:00	783.1
7/16/19 12:00	783.1
7/16/19 13:00	783.1
7/16/19 14:00	783.1
7/16/19 15:00	783.1
7/16/19 16:00	783.1
7/16/19 17:00	783.1
7/16/19 18:00	783.1
7/16/19 19:00	783.1
7/16/19 20:00	783.1
7/16/19 21:00	783.1
7/16/19 22:00	783.1
7/16/19 23:00	783.1
7/17/19 0:00	783.1
7/17/19 1:00	783.1
7/17/19 2:00	783.1
7/17/19 3:00	783.1
7/17/19 4:00	783.1
7/17/19 5:00	783.1
7/17/19 6:00	783.1
7/17/19 7:00	783.1
7/17/19 8:00	783.1
7/17/19 9:00	783.1
7/17/19 10:00	783.1
7/17/19 11:00	783.1
7/17/19 12:00	783.1
7/17/19 13:00	783.1
7/17/19 14:00	783.1
7/17/19 15:00	783.1
7/17/19 16:00	783.1
7/17/19 17:00	783.1
7/17/19 18:00	783.2
7/17/19 19:00	783.2
7/17/19 20:00	783.2
7/17/19 21:00	783.2
7/17/19 22:00	783.2

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

7/17/19 23:00	783.2
7/18/19 0:00	783.2
7/18/19 1:00	783.2
7/18/19 2:00	783.2
7/18/19 3:00	783.2
7/18/19 4:00	783.2
7/18/19 5:00	783.2
7/18/19 6:00	783.2
7/18/19 7:00	783.2
7/18/19 8:00	783.2
7/18/19 9:00	783.2
7/18/19 10:00	783.1
7/18/19 11:00	783.1
7/18/19 12:00	783.0
7/18/19 13:00	783.0
7/18/19 14:00	782.9
7/18/19 15:00	782.9
7/18/19 16:00	782.9
7/18/19 17:00	782.9
7/18/19 18:00	782.9
7/18/19 19:00	782.9
7/18/19 20:00	782.9
7/18/19 21:00	782.9
7/18/19 22:00	782.9
7/18/19 23:00	782.9
7/19/19 0:00	782.9
7/19/19 1:00	782.9
7/19/19 2:00	782.9
7/19/19 3:00	782.9
7/19/19 4:00	782.9
7/19/19 5:00	782.9
7/19/19 6:00	782.9
7/19/19 7:00	782.9
7/19/19 8:00	782.9
7/19/19 9:00	782.9
7/19/19 10:00	782.9
7/19/19 11:00	782.9
7/19/19 12:00	782.9
7/19/19 13:00	782.9

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

7/19/19 14:00	782.9
7/19/19 15:00	782.9
7/19/19 16:00	782.9
7/19/19 17:00	782.9
7/19/19 18:00	782.9
7/19/19 19:00	782.9
7/19/19 20:00	782.9
7/19/19 21:00	782.9
7/19/19 22:00	782.9
7/19/19 23:00	782.9
7/20/19 0:00	782.9
7/20/19 1:00	782.9
7/20/19 2:00	782.9
7/20/19 3:00	782.9
7/20/19 4:00	782.9
7/20/19 5:00	782.9
7/20/19 6:00	782.9
7/20/19 7:00	782.9
7/20/19 8:00	782.9
7/20/19 9:00	782.9
7/20/19 10:00	782.9
7/20/19 11:00	782.9
7/20/19 12:00	782.9
7/20/19 13:00	782.9
7/20/19 14:00	782.9
7/20/19 15:00	782.9
7/20/19 16:00	782.9
7/20/19 17:00	782.9
7/20/19 18:00	782.9
7/20/19 19:00	782.9
7/20/19 20:00	782.9
7/20/19 21:00	782.9
7/20/19 22:00	782.9
7/20/19 23:00	782.9
7/21/19 0:00	782.9
7/21/19 1:00	782.9
7/21/19 2:00	782.9
7/21/19 3:00	782.9
7/21/19 4:00	782.9

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

7/21/19 5:00	782.9
7/21/19 6:00	782.9
7/21/19 7:00	782.9
7/21/19 8:00	782.9
7/21/19 9:00	782.9
7/21/19 10:00	782.9
7/21/19 11:00	782.9
7/21/19 12:00	782.9
7/21/19 13:00	782.9
7/21/19 14:00	782.9
7/21/19 15:00	782.9
7/21/19 16:00	782.9
7/21/19 17:00	782.9
7/21/19 18:00	782.9
7/21/19 19:00	782.9
7/21/19 20:00	782.9
7/21/19 21:00	782.9
7/21/19 22:00	782.9
7/21/19 23:00	782.9
7/22/19 0:00	782.9
7/22/19 1:00	782.9
7/22/19 2:00	782.9
7/22/19 3:00	782.9
7/22/19 4:00	782.9
7/22/19 5:00	782.9
7/22/19 6:00	782.9
7/22/19 7:00	782.9
7/22/19 8:00	782.9
7/22/19 9:00	782.9
7/22/19 10:00	782.9
7/22/19 11:00	782.9
7/22/19 12:00	782.9
7/22/19 13:00	782.9
7/22/19 14:00	782.9
7/22/19 15:00	782.9
7/22/19 16:00	782.9
7/22/19 17:00	782.9
7/22/19 18:00	782.9
7/22/19 19:00	782.9

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

7/22/19 20:00	782.9
7/22/19 21:00	782.9
7/22/19 22:00	782.9
7/22/19 23:00	782.9
7/23/19 0:00	782.9
7/23/19 1:00	782.9
7/23/19 2:00	782.9
7/23/19 3:00	782.9
7/23/19 4:00	782.9
7/23/19 5:00	782.9
7/23/19 6:00	782.9
7/23/19 7:00	782.9
7/23/19 8:00	782.9
7/23/19 9:00	782.9
7/23/19 10:00	782.9
7/23/19 11:00	782.9
7/23/19 12:00	782.9
7/23/19 13:00	782.9
7/23/19 14:00	782.9
7/23/19 15:00	782.9
7/23/19 16:00	782.9
7/23/19 17:00	782.9
7/23/19 18:00	782.9
7/23/19 19:00	782.9
7/23/19 20:00	782.9
7/23/19 21:00	782.9
7/23/19 22:00	782.9
7/23/19 23:00	782.9
7/24/19 0:00	782.9
7/24/19 1:00	782.9
7/24/19 2:00	782.9
7/24/19 3:00	782.9
7/24/19 4:00	782.9
7/24/19 5:00	782.9
7/24/19 6:00	782.9
7/24/19 7:00	782.9
7/24/19 8:00	782.9
7/24/19 9:00	782.9
7/24/19 10:00	782.9

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

7/24/19 11:00	782.9
7/24/19 12:00	782.9
7/24/19 13:00	782.9
7/24/19 14:00	782.9
7/24/19 15:00	782.9
7/24/19 16:00	782.9
7/24/19 17:00	782.9
7/24/19 18:00	782.9
7/24/19 19:00	782.9
7/24/19 20:00	782.9
7/24/19 21:00	782.9
7/24/19 22:00	782.9
7/24/19 23:00	782.9
7/25/19 0:00	782.9
7/25/19 1:00	782.9
7/25/19 2:00	782.9
7/25/19 3:00	782.9
7/25/19 4:00	782.9
7/25/19 5:00	782.9
7/25/19 6:00	782.9
7/25/19 7:00	782.9
7/25/19 8:00	782.9
7/25/19 9:00	782.9
7/25/19 10:00	782.9
7/25/19 11:00	782.9
7/25/19 12:00	782.9
7/25/19 13:00	782.9
7/25/19 14:00	782.9
7/25/19 15:00	782.9
7/25/19 16:00	782.9
7/25/19 17:00	782.9
7/25/19 18:00	782.9
7/25/19 19:00	782.9
7/25/19 20:00	782.9
7/25/19 21:00	782.9
7/25/19 22:00	782.9
7/25/19 23:00	782.9
7/26/19 0:00	782.9
7/26/19 1:00	782.9

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

7/26/19 2:00	782.9
7/26/19 3:00	782.9
7/26/19 4:00	782.9
7/26/19 5:00	782.9
7/26/19 6:00	782.9
7/26/19 7:00	782.9
7/26/19 8:00	782.9
7/26/19 9:00	782.9
7/26/19 10:00	782.9
7/26/19 11:00	782.9
7/26/19 12:00	782.9
7/26/19 13:00	782.9
7/26/19 14:00	782.9
7/26/19 15:00	782.9
7/26/19 16:00	782.9
7/26/19 17:00	782.9
7/26/19 18:00	782.9
7/26/19 19:00	782.9
7/26/19 20:00	782.9
7/26/19 21:00	782.9
7/26/19 22:00	782.9
7/26/19 23:00	782.9
7/27/19 0:00	782.9
7/27/19 1:00	782.9
7/27/19 2:00	782.9
7/27/19 3:00	782.9
7/27/19 4:00	782.9
7/27/19 5:00	782.9
7/27/19 6:00	782.9
7/27/19 7:00	782.9
7/27/19 8:00	782.9
7/27/19 9:00	782.9
7/27/19 10:00	782.9
7/27/19 11:00	782.9
7/27/19 12:00	782.9
7/27/19 13:00	782.9
7/27/19 14:00	782.9
7/27/19 15:00	782.9
7/27/19 16:00	782.9

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

7/27/19 17:00	782.9
7/27/19 18:00	782.9
7/27/19 19:00	782.9
7/27/19 20:00	782.9
7/27/19 21:00	782.9
7/27/19 22:00	782.9
7/27/19 23:00	782.9
7/28/19 0:00	782.9
7/28/19 1:00	782.9
7/28/19 2:00	782.9
7/28/19 3:00	782.9
7/28/19 4:00	782.9
7/28/19 5:00	782.9
7/28/19 6:00	782.9
7/28/19 7:00	782.9
7/28/19 8:00	782.9
7/28/19 9:00	782.9
7/28/19 10:00	782.9
7/28/19 11:00	782.9
7/28/19 12:00	782.9
7/28/19 13:00	782.9
7/28/19 14:00	782.9
7/28/19 15:00	782.9
7/28/19 16:00	782.9
7/28/19 17:00	782.9
7/28/19 18:00	782.9
7/28/19 19:00	782.9
7/28/19 20:00	782.9
7/28/19 21:00	782.9
7/28/19 22:00	782.9
7/28/19 23:00	782.9
7/29/19 0:00	782.9
7/29/19 1:00	782.9
7/29/19 2:00	782.9
7/29/19 3:00	782.9
7/29/19 4:00	782.9
7/29/19 5:00	782.9
7/29/19 6:00	782.9
7/29/19 7:00	782.9

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

7/29/19 8:00	782.9
7/29/19 9:00	782.9
7/29/19 10:00	782.9
7/29/19 11:00	782.9
7/29/19 12:00	782.9
7/29/19 13:00	782.9
7/29/19 14:00	782.9
7/29/19 15:00	782.9
7/29/19 16:00	782.9
7/29/19 17:00	782.9
7/29/19 18:00	782.9
7/29/19 19:00	782.9
7/29/19 20:00	782.9
7/29/19 21:00	782.9
7/29/19 22:00	782.9
7/29/19 23:00	782.9
7/30/19 0:00	782.9
7/30/19 1:00	782.9
7/30/19 2:00	782.9
7/30/19 3:00	782.9
7/30/19 4:00	782.9
7/30/19 5:00	782.9
7/30/19 6:00	782.9
7/30/19 7:00	782.9
7/30/19 8:00	782.9
7/30/19 9:00	782.9
7/30/19 10:00	782.9
7/30/19 11:00	782.9
7/30/19 12:00	782.9
7/30/19 13:00	782.9
7/30/19 14:00	782.9
7/30/19 15:00	782.9
7/30/19 16:00	782.9
7/30/19 17:00	782.9
7/30/19 18:00	782.9
7/30/19 19:00	782.9
7/30/19 20:00	782.9
7/30/19 21:00	782.9
7/30/19 22:00	782.9

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

7/30/19 23:00	782.9
7/31/19 0:00	782.9
7/31/19 1:00	782.9
7/31/19 2:00	782.9
7/31/19 3:00	782.9
7/31/19 4:00	782.9
7/31/19 5:00	782.9
7/31/19 6:00	782.9
7/31/19 7:00	782.9
7/31/19 8:00	782.9
7/31/19 9:00	782.9
7/31/19 10:00	782.9
7/31/19 11:00	782.9
7/31/19 12:00	782.9
7/31/19 13:00	782.9
7/31/19 14:00	782.9
7/31/19 15:00	782.9
7/31/19 16:00	782.9
7/31/19 17:00	782.9
7/31/19 18:00	782.9
7/31/19 19:00	782.9
7/31/19 20:00	782.9
7/31/19 21:00	782.9
7/31/19 22:00	782.9
7/31/19 23:00	782.9
8/1/19 0:00	782.9
8/1/19 1:00	782.9
8/1/19 2:00	782.9
8/1/19 3:00	782.9
8/1/19 4:00	782.9
8/1/19 5:00	782.9
8/1/19 6:00	782.9
8/1/19 7:00	782.9
8/1/19 8:00	782.9
8/1/19 9:00	782.9
8/1/19 10:00	782.9
8/1/19 11:00	782.9
8/1/19 12:00	782.9
8/1/19 13:00	782.9

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

8/1/19 14:00	782.9
8/1/19 15:00	782.9
8/1/19 16:00	782.9
8/1/19 17:00	782.9
8/1/19 18:00	782.9
8/1/19 19:00	782.9
8/1/19 20:00	782.9
8/1/19 21:00	782.9
8/1/19 22:00	782.9
8/1/19 23:00	782.9
8/2/19 0:00	782.9
8/2/19 1:00	782.9
8/2/19 2:00	782.9
8/2/19 3:00	782.9
8/2/19 4:00	782.9
8/2/19 5:00	782.9
8/2/19 6:00	782.9
8/2/19 7:00	782.9
8/2/19 8:00	782.9
8/2/19 9:00	782.9
8/2/19 10:00	782.9
8/2/19 11:00	782.9
8/2/19 12:00	782.9
8/2/19 13:00	782.9
8/2/19 14:00	782.9
8/2/19 15:00	782.9
8/2/19 16:00	782.9
8/2/19 17:00	782.9
8/2/19 18:00	782.9
8/2/19 19:00	782.8
8/2/19 20:00	782.8
8/2/19 21:00	782.8
8/2/19 22:00	782.8
8/2/19 23:00	782.8
8/3/19 0:00	782.8
8/3/19 1:00	782.8
8/3/19 2:00	782.8
8/3/19 3:00	782.8
8/3/19 4:00	782.8

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

8/3/19 5:00	782.8
8/3/19 6:00	782.8
8/3/19 7:00	782.8
8/3/19 8:00	782.8
8/3/19 9:00	782.9
8/3/19 10:00	782.9
8/3/19 11:00	782.9
8/3/19 12:00	782.9
8/3/19 13:00	782.9
8/3/19 14:00	782.9
8/3/19 15:00	782.9
8/3/19 16:00	782.9
8/3/19 17:00	782.9
8/3/19 18:00	782.9
8/3/19 19:00	782.9
8/3/19 20:00	782.9
8/3/19 21:00	782.9
8/3/19 22:00	782.9
8/3/19 23:00	782.9
8/4/19 0:00	782.9
8/4/19 1:00	782.9
8/4/19 2:00	782.9
8/4/19 3:00	782.9
8/4/19 4:00	782.9
8/4/19 5:00	782.9
8/4/19 6:00	782.9
8/4/19 7:00	782.9
8/4/19 8:00	782.9
8/4/19 9:00	782.9
8/4/19 10:00	782.9
8/4/19 11:00	782.9
8/4/19 12:00	782.9
8/4/19 13:00	782.9
8/4/19 14:00	782.9
8/4/19 15:00	782.9
8/4/19 16:00	782.9
8/4/19 17:00	782.9
8/4/19 18:00	782.9
8/4/19 19:00	782.9

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

8/4/19 20:00	782.9
8/4/19 21:00	782.9
8/4/19 22:00	782.9
8/4/19 23:00	782.9
8/5/19 0:00	782.9
8/5/19 1:00	782.9
8/5/19 2:00	782.9
8/5/19 3:00	782.9
8/5/19 4:00	782.9
8/5/19 5:00	782.9
8/5/19 6:00	782.9
8/5/19 7:00	782.9
8/5/19 8:00	782.9
8/5/19 9:00	782.9
8/5/19 10:00	782.9
8/5/19 11:00	782.9
8/5/19 12:00	782.9
8/5/19 13:00	782.9
8/5/19 14:00	782.9
8/5/19 15:00	782.9
8/5/19 16:00	782.9
8/5/19 17:00	782.9
8/5/19 18:00	782.9
8/5/19 19:00	782.9
8/5/19 20:00	782.9
8/5/19 21:00	782.9
8/5/19 22:00	782.9
8/5/19 23:00	782.9
8/6/19 0:00	782.9
8/6/19 1:00	782.9
8/6/19 2:00	782.9
8/6/19 3:00	782.9
8/6/19 4:00	782.9
8/6/19 5:00	782.9
8/6/19 6:00	782.9
8/6/19 7:00	782.9
8/6/19 8:00	782.9
8/6/19 9:00	782.9
8/6/19 10:00	782.9

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

8/6/19 11:00	782.9
8/6/19 12:00	782.9
8/6/19 13:00	782.9
8/6/19 14:00	782.9
8/6/19 15:00	782.9
8/6/19 16:00	782.9
8/6/19 17:00	782.9
8/6/19 18:00	782.9
8/6/19 19:00	782.9
8/6/19 20:00	782.9
8/6/19 21:00	782.9
8/6/19 22:00	782.9
8/6/19 23:00	782.9
8/7/19 0:00	782.9
8/7/19 1:00	782.9
8/7/19 2:00	782.9
8/7/19 3:00	782.9
8/7/19 4:00	782.9
8/7/19 5:00	782.9
8/7/19 6:00	782.9
8/7/19 7:00	782.9
8/7/19 8:00	782.9
8/7/19 9:00	782.9
8/7/19 10:00	782.9
8/7/19 11:00	782.9
8/7/19 12:00	782.9
8/7/19 13:00	782.9
8/7/19 14:00	782.9
8/7/19 15:00	782.9
8/7/19 16:00	782.9
8/7/19 17:00	782.9
8/7/19 18:00	782.9
8/7/19 19:00	782.9
8/7/19 20:00	782.9
8/7/19 21:00	782.9
8/7/19 22:00	782.9
8/7/19 23:00	782.9
8/8/19 0:00	782.9
8/8/19 1:00	782.9

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

8/8/19 2:00	782.9
8/8/19 3:00	782.9
8/8/19 4:00	782.9
8/8/19 5:00	782.9
8/8/19 6:00	782.9
8/8/19 7:00	782.9
8/8/19 8:00	782.9
8/8/19 9:00	782.9
8/8/19 10:00	782.9
8/8/19 11:00	782.9
8/8/19 12:00	782.9
8/8/19 13:00	782.9
8/8/19 14:00	782.9
8/8/19 15:00	782.9
8/8/19 16:00	782.9
8/8/19 17:00	782.9
8/8/19 18:00	782.9
8/8/19 19:00	782.9
8/8/19 20:00	782.9
8/8/19 21:00	782.9
8/8/19 22:00	782.9
8/8/19 23:00	782.9
8/9/19 0:00	782.9
8/9/19 1:00	782.9
8/9/19 2:00	782.9
8/9/19 3:00	782.9
8/9/19 4:00	782.9
8/9/19 5:00	782.9
8/9/19 6:00	782.9
8/9/19 7:00	782.9
8/9/19 8:00	782.9
8/9/19 9:00	782.9
8/9/19 10:00	782.9
8/9/19 11:00	782.9
8/9/19 12:00	782.9
8/9/19 13:00	782.9
8/9/19 14:00	782.9
8/9/19 15:00	782.9
8/9/19 16:00	782.9

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

8/9/19 17:00	782.9
8/9/19 18:00	782.9
8/9/19 19:00	782.9
8/9/19 20:00	782.9
8/9/19 21:00	782.9
8/9/19 22:00	782.9
8/9/19 23:00	782.9
8/10/19 0:00	782.9
8/10/19 1:00	782.9
8/10/19 2:00	782.9
8/10/19 3:00	782.8
8/10/19 4:00	782.8
8/10/19 5:00	782.8
8/10/19 6:00	782.8
8/10/19 7:00	782.8
8/10/19 8:00	782.9
8/10/19 9:00	782.9
8/10/19 10:00	782.9
8/10/19 11:00	782.9
8/10/19 12:00	782.9
8/10/19 13:00	782.9
8/10/19 14:00	782.8
8/10/19 15:00	782.8
8/10/19 16:00	782.8
8/10/19 17:00	782.9
8/10/19 18:00	782.8
8/10/19 19:00	782.8
8/10/19 20:00	782.8
8/10/19 21:00	782.8
8/10/19 22:00	782.8
8/10/19 23:00	782.8
8/11/19 0:00	782.8
8/11/19 1:00	782.8
8/11/19 2:00	782.8
8/11/19 3:00	782.8
8/11/19 4:00	782.8
8/11/19 5:00	782.8
8/11/19 6:00	782.8
8/11/19 7:00	782.8

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

8/11/19 8:00	782.8
8/11/19 9:00	782.8
8/11/19 10:00	782.9
8/11/19 11:00	782.8
8/11/19 12:00	782.9
8/11/19 13:00	782.9
8/11/19 14:00	782.8
8/11/19 15:00	782.8
8/11/19 16:00	782.8
8/11/19 17:00	782.8
8/11/19 18:00	782.8
8/11/19 19:00	782.8
8/11/19 20:00	782.8
8/11/19 21:00	782.8
8/11/19 22:00	782.9
8/11/19 23:00	782.9
8/12/19 0:00	782.9
8/12/19 1:00	782.9
8/12/19 2:00	782.9
8/12/19 3:00	782.9
8/12/19 4:00	782.9
8/12/19 5:00	782.9
8/12/19 6:00	782.9
8/12/19 7:00	782.9
8/12/19 8:00	782.9
8/12/19 9:00	782.9
8/12/19 10:00	782.8
8/12/19 11:00	782.8
8/12/19 12:00	782.8
8/12/19 13:00	782.8
8/12/19 14:00	782.7
8/12/19 15:00	782.7
8/12/19 16:00	782.7
8/12/19 17:00	782.7
8/12/19 18:00	782.7
8/12/19 19:00	782.7
8/12/19 20:00	782.7
8/12/19 21:00	782.7
8/12/19 22:00	782.7

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

8/12/19 23:00	782.7
8/13/19 0:00	782.7
8/13/19 1:00	782.7
8/13/19 2:00	782.7
8/13/19 3:00	782.7
8/13/19 4:00	782.7
8/13/19 5:00	782.7
8/13/19 6:00	782.7
8/13/19 7:00	782.7
8/13/19 8:00	782.7
8/13/19 9:00	782.7
8/13/19 10:00	782.7
8/13/19 11:00	782.6
8/13/19 12:00	782.6
8/13/19 13:00	782.6
8/13/19 14:00	782.6
8/13/19 15:00	782.6
8/13/19 16:00	782.6
8/13/19 17:00	782.5
8/13/19 18:00	782.5
8/13/19 19:00	782.5
8/13/19 20:00	782.5
8/13/19 21:00	782.5
8/13/19 22:00	782.5
8/13/19 23:00	782.5
8/14/19 0:00	782.4
8/14/19 1:00	782.44
8/14/19 2:00	782.44
8/14/19 3:00	782.44
8/14/19 4:00	782.45
8/14/19 5:00	782.44
8/14/19 6:00	782.44
8/14/19 7:00	782.44
8/14/19 8:00	782.45
8/14/19 9:00	782.44
8/14/19 10:00	782.44
8/14/19 11:00	782.44
8/14/19 12:00	782.44
8/14/19 13:00	782.45

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

8/14/19 14:00	782.48
8/14/19 15:00	782.51
8/14/19 16:00	782.54
8/14/19 17:00	782.57
8/14/19 18:00	782.6
8/14/19 19:00	782.63
8/14/19 20:00	782.65
8/14/19 21:00	782.68
8/14/19 22:00	782.71
8/14/19 23:00	782.73
8/15/19 0:00	782.75
8/15/19 1:00	782.76
8/15/19 2:00	782.76
8/15/19 3:00	782.76
8/15/19 4:00	782.77
8/15/19 5:00	782.77
8/15/19 6:00	782.77
8/15/19 7:00	782.78
8/15/19 8:00	782.78
8/15/19 9:00	782.79
8/15/19 10:00	782.79
8/15/19 11:00	782.82
8/15/19 12:00	782.84
8/15/19 13:00	782.86
8/15/19 14:00	782.88
8/15/19 15:00	782.91
8/15/19 16:00	782.93
8/15/19 17:00	782.95
8/15/19 18:00	782.97
8/15/19 19:00	782.98
8/15/19 20:00	782.98
8/15/19 21:00	782.98
8/15/19 22:00	782.98
8/15/19 23:00	782.98
8/16/19 0:00	782.98
8/16/19 1:00	782.98
8/16/19 2:00	782.98
8/16/19 3:00	782.98
8/16/19 4:00	782.98

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

8/16/19 5:00	782.98
8/16/19 6:00	782.98
8/16/19 7:00	782.98
8/16/19 8:00	782.98
8/16/19 9:00	782.99
8/16/19 10:00	782.99
8/16/19 11:00	782.99
8/16/19 12:00	782.99
8/16/19 13:00	782.99
8/16/19 14:00	782.96
8/16/19 15:00	782.95
8/16/19 16:00	782.93
8/16/19 17:00	782.91
8/16/19 18:00	782.9
8/16/19 19:00	782.9
8/16/19 20:00	782.9
8/16/19 21:00	782.9
8/16/19 22:00	782.91
8/16/19 23:00	782.9
8/17/19 0:00	782.91
8/17/19 1:00	782.91
8/17/19 2:00	782.9
8/17/19 3:00	782.91
8/17/19 4:00	782.92
8/17/19 5:00	782.94
8/17/19 6:00	782.96
8/17/19 7:00	782.98
8/17/19 8:00	783
8/17/19 9:00	783.02
8/17/19 10:00	783.03
8/17/19 11:00	783.05
8/17/19 12:00	783.05
8/17/19 13:00	783.04
8/17/19 14:00	783.02
8/17/19 15:00	783.01
8/17/19 16:00	783
8/17/19 17:00	782.99
8/17/19 18:00	782.98
8/17/19 19:00	782.97

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

8/17/19 20:00	782.96
8/17/19 21:00	782.96
8/17/19 22:00	782.96
8/17/19 23:00	782.96
8/18/19 0:00	782.97
8/18/19 1:00	782.98
8/18/19 2:00	782.99
8/18/19 3:00	782.99
8/18/19 4:00	783
8/18/19 5:00	783
8/18/19 6:00	783.01
8/18/19 7:00	783.01
8/18/19 8:00	783.02
8/18/19 9:00	783.02
8/18/19 10:00	783.02
8/18/19 11:00	783.02
8/18/19 12:00	783.02
8/18/19 13:00	783.05
8/18/19 14:00	783.06
8/18/19 15:00	783.06
8/18/19 16:00	783.06
8/18/19 17:00	783.06
8/18/19 18:00	783.06
8/18/19 19:00	783.06
8/18/19 20:00	783.05
8/18/19 21:00	783.04
8/18/19 22:00	783.03
8/18/19 23:00	783.02
8/19/19 0:00	783
8/19/19 1:00	782.99
8/19/19 2:00	782.98
8/19/19 3:00	782.97
8/19/19 4:00	782.96
8/19/19 5:00	782.95
8/19/19 6:00	782.94
8/19/19 7:00	782.94
8/19/19 8:00	782.93
8/19/19 9:00	782.92
8/19/19 10:00	782.89

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

8/19/19 11:00	782.88
8/19/19 12:00	782.86
8/19/19 13:00	782.85
8/19/19 14:00	782.85
8/19/19 15:00	782.85
8/19/19 16:00	782.86
8/19/19 17:00	782.86
8/19/19 18:00	782.86
8/19/19 19:00	782.86
8/19/19 20:00	782.86
8/19/19 21:00	782.86
8/19/19 22:00	782.86
8/19/19 23:00	782.86
8/20/19 0:00	782.86
8/20/19 1:00	782.86
8/20/19 2:00	782.86
8/20/19 3:00	782.86
8/20/19 4:00	782.86
8/20/19 5:00	782.85
8/20/19 6:00	782.86
8/20/19 7:00	782.86
8/20/19 8:00	782.86
8/20/19 9:00	782.86
8/20/19 10:00	782.86
8/20/19 11:00	782.86
8/20/19 12:00	782.86
8/20/19 13:00	782.86
8/20/19 14:00	782.86
8/20/19 15:00	782.86
8/20/19 16:00	782.86
8/20/19 17:00	782.85
8/20/19 18:00	782.86
8/20/19 19:00	782.86
8/20/19 20:00	782.86
8/20/19 21:00	782.86
8/20/19 22:00	782.86
8/20/19 23:00	782.86
8/21/19 0:00	782.86
8/21/19 1:00	782.86

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

8/21/19 2:00	782.86
8/21/19 3:00	782.86
8/21/19 4:00	782.86
8/21/19 5:00	782.86
8/21/19 6:00	782.86
8/21/19 7:00	782.86
8/21/19 8:00	782.86
8/21/19 9:00	782.86
8/21/19 10:00	782.86
8/21/19 11:00	782.86
8/21/19 12:00	782.87
8/21/19 13:00	782.86
8/21/19 14:00	782.86
8/21/19 15:00	782.86
8/21/19 16:00	782.86
8/21/19 17:00	782.86
8/21/19 18:00	782.86
8/21/19 19:00	782.86
8/21/19 20:00	782.86
8/21/19 21:00	782.87
8/21/19 22:00	782.87
8/21/19 23:00	782.87
8/22/19 0:00	782.87
8/22/19 1:00	782.88
8/22/19 2:00	782.88
8/22/19 3:00	782.91
8/22/19 4:00	782.93
8/22/19 5:00	782.95
8/22/19 6:00	782.97
8/22/19 7:00	782.99
8/22/19 8:00	783.01
8/22/19 9:00	783.03
8/22/19 10:00	783.04
8/22/19 11:00	783.05
8/22/19 12:00	783.05
8/22/19 13:00	783.06
8/22/19 14:00	783.06
8/22/19 15:00	783.05
8/22/19 16:00	783.05

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

8/22/19 17:00	783.05
8/22/19 18:00	783.04
8/22/19 19:00	783.04
8/22/19 20:00	782.6
8/22/19 21:00	783.02
8/22/19 22:00	783.01
8/22/19 23:00	783.01
8/23/19 0:00	783
8/23/19 1:00	783
8/23/19 2:00	782.99
8/23/19 3:00	782.99
8/23/19 4:00	782.98
8/23/19 5:00	782.98
8/23/19 6:00	782.98
8/23/19 7:00	782.97
8/23/19 8:00	782.97
8/23/19 9:00	782.98
8/23/19 10:00	782.98
8/23/19 11:00	782.98
8/23/19 12:00	782.99
8/23/19 13:00	783
8/23/19 14:00	783.01
8/23/19 15:00	783.02
8/23/19 16:00	783.03
8/23/19 17:00	783.03
8/23/19 18:00	783.03
8/23/19 19:00	783.03
8/23/19 20:00	783.03
8/23/19 21:00	783.03
8/23/19 22:00	783.03
8/23/19 23:00	783.03
8/24/19 0:00	783.03
8/24/19 1:00	783.03
8/24/19 2:00	783.03
8/24/19 3:00	783.03
8/24/19 4:00	783.03
8/24/19 5:00	783.03
8/24/19 6:00	783.03
8/24/19 7:00	783.03

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

8/24/19 8:00	783.03
8/24/19 9:00	783.03
8/24/19 10:00	783.03
8/24/19 11:00	783.02
8/24/19 12:00	783.01
8/24/19 13:00	783
8/24/19 14:00	782.99
8/24/19 15:00	782.99
8/24/19 16:00	782.98
8/24/19 17:00	782.98
8/24/19 18:00	782.97
8/24/19 19:00	782.96
8/24/19 20:00	782.96
8/24/19 21:00	782.95
8/24/19 22:00	782.94
8/24/19 23:00	782.94
8/25/19 0:00	782.93
8/25/19 1:00	782.92
8/25/19 2:00	782.91
8/25/19 3:00	782.9
8/25/19 4:00	782.89
8/25/19 5:00	782.88
8/25/19 6:00	782.87
8/25/19 7:00	782.86
8/25/19 8:00	782.86
8/25/19 9:00	782.86
8/25/19 10:00	782.86
8/25/19 11:00	782.86
8/25/19 12:00	782.86
8/25/19 13:00	782.85
8/25/19 14:00	782.86
8/25/19 15:00	782.86
8/25/19 16:00	782.86
8/25/19 17:00	782.86
8/25/19 18:00	782.86
8/25/19 19:00	782.86
8/25/19 20:00	782.86
8/25/19 21:00	782.86
8/25/19 22:00	782.86

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

8/25/19 23:00	782.86
8/26/19 0:00	782.86
8/26/19 1:00	782.86
8/26/19 2:00	782.86
8/26/19 3:00	782.86
8/26/19 4:00	782.86
8/26/19 5:00	782.85
8/26/19 6:00	782.85
8/26/19 7:00	782.86
8/26/19 8:00	782.86
8/26/19 9:00	782.86
8/26/19 10:00	782.86
8/26/19 11:00	782.86
8/26/19 12:00	782.86
8/26/19 13:00	782.86
8/26/19 14:00	782.86
8/26/19 15:00	782.86
8/26/19 16:00	782.86
8/26/19 17:00	782.86
8/26/19 18:00	782.86
8/26/19 19:00	782.86
8/26/19 20:00	782.86
8/26/19 21:00	782.86
8/26/19 22:00	782.86
8/26/19 23:00	782.86
8/27/19 0:00	782.86
8/27/19 1:00	782.86
8/27/19 2:00	782.86
8/27/19 3:00	782.86
8/27/19 4:00	782.86
8/27/19 5:00	782.86
8/27/19 6:00	782.86
8/27/19 7:00	782.86
8/27/19 8:00	782.86
8/27/19 9:00	782.86
8/27/19 10:00	782.86
8/27/19 11:00	782.86
8/27/19 12:00	782.86
8/27/19 13:00	782.86

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

8/27/19 14:00	782.86
8/27/19 15:00	782.86
8/27/19 16:00	782.86
8/27/19 17:00	782.86
8/27/19 18:00	782.86
8/27/19 19:00	782.86
8/27/19 20:00	782.86
8/27/19 21:00	782.86
8/27/19 22:00	782.86
8/27/19 23:00	782.86
8/28/19 0:00	782.86
8/28/19 1:00	782.86
8/28/19 2:00	782.86
8/28/19 3:00	782.86
8/28/19 4:00	782.86
8/28/19 5:00	782.86
8/28/19 6:00	782.86
8/28/19 7:00	782.86
8/28/19 8:00	782.86
8/28/19 9:00	782.86
8/28/19 10:00	782.86
8/28/19 11:00	782.86
8/28/19 12:00	782.86
8/28/19 13:00	782.86
8/28/19 14:00	782.86
8/28/19 15:00	782.86
8/28/19 16:00	782.86
8/28/19 17:00	782.86
8/28/19 18:00	782.86
8/28/19 19:00	782.86
8/28/19 20:00	782.86
8/28/19 21:00	782.86
8/28/19 22:00	782.86
8/28/19 23:00	782.86
8/29/19 0:00	782.86
8/29/19 1:00	782.86
8/29/19 2:00	782.86
8/29/19 3:00	782.85
8/29/19 4:00	782.86

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

8/29/19 5:00	782.86
8/29/19 6:00	782.86
8/29/19 7:00	782.86
8/29/19 8:00	782.86
8/29/19 9:00	782.86
8/29/19 10:00	782.86
8/29/19 11:00	782.86
8/29/19 12:00	782.86
8/29/19 13:00	782.86
8/29/19 14:00	782.86
8/29/19 15:00	782.86
8/29/19 16:00	782.86
8/29/19 17:00	782.86
8/29/19 18:00	782.86
8/29/19 19:00	782.86
8/29/19 20:00	782.86
8/29/19 21:00	782.86
8/29/19 22:00	782.86
8/29/19 23:00	782.86
8/30/19 0:00	782.86
8/30/19 1:00	782.86
8/30/19 2:00	782.86
8/30/19 3:00	782.85
8/30/19 4:00	782.85
8/30/19 5:00	782.86
8/30/19 6:00	782.86
8/30/19 7:00	782.86
8/30/19 8:00	782.86
8/30/19 9:00	782.86
8/30/19 10:00	782.86
8/30/19 11:00	782.86
8/30/19 12:00	782.86
8/30/19 13:00	782.86
8/30/19 14:00	782.86
8/30/19 15:00	782.86
8/30/19 16:00	782.85
8/30/19 17:00	782.86
8/30/19 18:00	782.86
8/30/19 19:00	782.86

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

8/30/19 20:00	782.86
8/30/19 21:00	782.85
8/30/19 22:00	782.86
8/30/19 23:00	782.85
8/31/19 0:00	782.86
8/31/19 1:00	782.86
8/31/19 2:00	782.85
8/31/19 3:00	782.86
8/31/19 4:00	782.85
8/31/19 5:00	782.86
8/31/19 6:00	782.86
8/31/19 7:00	782.85
8/31/19 8:00	782.86
8/31/19 9:00	782.85
8/31/19 10:00	782.86
8/31/19 11:00	782.86
8/31/19 12:00	782.86
8/31/19 13:00	782.86
8/31/19 14:00	782.85
8/31/19 15:00	782.86
8/31/19 16:00	782.85
8/31/19 17:00	782.86
8/31/19 18:00	782.85
8/31/19 19:00	782.86
8/31/19 20:00	782.85
8/31/19 21:00	782.86
8/31/19 22:00	782.86
8/31/19 23:00	782.86
9/1/19 0:00	782.85
9/1/19 1:00	782.86
9/1/19 2:00	782.85
9/1/19 3:00	782.86
9/1/19 4:00	782.85
9/1/19 5:00	782.86
9/1/19 6:00	782.86
9/1/19 7:00	782.85
9/1/19 8:00	782.86
9/1/19 9:00	782.86
9/1/19 10:00	782.86

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

9/1/19 11:00	782.86
9/1/19 12:00	782.86
9/1/19 13:00	782.86
9/1/19 14:00	782.86
9/1/19 15:00	782.86
9/1/19 16:00	782.86
9/1/19 17:00	782.86
9/1/19 18:00	782.85
9/1/19 19:00	782.86
9/1/19 20:00	782.86
9/1/19 21:00	782.86
9/1/19 22:00	782.86
9/1/19 23:00	782.86
9/2/19 0:00	782.86
9/2/19 1:00	782.86
9/2/19 2:00	782.86
9/2/19 3:00	782.86
9/2/19 4:00	782.86
9/2/19 5:00	782.86
9/2/19 6:00	782.86
9/2/19 7:00	782.86
9/2/19 8:00	782.86
9/2/19 9:00	782.86
9/2/19 10:00	782.86
9/2/19 11:00	782.86
9/2/19 12:00	782.85
9/2/19 13:00	782.86
9/2/19 14:00	782.86
9/2/19 15:00	782.86
9/2/19 16:00	782.86
9/2/19 17:00	782.86
9/2/19 18:00	782.86
9/2/19 19:00	782.86
9/2/19 20:00	782.86
9/2/19 21:00	782.86
9/2/19 22:00	782.85
9/2/19 23:00	782.86
9/3/19 0:00	782.86
9/3/19 1:00	782.86

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

9/3/19 2:00	782.86
9/3/19 3:00	782.86
9/3/19 4:00	782.86
9/3/19 5:00	782.86
9/3/19 6:00	782.86
9/3/19 7:00	782.85
9/3/19 8:00	782.86
9/3/19 9:00	782.86
9/3/19 10:00	782.86
9/3/19 11:00	782.85
9/3/19 12:00	782.86
9/3/19 13:00	782.87
9/3/19 14:00	782.86
9/3/19 15:00	782.85
9/3/19 16:00	782.85
9/3/19 17:00	782.86
9/3/19 18:00	782.86
9/3/19 19:00	782.86
9/3/19 20:00	782.85
9/3/19 21:00	782.86
9/3/19 22:00	782.86
9/3/19 23:00	782.86
9/4/19 0:00	782.86
9/4/19 1:00	782.85
9/4/19 2:00	782.86
9/4/19 3:00	782.86
9/4/19 4:00	782.86
9/4/19 5:00	782.86
9/4/19 6:00	782.86
9/4/19 7:00	782.86
9/4/19 8:00	782.86
9/4/19 9:00	782.86
9/4/19 10:00	782.86
9/4/19 11:00	782.85
9/4/19 12:00	782.85
9/4/19 13:00	782.86
9/4/19 14:00	782.86
9/4/19 15:00	782.86
9/4/19 16:00	782.86

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

9/4/19 17:00	782.86
9/4/19 18:00	782.86
9/4/19 19:00	782.85
9/4/19 20:00	782.86
9/4/19 21:00	782.86
9/4/19 22:00	782.86
9/4/19 23:00	782.85
9/5/19 0:00	782.86
9/5/19 1:00	782.85
9/5/19 2:00	782.86
9/5/19 3:00	782.86
9/5/19 4:00	782.85
9/5/19 5:00	782.86
9/5/19 6:00	782.86
9/5/19 7:00	782.85
9/5/19 8:00	782.86
9/5/19 9:00	782.86
9/5/19 10:00	782.86
9/5/19 11:00	782.85
9/5/19 12:00	782.86
9/5/19 13:00	782.85
9/5/19 14:00	782.86
9/5/19 15:00	782.86
9/5/19 16:00	782.86
9/5/19 17:00	782.86
9/5/19 18:00	782.86
9/5/19 19:00	782.86
9/5/19 20:00	782.86
9/5/19 21:00	782.86
9/5/19 22:00	782.86
9/5/19 23:00	782.86
9/6/19 0:00	782.86
9/6/19 1:00	782.85
9/6/19 2:00	782.86
9/6/19 3:00	782.86
9/6/19 4:00	782.86
9/6/19 5:00	782.85
9/6/19 6:00	782.86
9/6/19 7:00	782.86

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

9/6/19 8:00	782.86
9/6/19 9:00	782.86
9/6/19 10:00	782.86
9/6/19 11:00	782.86
9/6/19 12:00	782.86
9/6/19 13:00	782.86
9/6/19 14:00	782.86
9/6/19 15:00	782.86
9/6/19 16:00	782.85
9/6/19 17:00	782.86
9/6/19 18:00	782.86
9/6/19 19:00	782.85
9/6/19 20:00	782.86
9/6/19 21:00	782.86
9/6/19 22:00	782.86
9/6/19 23:00	782.85
9/7/19 0:00	782.86
9/7/19 1:00	782.86
9/7/19 2:00	782.86
9/7/19 3:00	782.85
9/7/19 4:00	782.86
9/7/19 5:00	782.86
9/7/19 6:00	782.86
9/7/19 7:00	782.86
9/7/19 8:00	782.86
9/7/19 9:00	782.86
9/7/19 10:00	782.86
9/7/19 11:00	782.85
9/7/19 12:00	782.86
9/7/19 13:00	782.86
9/7/19 14:00	782.86
9/7/19 15:00	782.86
9/7/19 16:00	782.85
9/7/19 17:00	782.85
9/7/19 18:00	782.86
9/7/19 19:00	782.86
9/7/19 20:00	782.86
9/7/19 21:00	782.85
9/7/19 22:00	782.86

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

9/7/19 23:00	782.86
9/8/19 0:00	782.86
9/8/19 1:00	782.86
9/8/19 2:00	782.86
9/8/19 3:00	782.86
9/8/19 4:00	782.86
9/8/19 5:00	782.86
9/8/19 6:00	782.86
9/8/19 7:00	782.86
9/8/19 8:00	782.86
9/8/19 9:00	782.86
9/8/19 10:00	782.86
9/8/19 11:00	782.85
9/8/19 12:00	782.86
9/8/19 13:00	782.86
9/8/19 14:00	782.86
9/8/19 15:00	782.86
9/8/19 16:00	782.86
9/8/19 17:00	782.86
9/8/19 18:00	782.86
9/8/19 19:00	782.86
9/8/19 20:00	782.85
9/8/19 21:00	782.86
9/8/19 22:00	782.86
9/8/19 23:00	782.86
9/9/19 0:00	782.86
9/9/19 1:00	782.86
9/9/19 2:00	782.86
9/9/19 3:00	782.86
9/9/19 4:00	782.86
9/9/19 5:00	782.86
9/9/19 6:00	782.86
9/9/19 7:00	782.86
9/9/19 8:00	782.86
9/9/19 9:00	782.87
9/9/19 10:00	782.91
9/9/19 11:00	782.95
9/9/19 12:00	782.98
9/9/19 13:00	783.02

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

9/9/19 14:00	783.05
9/9/19 15:00	783.07
9/9/19 16:00	783.07
9/9/19 17:00	783.04
9/9/19 18:00	783.02
9/9/19 19:00	783
9/9/19 20:00	782.98
9/9/19 21:00	782.95
9/9/19 22:00	782.94
9/9/19 23:00	782.92
9/10/19 0:00	782.9
9/10/19 1:00	782.87
9/10/19 2:00	782.86
9/10/19 3:00	782.85
9/10/19 4:00	782.85
9/10/19 5:00	782.86
9/10/19 6:00	782.86
9/10/19 7:00	782.86
9/10/19 8:00	782.86
9/10/19 9:00	782.86
9/10/19 10:00	782.86
9/10/19 11:00	782.86
9/10/19 12:00	782.85
9/10/19 13:00	782.86
9/10/19 14:00	782.86
9/10/19 15:00	782.86
9/10/19 16:00	782.86
9/10/19 17:00	782.86
9/10/19 18:00	782.86
9/10/19 19:00	782.86
9/10/19 20:00	782.85
9/10/19 21:00	782.86
9/10/19 22:00	782.86
9/10/19 23:00	782.86
9/11/19 0:00	782.86
9/11/19 1:00	782.86
9/11/19 2:00	782.86
9/11/19 3:00	782.86
9/11/19 4:00	782.86

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

9/11/19 5:00	782.86
9/11/19 6:00	782.86
9/11/19 7:00	782.86
9/11/19 8:00	782.86
9/11/19 9:00	782.86
9/11/19 10:00	782.85
9/11/19 11:00	782.85
9/11/19 12:00	782.86
9/11/19 13:00	782.86
9/11/19 14:00	782.86
9/11/19 15:00	782.86
9/11/19 16:00	782.86
9/11/19 17:00	782.85
9/11/19 18:00	782.86
9/11/19 19:00	782.86
9/11/19 20:00	782.86
9/11/19 21:00	782.86
9/11/19 22:00	782.85
9/11/19 23:00	782.86
9/12/19 0:00	782.86
9/12/19 1:00	782.86
9/12/19 2:00	782.92
9/12/19 3:00	782.97
9/12/19 4:00	783.02
9/12/19 5:00	783.01
9/12/19 6:00	783
9/12/19 7:00	782.99
9/12/19 8:00	783.04
9/12/19 9:00	783.06
9/12/19 10:00	783.05
9/12/19 11:00	783.04
9/12/19 12:00	783.03
9/12/19 13:00	783.02
9/12/19 14:00	783
9/12/19 15:00	782.99
9/12/19 16:00	782.98
9/12/19 17:00	782.97
9/12/19 18:00	782.96
9/12/19 19:00	782.94

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

9/12/19 20:00	782.93
9/12/19 21:00	782.92
9/12/19 22:00	782.91
9/12/19 23:00	782.89
9/13/19 0:00	782.88
9/13/19 1:00	782.87
9/13/19 2:00	782.88
9/13/19 3:00	782.86
9/13/19 4:00	782.85
9/13/19 5:00	782.85
9/13/19 6:00	782.85
9/13/19 7:00	782.86
9/13/19 8:00	782.86
9/13/19 9:00	782.86
9/13/19 10:00	782.86
9/13/19 11:00	782.85
9/13/19 12:00	782.86
9/13/19 13:00	782.86
9/13/19 14:00	782.86
9/13/19 15:00	782.85
9/13/19 16:00	782.86
9/13/19 17:00	782.86
9/13/19 18:00	782.85
9/13/19 19:00	782.86
9/13/19 20:00	782.86
9/13/19 21:00	782.86
9/13/19 22:00	782.86
9/13/19 23:00	782.86
9/14/19 0:00	782.86
9/14/19 1:00	782.86
9/14/19 2:00	782.86
9/14/19 3:00	782.86
9/14/19 4:00	782.86
9/14/19 5:00	782.86
9/14/19 6:00	782.86
9/14/19 7:00	782.86
9/14/19 8:00	782.86
9/14/19 9:00	782.86
9/14/19 10:00	782.86

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

9/14/19 11:00	782.86
9/14/19 12:00	782.86
9/14/19 13:00	782.86
9/14/19 14:00	782.86
9/14/19 15:00	782.86
9/14/19 16:00	782.86
9/14/19 17:00	782.86
9/14/19 18:00	782.86
9/14/19 19:00	782.86
9/14/19 20:00	782.86
9/14/19 21:00	782.86
9/14/19 22:00	782.86
9/14/19 23:00	782.86
9/15/19 0:00	782.86
9/15/19 1:00	782.86
9/15/19 2:00	782.86
9/15/19 3:00	782.86
9/15/19 4:00	782.86
9/15/19 5:00	782.86
9/15/19 6:00	782.86
9/15/19 7:00	782.86
9/15/19 8:00	782.86
9/15/19 9:00	782.86
9/15/19 10:00	782.86
9/15/19 11:00	782.86
9/15/19 12:00	782.86
9/15/19 13:00	782.86
9/15/19 14:00	782.85
9/15/19 15:00	782.86
9/15/19 16:00	782.86
9/15/19 17:00	782.86
9/15/19 18:00	782.86
9/15/19 19:00	782.86
9/15/19 20:00	782.86
9/15/19 21:00	782.86
9/15/19 22:00	782.86
9/15/19 23:00	782.86
9/16/19 0:00	782.86
9/16/19 1:00	782.86

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

9/16/19 2:00	782.86
9/16/19 3:00	782.86
9/16/19 4:00	782.86
9/16/19 5:00	782.86
9/16/19 6:00	782.86
9/16/19 7:00	782.86
9/16/19 8:00	782.86
9/16/19 9:00	782.86
9/16/19 10:00	782.86
9/16/19 11:00	782.86
9/16/19 12:00	782.86
9/16/19 13:00	782.86
9/16/19 14:00	782.86
9/16/19 15:00	782.86
9/16/19 16:00	782.86
9/16/19 17:00	782.86
9/16/19 18:00	782.86
9/16/19 19:00	782.86
9/16/19 20:00	782.86
9/16/19 21:00	782.86
9/16/19 22:00	782.86
9/16/19 23:00	782.86
9/17/19 0:00	782.86
9/17/19 1:00	782.86
9/17/19 2:00	782.86
9/17/19 3:00	782.86
9/17/19 4:00	782.86
9/17/19 5:00	782.86
9/17/19 6:00	782.86
9/17/19 7:00	782.86
9/17/19 8:00	782.86
9/17/19 9:00	782.86
9/17/19 10:00	782.86
9/17/19 11:00	782.86
9/17/19 12:00	782.86
9/17/19 13:00	782.86
9/17/19 14:00	782.86
9/17/19 15:00	782.86
9/17/19 16:00	782.86

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

9/17/19 17:00	782.86
9/17/19 18:00	782.86
9/17/19 19:00	782.86
9/17/19 20:00	782.86
9/17/19 21:00	782.86
9/17/19 22:00	782.86
9/17/19 23:00	782.86
9/18/19 0:00	782.86
9/18/19 1:00	782.86
9/18/19 2:00	782.86
9/18/19 3:00	782.86
9/18/19 4:00	782.86
9/18/19 5:00	782.86
9/18/19 6:00	782.85
9/18/19 7:00	782.86
9/18/19 8:00	782.86
9/18/19 9:00	782.86
9/18/19 10:00	782.86
9/18/19 11:00	782.86
9/18/19 12:00	782.85
9/18/19 13:00	782.85
9/18/19 14:00	782.86
9/18/19 15:00	782.86
9/18/19 16:00	782.86
9/18/19 17:00	782.86
9/18/19 18:00	782.86
9/18/19 19:00	782.86
9/18/19 20:00	782.85
9/18/19 21:00	782.86
9/18/19 22:00	782.86
9/18/19 23:00	782.85
9/19/19 0:00	782.85
9/19/19 1:00	782.86
9/19/19 2:00	782.86
9/19/19 3:00	782.86
9/19/19 4:00	782.85
9/19/19 5:00	782.85
9/19/19 6:00	782.85
9/19/19 7:00	782.85

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

9/19/19 8:00	782.85
9/19/19 9:00	782.85
9/19/19 10:00	782.85
9/19/19 11:00	782.85
9/19/19 12:00	782.85
9/19/19 13:00	782.85
9/19/19 14:00	782.85
9/19/19 15:00	782.86
9/19/19 16:00	782.86
9/19/19 17:00	782.86
9/19/19 18:00	782.86
9/19/19 19:00	782.86
9/19/19 20:00	782.86
9/19/19 21:00	782.86
9/19/19 22:00	782.86
9/19/19 23:00	782.86
9/20/19 0:00	782.86
9/20/19 1:00	782.86
9/20/19 2:00	782.85
9/20/19 3:00	782.85
9/20/19 4:00	782.85
9/20/19 5:00	782.85
9/20/19 6:00	782.85
9/20/19 7:00	782.85
9/20/19 8:00	782.85
9/20/19 9:00	782.85
9/20/19 10:00	782.85
9/20/19 11:00	782.85
9/20/19 12:00	782.85
9/20/19 13:00	782.86
9/20/19 14:00	782.86
9/20/19 15:00	782.86
9/20/19 16:00	782.85
9/20/19 17:00	782.86
9/20/19 18:00	782.86
9/20/19 19:00	782.86
9/20/19 20:00	782.86
9/20/19 21:00	782.86
9/20/19 22:00	782.86

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

9/20/19 23:00	782.86
9/21/19 0:00	782.85
9/21/19 1:00	782.86
9/21/19 2:00	782.86
9/21/19 3:00	782.86
9/21/19 4:00	782.86
9/21/19 5:00	782.85
9/21/19 6:00	782.86
9/21/19 7:00	782.86
9/21/19 8:00	782.86
9/21/19 9:00	782.86
9/21/19 10:00	782.85
9/21/19 11:00	782.86
9/21/19 12:00	782.86
9/21/19 13:00	782.86
9/21/19 14:00	782.85
9/21/19 15:00	782.86
9/21/19 16:00	782.85
9/21/19 17:00	782.86
9/21/19 18:00	782.86
9/21/19 19:00	782.85
9/21/19 20:00	782.86
9/21/19 21:00	782.85
9/21/19 22:00	782.86
9/21/19 23:00	782.85
9/22/19 0:00	782.85
9/22/19 1:00	782.86
9/22/19 2:00	782.86
9/22/19 3:00	782.85
9/22/19 4:00	782.86
9/22/19 5:00	782.86
9/22/19 6:00	782.85
9/22/19 7:00	782.85
9/22/19 8:00	782.86
9/22/19 9:00	782.86
9/22/19 10:00	782.85
9/22/19 11:00	782.85
9/22/19 12:00	782.86
9/22/19 13:00	782.86

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

9/22/19 14:00	782.86
9/22/19 15:00	782.86
9/22/19 16:00	782.86
9/22/19 17:00	782.85
9/22/19 18:00	782.85
9/22/19 19:00	782.85
9/22/19 20:00	782.86
9/22/19 21:00	782.86
9/22/19 22:00	782.85
9/22/19 23:00	782.85
9/23/19 0:00	782.86
9/23/19 1:00	782.86
9/23/19 2:00	782.86
9/23/19 3:00	782.85
9/23/19 4:00	782.85
9/23/19 5:00	782.85
9/23/19 6:00	782.86
9/23/19 7:00	782.86
9/23/19 8:00	782.85
9/23/19 9:00	782.86
9/23/19 10:00	782.86
9/23/19 11:00	782.86
9/23/19 12:00	782.88
9/23/19 13:00	782.87
9/23/19 14:00	782.87
9/23/19 15:00	782.87
9/23/19 16:00	782.86
9/23/19 17:00	782.86
9/23/19 18:00	782.86
9/23/19 19:00	782.86
9/23/19 20:00	782.86
9/23/19 21:00	782.86
9/23/19 22:00	782.86
9/23/19 23:00	782.86
9/24/19 0:00	782.85
9/24/19 1:00	782.85
9/24/19 2:00	782.85
9/24/19 3:00	782.85
9/24/19 4:00	782.85

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

9/24/19 5:00	782.85
9/24/19 6:00	782.85
9/24/19 7:00	782.86
9/24/19 8:00	782.86
9/24/19 9:00	782.85
9/24/19 10:00	782.86
9/24/19 11:00	782.86
9/24/19 12:00	782.86
9/24/19 13:00	782.86
9/24/19 14:00	782.86
9/24/19 15:00	782.86
9/24/19 16:00	782.86
9/24/19 17:00	782.86
9/24/19 18:00	782.85
9/24/19 19:00	782.86
9/24/19 20:00	782.86
9/24/19 21:00	782.86
9/24/19 22:00	782.85
9/24/19 23:00	782.85
9/25/19 0:00	782.86
9/25/19 1:00	782.86
9/25/19 2:00	782.86
9/25/19 3:00	782.85
9/25/19 4:00	782.86
9/25/19 5:00	782.86
9/25/19 6:00	782.85
9/25/19 7:00	782.85
9/25/19 8:00	782.86
9/25/19 9:00	782.86
9/25/19 10:00	782.85
9/25/19 11:00	782.85
9/25/19 12:00	782.86
9/25/19 13:00	782.86
9/25/19 14:00	782.86
9/25/19 15:00	782.86
9/25/19 16:00	782.86
9/25/19 17:00	782.86
9/25/19 18:00	782.86
9/25/19 19:00	782.86

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

9/25/19 20:00	782.86
9/25/19 21:00	782.86
9/25/19 22:00	782.86
9/25/19 23:00	782.86
9/26/19 0:00	782.85
9/26/19 1:00	782.86
9/26/19 2:00	782.86
9/26/19 3:00	782.85
9/26/19 4:00	782.86
9/26/19 5:00	782.86
9/26/19 6:00	782.86
9/26/19 7:00	782.85
9/26/19 8:00	782.86
9/26/19 9:00	782.86
9/26/19 10:00	782.86
9/26/19 11:00	782.85
9/26/19 12:00	782.85
9/26/19 13:00	782.85
9/26/19 14:00	782.86
9/26/19 15:00	782.86
9/26/19 16:00	782.86
9/26/19 17:00	782.85
9/26/19 18:00	782.85
9/26/19 19:00	782.86
9/26/19 20:00	782.85
9/26/19 21:00	782.85
9/26/19 22:00	782.86
9/26/19 23:00	782.86
9/27/19 0:00	782.85
9/27/19 1:00	782.86
9/27/19 2:00	782.86
9/27/19 3:00	782.85
9/27/19 4:00	782.85
9/27/19 5:00	782.86
9/27/19 6:00	782.86
9/27/19 7:00	782.85
9/27/19 8:00	782.85
9/27/19 9:00	782.86
9/27/19 10:00	782.85

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

9/27/19 11:00	782.85
9/27/19 12:00	782.86
9/27/19 13:00	782.86
9/27/19 14:00	782.86
9/27/19 15:00	782.86
9/27/19 16:00	782.85
9/27/19 17:00	782.85
9/27/19 18:00	782.86
9/27/19 19:00	782.86
9/27/19 20:00	782.86
9/27/19 21:00	782.85
9/27/19 22:00	782.86
9/27/19 23:00	782.97
9/28/19 0:00	783.02
9/28/19 1:00	782.99
9/28/19 2:00	783.02
9/28/19 3:00	783
9/28/19 4:00	783.04
9/28/19 5:00	783.11
9/28/19 6:00	783.02
9/28/19 7:00	783.01
9/28/19 8:00	783.01
9/28/19 9:00	783.02
9/28/19 10:00	783.03
9/28/19 11:00	783.04
9/28/19 12:00	783.06
9/28/19 13:00	783.08
9/28/19 14:00	783.1
9/28/19 15:00	783.11
9/28/19 16:00	783.13
9/28/19 17:00	783.14
9/28/19 18:00	783.15
9/28/19 19:00	783.16
9/28/19 20:00	783.16
9/28/19 21:00	783.17
9/28/19 22:00	783.17
9/28/19 23:00	783.18
9/29/19 0:00	783.19
9/29/19 1:00	783.19

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

9/29/19 2:00	783.2
9/29/19 3:00	783.2
9/29/19 4:00	783.2
9/29/19 5:00	783.21
9/29/19 6:00	783.21
9/29/19 7:00	783.21
9/29/19 8:00	783.21
9/29/19 9:00	783.21
9/29/19 10:00	783.22
9/29/19 11:00	783.23
9/29/19 12:00	783.23
9/29/19 13:00	783.22
9/29/19 14:00	783.22
9/29/19 15:00	783.23
9/29/19 16:00	783.23
9/29/19 17:00	783.23
9/29/19 18:00	783.23
9/29/19 19:00	783.22
9/29/19 20:00	783.23
9/29/19 21:00	783.23
9/29/19 22:00	783.24
9/29/19 23:00	783.25
9/30/19 0:00	783.25
9/30/19 1:00	783.25
9/30/19 2:00	783.26
9/30/19 3:00	783.26
9/30/19 4:00	783.26
9/30/19 5:00	783.27
9/30/19 6:00	783.27
9/30/19 7:00	783.27
9/30/19 8:00	783.27
9/30/19 9:00	783.27
9/30/19 10:00	783.24
9/30/19 11:00	783.23
9/30/19 12:00	783.22
9/30/19 13:00	783.21
9/30/19 14:00	783.2
9/30/19 15:00	783.19
9/30/19 16:00	783.18

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

9/30/19 17:00	783.17
9/30/19 18:00	783.17
9/30/19 19:00	783.17
9/30/19 20:00	783.17
9/30/19 21:00	783.18
9/30/19 22:00	783.18
9/30/19 23:00	783.19
10/1/19 0:00	783.19
10/1/19 1:00	783.2
10/1/19 2:00	783.21
10/1/19 3:00	783.22
10/1/19 4:00	783.23
10/1/19 5:00	783.23
10/1/19 6:00	783.24
10/1/19 7:00	783.25
10/1/19 8:00	783.25
10/1/19 9:00	783.25
10/1/19 10:00	783.26
10/1/19 11:00	783.26
10/1/19 12:00	783.26
10/1/19 13:00	783.27
10/1/19 14:00	783.27
10/1/19 15:00	783.27
10/1/19 16:00	783.27
10/1/19 17:00	783.28
10/1/19 18:00	783.28
10/1/19 19:00	783.28
10/1/19 20:00	783.28
10/1/19 21:00	783.28
10/1/19 22:00	783.28
10/1/19 23:00	783.28
10/2/19 0:00	783.28
10/2/19 1:00	783.28
10/2/19 2:00	783.28
10/2/19 3:00	783.28
10/2/19 4:00	783.28
10/2/19 5:00	783.29
10/2/19 6:00	783.28
10/2/19 7:00	783.29

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

10/2/19 8:00	783.28
10/2/19 9:00	783.28
10/2/19 10:00	783.27
10/2/19 11:00	783.26
10/2/19 12:00	783.26
10/2/19 13:00	783.25
10/2/19 14:00	783.25
10/2/19 15:00	783.25
10/2/19 16:00	783.26
10/2/19 17:00	783.26
10/2/19 18:00	783.26
10/2/19 19:00	783.28
10/2/19 20:00	783.29
10/2/19 21:00	783.3
10/2/19 22:00	783.31
10/2/19 23:00	783.32
10/3/19 0:00	783.32
10/3/19 1:00	783.32
10/3/19 2:00	783.33
10/3/19 3:00	783.36
10/3/19 4:00	783.38
10/3/19 5:00	783.4
10/3/19 6:00	783.4
10/3/19 7:00	783.41
10/3/19 8:00	783.41
10/3/19 9:00	783.41
10/3/19 10:00	783.41
10/3/19 11:00	783.41
10/3/19 12:00	783.41
10/3/19 13:00	783.42
10/3/19 14:00	783.42
10/3/19 15:00	783.43
10/3/19 16:00	783.43
10/3/19 17:00	783.43
10/3/19 18:00	783.43
10/3/19 19:00	783.43
10/3/19 20:00	783.43
10/3/19 21:00	783.41
10/3/19 22:00	783.4

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

10/3/19 23:00	783.38
10/4/19 0:00	783.37
10/4/19 1:00	783.36
10/4/19 2:00	783.35
10/4/19 3:00	783.34
10/4/19 4:00	783.33
10/4/19 5:00	783.32
10/4/19 6:00	783.31
10/4/19 7:00	783.31
10/4/19 8:00	783.31
10/4/19 9:00	783.3
10/4/19 10:00	783.3
10/4/19 11:00	783.29
10/4/19 12:00	783.29
10/4/19 13:00	783.28
10/4/19 14:00	783.27
10/4/19 15:00	783.27
10/4/19 16:00	783.27
10/4/19 17:00	783.26
10/4/19 18:00	783.26
10/4/19 19:00	783.26
10/4/19 20:00	783.26
10/4/19 21:00	783.26
10/4/19 22:00	783.25
10/4/19 23:00	783.25
10/5/19 0:00	783.25
10/5/19 1:00	783.25
10/5/19 2:00	783.25
10/5/19 3:00	783.25
10/5/19 4:00	783.25
10/5/19 5:00	783.25
10/5/19 6:00	783.25
10/5/19 7:00	783.25
10/5/19 8:00	783.25
10/5/19 9:00	783.25
10/5/19 10:00	783.25
10/5/19 11:00	783.25
10/5/19 12:00	783.25
10/5/19 13:00	783.25

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

10/5/19 14:00	783.26
10/5/19 15:00	783.26
10/5/19 16:00	783.26
10/5/19 17:00	783.26
10/5/19 18:00	783.26
10/5/19 19:00	783.26
10/5/19 20:00	783.27
10/5/19 21:00	783.27
10/5/19 22:00	783.27
10/5/19 23:00	783.28
10/6/19 0:00	783.29
10/6/19 1:00	783.29
10/6/19 2:00	783.29
10/6/19 3:00	783.29
10/6/19 4:00	783.3
10/6/19 5:00	783.3
10/6/19 6:00	783.3
10/6/19 7:00	783.3
10/6/19 8:00	783.31
10/6/19 9:00	783.32
10/6/19 10:00	783.32
10/6/19 11:00	783.33
10/6/19 12:00	783.35
10/6/19 13:00	783.36
10/6/19 14:00	783.35
10/6/19 15:00	783.34
10/6/19 16:00	783.36
10/6/19 17:00	783.36
10/6/19 18:00	783.38
10/6/19 19:00	783.46
10/6/19 20:00	783.44
10/6/19 21:00	783.45
10/6/19 22:00	783.47
10/6/19 23:00	783.45
10/7/19 0:00	783.48
10/7/19 1:00	783.48
10/7/19 2:00	783.49
10/7/19 3:00	783.5
10/7/19 4:00	783.46

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

10/7/19 5:00	783.47
10/7/19 6:00	783.52
10/7/19 7:00	783.53
10/7/19 8:00	783.55
10/7/19 9:00	783.54
10/7/19 10:00	783.53
10/7/19 11:00	783.53
10/7/19 12:00	783.54
10/7/19 13:00	783.49
10/7/19 14:00	783.5
10/7/19 15:00	783.44
10/7/19 16:00	783.46
10/7/19 17:00	783.5
10/7/19 18:00	783.5
10/7/19 19:00	783.53
10/7/19 20:00	783.53
10/7/19 21:00	783.56
10/7/19 22:00	783.59
10/7/19 23:00	783.56
10/8/19 0:00	783.5
10/8/19 1:00	783.55
10/8/19 2:00	783.54
10/8/19 3:00	783.61
10/8/19 4:00	783.55
10/8/19 5:00	783.54
10/8/19 6:00	783.52
10/8/19 7:00	783.58
10/8/19 8:00	783.59
10/8/19 9:00	783.57
10/8/19 10:00	783.6
10/8/19 11:00	783.61
10/8/19 12:00	783.8
10/8/19 13:00	783.79
10/8/19 14:00	783.73
10/8/19 15:00	783.74
10/8/19 16:00	783.73
10/8/19 17:00	783.73
10/8/19 18:00	783.66
10/8/19 19:00	783.7

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

10/8/19 20:00	783.71
10/8/19 21:00	783.7
10/8/19 22:00	783.72
10/8/19 23:00	783.68
10/9/19 0:00	783.7
10/9/19 1:00	783.67
10/9/19 2:00	783.63
10/9/19 3:00	783.6
10/9/19 4:00	783.6
10/9/19 5:00	783.63
10/9/19 6:00	783.69
10/9/19 7:00	783.81
10/9/19 8:00	783.81
10/9/19 9:00	783.81
10/9/19 10:00	783.79
10/9/19 11:00	783.86
10/9/19 12:00	783.9
10/9/19 13:00	783.89
10/9/19 14:00	783.84
10/9/19 15:00	783.89
10/9/19 16:00	783.86
10/9/19 17:00	783.87
10/9/19 18:00	783.93
10/9/19 19:00	783.93
10/9/19 20:00	784
10/9/19 21:00	784.02
10/9/19 22:00	783.99
10/9/19 23:00	783.99
10/10/19 0:00	783.9
10/10/19 1:00	783.9
10/10/19 2:00	783.85
10/10/19 3:00	783.68
10/10/19 4:00	783.62
10/10/19 5:00	783.72
10/10/19 6:00	783.65
10/10/19 7:00	783.66
10/10/19 8:00	783.67
10/10/19 9:00	783.63
10/10/19 10:00	783.54

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

10/10/19 11:00	783.59
10/10/19 12:00	783.6
10/10/19 13:00	783.59
10/10/19 14:00	783.62
10/10/19 15:00	783.66
10/10/19 16:00	783.67
10/10/19 17:00	783.62
10/10/19 18:00	783.62
10/10/19 19:00	783.56
10/10/19 20:00	783.48
10/10/19 21:00	783.45
10/10/19 22:00	783.42
10/10/19 23:00	783.41
10/11/19 0:00	783.39
10/11/19 1:00	783.37
10/11/19 2:00	783.47
10/11/19 3:00	783.46
10/11/19 4:00	783.46
10/11/19 5:00	783.44
10/11/19 6:00	783.47
10/11/19 7:00	783.51
10/11/19 8:00	783.52
10/11/19 9:00	783.52
10/11/19 10:00	783.49
10/11/19 11:00	783.47
10/11/19 12:00	783.44
10/11/19 13:00	783.39
10/11/19 14:00	783.37
10/11/19 15:00	783.37
10/11/19 16:00	783.38
10/11/19 17:00	783.45
10/11/19 18:00	783.5
10/11/19 19:00	783.47
10/11/19 20:00	783.51
10/11/19 21:00	783.56
10/11/19 22:00	783.58
10/11/19 23:00	783.62
10/12/19 0:00	783.66
10/12/19 1:00	783.65

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

10/12/19 2:00	783.69
10/12/19 3:00	783.61
10/12/19 4:00	783.6
10/12/19 5:00	783.52
10/12/19 6:00	783.52
10/12/19 7:00	783.59
10/12/19 8:00	783.58
10/12/19 9:00	783.58
10/12/19 10:00	783.6
10/12/19 11:00	783.69
10/12/19 12:00	783.69
10/12/19 13:00	783.73
10/12/19 14:00	783.78
10/12/19 15:00	783.83
10/12/19 16:00	783.83
10/12/19 17:00	783.82
10/12/19 18:00	783.76
10/12/19 19:00	783.75
10/12/19 20:00	783.74
10/12/19 21:00	783.75
10/12/19 22:00	783.79
10/12/19 23:00	783.85
10/13/19 0:00	783.89
10/13/19 1:00	783.94
10/13/19 2:00	783.93
10/13/19 3:00	783.94
10/13/19 4:00	783.93
10/13/19 5:00	783.91
10/13/19 6:00	783.86
10/13/19 7:00	783.83
10/13/19 8:00	783.74
10/13/19 9:00	783.75
10/13/19 10:00	783.77
10/13/19 11:00	783.77
10/13/19 12:00	783.72
10/13/19 13:00	783.8
10/13/19 14:00	783.86
10/13/19 15:00	783.85
10/13/19 16:00	783.9

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

10/13/19 17:00	783.93
10/13/19 18:00	783.96
10/13/19 19:00	783.92
10/13/19 20:00	783.87
10/13/19 21:00	783.88
10/13/19 22:00	783.93
10/13/19 23:00	783.86
10/14/19 0:00	783.9
10/14/19 1:00	783.88
10/14/19 2:00	783.76
10/14/19 3:00	783.64
10/14/19 4:00	783.65
10/14/19 5:00	783.61
10/14/19 6:00	783.68
10/14/19 7:00	783.59
10/14/19 8:00	783.66
10/14/19 9:00	783.62
10/14/19 10:00	783.56
10/14/19 11:00	783.6
10/14/19 12:00	783.6
10/14/19 13:00	783.62
10/14/19 14:00	783.59
10/14/19 15:00	783.6
10/14/19 16:00	783.56
10/14/19 17:00	783.6
10/14/19 18:00	783.52
10/14/19 19:00	783.5
10/14/19 20:00	783.47
10/14/19 21:00	783.47
10/14/19 22:00	783.45
10/14/19 23:00	783.39
10/15/19 0:00	783.4
10/15/19 1:00	783.4
10/15/19 2:00	783.38
10/15/19 3:00	783.34
10/15/19 4:00	783.33
10/15/19 5:00	783.35
10/15/19 6:00	783.35
10/15/19 7:00	783.35

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

10/15/19 8:00	783.35
10/15/19 9:00	783.39
10/15/19 10:00	783.41
10/15/19 11:00	783.37
10/15/19 12:00	783.37
10/15/19 13:00	783.4
10/15/19 14:00	783.4
10/15/19 15:00	783.4
10/15/19 16:00	783.47
10/15/19 17:00	783.52
10/15/19 18:00	783.49
10/15/19 19:00	783.42
10/15/19 20:00	783.35
10/15/19 21:00	783.33
10/15/19 22:00	783.3
10/15/19 23:00	783.26
10/16/19 0:00	783.27
10/16/19 1:00	783.27
10/16/19 2:00	783.26
10/16/19 3:00	783.28
10/16/19 4:00	783.26
10/16/19 5:00	783.29
10/16/19 6:00	783.31
10/16/19 7:00	783.29
10/16/19 8:00	783.25
10/16/19 9:00	783.26
10/16/19 10:00	783.26
10/16/19 11:00	783.26
10/16/19 12:00	783.24
10/16/19 13:00	783.23
10/16/19 14:00	783.23
10/16/19 15:00	783.23
10/16/19 16:00	783.24
10/16/19 17:00	783.25
10/16/19 18:00	783.25
10/16/19 19:00	783.25
10/16/19 20:00	783.29
10/16/19 21:00	783.26
10/16/19 22:00	783.23

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

10/16/19 23:00	783.2
10/17/19 0:00	783.23
10/17/19 1:00	783.25
10/17/19 2:00	783.24
10/17/19 3:00	783.22
10/17/19 4:00	783.22
10/17/19 5:00	783.23
10/17/19 6:00	783.22
10/17/19 7:00	783.23
10/17/19 8:00	783.24
10/17/19 9:00	783.23
10/17/19 10:00	783.19
10/17/19 11:00	783.19
10/17/19 12:00	783.24
10/17/19 13:00	783.25
10/17/19 14:00	783.24
10/17/19 15:00	783.2
10/17/19 16:00	783.21
10/17/19 17:00	783.23
10/17/19 18:00	783.27
10/17/19 19:00	783.23
10/17/19 20:00	783.25
10/17/19 21:00	783.23
10/17/19 22:00	783.18
10/17/19 23:00	783.22
10/18/19 0:00	783.25
10/18/19 1:00	783.29
10/18/19 2:00	783.27
10/18/19 3:00	783.25
10/18/19 4:00	783.28
10/18/19 5:00	783.26
10/18/19 6:00	783.26
10/18/19 7:00	783.26
10/18/19 8:00	783.29
10/18/19 9:00	783.35
10/18/19 10:00	783.43
10/18/19 11:00	783.46
10/18/19 12:00	783.46
10/18/19 13:00	783.43

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

10/18/19 14:00	783.39
10/18/19 15:00	783.39
10/18/19 16:00	783.36
10/18/19 17:00	783.41
10/18/19 18:00	783.44
10/18/19 19:00	783.43
10/18/19 20:00	783.46
10/18/19 21:00	783.47
10/18/19 22:00	783.39
10/18/19 23:00	783.33
10/19/19 0:00	783.29
10/19/19 1:00	783.32
10/19/19 2:00	783.36
10/19/19 3:00	783.34
10/19/19 4:00	783.23
10/19/19 5:00	783.25
10/19/19 6:00	783.28
10/19/19 7:00	783.28
10/19/19 8:00	783.26
10/19/19 9:00	783.23
10/19/19 10:00	783.26
10/19/19 11:00	783.27
10/19/19 12:00	783.28
10/19/19 13:00	783.3
10/19/19 14:00	783.26
10/19/19 15:00	783.21
10/19/19 16:00	783.18
10/19/19 17:00	783.2
10/19/19 18:00	783.21
10/19/19 19:00	783.2
10/19/19 20:00	783.18
10/19/19 21:00	783.17
10/19/19 22:00	783.06
10/19/19 23:00	782.9
10/20/19 0:00	782.89
10/20/19 1:00	782.89
10/20/19 2:00	782.88
10/20/19 3:00	782.88
10/20/19 4:00	782.87

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

10/20/19 5:00	782.87
10/20/19 6:00	782.87
10/20/19 7:00	782.86
10/20/19 8:00	782.86
10/20/19 9:00	782.87
10/20/19 10:00	782.89
10/20/19 11:00	782.9
10/20/19 12:00	782.92
10/20/19 13:00	782.95
10/20/19 14:00	782.96
10/20/19 15:00	782.99
10/20/19 16:00	783
10/20/19 17:00	783.03
10/20/19 18:00	783.1
10/20/19 19:00	783.12
10/20/19 20:00	783.15
10/20/19 21:00	783.14
10/20/19 22:00	783.16
10/20/19 23:00	783.2
10/21/19 0:00	783.22
10/21/19 1:00	783.22
10/21/19 2:00	783.23
10/21/19 3:00	783.24
10/21/19 4:00	783.24
10/21/19 5:00	783.24
10/21/19 6:00	783.25
10/21/19 7:00	783.26
10/21/19 8:00	783.26
10/21/19 9:00	783.26
10/21/19 10:00	783.27
10/21/19 11:00	783.27
10/21/19 12:00	783.27
10/21/19 13:00	783.26
10/21/19 14:00	783.27
10/21/19 15:00	783.28
10/21/19 16:00	783.25
10/21/19 17:00	783.21
10/21/19 18:00	783.2
10/21/19 19:00	783.19

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

10/21/19 20:00	783.26
10/21/19 21:00	783.3
10/21/19 22:00	783.33
10/21/19 23:00	783.32
10/22/19 0:00	783.37
10/22/19 1:00	783.35
10/22/19 2:00	783.31
10/22/19 3:00	783.26
10/22/19 4:00	783.26
10/22/19 5:00	783.23
10/22/19 6:00	783.29
10/22/19 7:00	783.31
10/22/19 8:00	783.3
10/22/19 9:00	783.27
10/22/19 10:00	783.25
10/22/19 11:00	783.25
10/22/19 12:00	783.27
10/22/19 13:00	783.24
10/22/19 14:00	783.22
10/22/19 15:00	783.22
10/22/19 16:00	783.19
10/22/19 17:00	783.16
10/22/19 18:00	783.16
10/22/19 19:00	783.2
10/22/19 20:00	783.21
10/22/19 21:00	783.18
10/22/19 22:00	783.18
10/22/19 23:00	783.16
10/23/19 0:00	783.15
10/23/19 1:00	783.17
10/23/19 2:00	783.21
10/23/19 3:00	783.19
10/23/19 4:00	783.18
10/23/19 5:00	783.16
10/23/19 6:00	783.15
10/23/19 7:00	783.13
10/23/19 8:00	783.14
10/23/19 9:00	783.15
10/23/19 10:00	783.16

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

10/23/19 11:00	783.24
10/23/19 12:00	783.26
10/23/19 13:00	783.23
10/23/19 14:00	783.22
10/23/19 15:00	783.26
10/23/19 16:00	783.26
10/23/19 17:00	783.18
10/23/19 18:00	783.15
10/23/19 19:00	783.16
10/23/19 20:00	783.14
10/23/19 21:00	783.13
10/23/19 22:00	783.13
10/23/19 23:00	783.14
10/24/19 0:00	783.12
10/24/19 1:00	783.13
10/24/19 2:00	783.13
10/24/19 3:00	783.15
10/24/19 4:00	783.13
10/24/19 5:00	783.12
10/24/19 6:00	783.12
10/24/19 7:00	783.13
10/24/19 8:00	783.12
10/24/19 9:00	783.12
10/24/19 10:00	783.15
10/24/19 11:00	783.18
10/24/19 12:00	783.21
10/24/19 13:00	783.21
10/24/19 14:00	783.2
10/24/19 15:00	783.17
10/24/19 16:00	783.15
10/24/19 17:00	783.15
10/24/19 18:00	783.15
10/24/19 19:00	783.13
10/24/19 20:00	783.14
10/24/19 21:00	783.13
10/24/19 22:00	783.12
10/24/19 23:00	783.12
10/25/19 0:00	783.13
10/25/19 1:00	783.14

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

10/25/19 2:00	783.12
10/25/19 3:00	783.1
10/25/19 4:00	783.11
10/25/19 5:00	783.11
10/25/19 6:00	783.1
10/25/19 7:00	783.1
10/25/19 8:00	783.13
10/25/19 9:00	783.18
10/25/19 10:00	783.15
10/25/19 11:00	783.15
10/25/19 12:00	783.14
10/25/19 13:00	783.13
10/25/19 14:00	783.15
10/25/19 15:00	783.16
10/25/19 16:00	783.17
10/25/19 17:00	783.17
10/25/19 18:00	783.15
10/25/19 19:00	783.15
10/25/19 20:00	783.16
10/25/19 21:00	783.16
10/25/19 22:00	783.17
10/25/19 23:00	783.19
10/26/19 0:00	783.21
10/26/19 1:00	783.22
10/26/19 2:00	783.23
10/26/19 3:00	783.22
10/26/19 4:00	783.21
10/26/19 5:00	783.19
10/26/19 6:00	783.18
10/26/19 7:00	783.18
10/26/19 8:00	783.18
10/26/19 9:00	783.21
10/26/19 10:00	783.22
10/26/19 11:00	783.19
10/26/19 12:00	783.19
10/26/19 13:00	783.17
10/26/19 14:00	783.17
10/26/19 15:00	783.17
10/26/19 16:00	783.15

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

10/26/19 17:00	783.14
10/26/19 18:00	783.16
10/26/19 19:00	783.16
10/26/19 20:00	783.18
10/26/19 21:00	783.19
10/26/19 22:00	783.19
10/26/19 23:00	783.2
10/27/19 0:00	783.21
10/27/19 1:00	783.22
10/27/19 2:00	783.24
10/27/19 3:00	783.21
10/27/19 4:00	783.22
10/27/19 5:00	783.22
10/27/19 6:00	783.24
10/27/19 7:00	783.24
10/27/19 8:00	783.25
10/27/19 9:00	783.28
10/27/19 10:00	783.34
10/27/19 11:00	783.41
10/27/19 12:00	783.46
10/27/19 13:00	783.48
10/27/19 14:00	783.49
10/27/19 15:00	783.53
10/27/19 16:00	783.59
10/27/19 17:00	783.58
10/27/19 18:00	783.58
10/27/19 19:00	783.57
10/27/19 20:00	783.58
10/27/19 21:00	783.72
10/27/19 22:00	783.73
10/27/19 23:00	783.77
10/28/19 0:00	783.82
10/28/19 1:00	783.91
10/28/19 2:00	783.83
10/28/19 3:00	783.9
10/28/19 4:00	784.37
10/28/19 5:00	784.3
10/28/19 6:00	784.1
10/28/19 7:00	784.03

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

10/28/19 8:00	784.04
10/28/19 9:00	784.01
10/28/19 10:00	783.96
10/28/19 11:00	783.93
10/28/19 12:00	783.83
10/28/19 13:00	783.69
10/28/19 14:00	783.71
10/28/19 15:00	783.71
10/28/19 16:00	783.74
10/28/19 17:00	783.68
10/28/19 18:00	783.61
10/28/19 19:00	783.54
10/28/19 20:00	783.51
10/28/19 21:00	783.5
10/28/19 22:00	783.47
10/28/19 23:00	783.51
10/29/19 0:00	783.53
10/29/19 1:00	783.56
10/29/19 2:00	783.56
10/29/19 3:00	783.48
10/29/19 4:00	783.51
10/29/19 5:00	783.5
10/29/19 6:00	783.53
10/29/19 7:00	783.52
10/29/19 8:00	783.53
10/29/19 9:00	783.52
10/29/19 10:00	783.48
10/29/19 11:00	783.5
10/29/19 12:00	783.59
10/29/19 13:00	783.55
10/29/19 14:00	783.49
10/29/19 15:00	783.53
10/29/19 16:00	783.57
10/29/19 17:00	783.6
10/29/19 18:00	783.63
10/29/19 19:00	783.61
10/29/19 20:00	783.62
10/29/19 21:00	783.63
10/29/19 22:00	783.6

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

10/29/19 23:00	783.55
10/30/19 0:00	783.55
10/30/19 1:00	783.48
10/30/19 2:00	783.43
10/30/19 3:00	783.47
10/30/19 4:00	783.52
10/30/19 5:00	783.51
10/30/19 6:00	783.49
10/30/19 7:00	783.53
10/30/19 8:00	783.51
10/30/19 9:00	783.52
10/30/19 10:00	783.49
10/30/19 11:00	783.47
10/30/19 12:00	783.48
10/30/19 13:00	783.46
10/30/19 14:00	783.47
10/30/19 15:00	783.47
10/30/19 16:00	783.45
10/30/19 17:00	783.44
10/30/19 18:00	783.44
10/30/19 19:00	783.43
10/30/19 20:00	783.44
10/30/19 21:00	783.43
10/30/19 22:00	783.44
10/30/19 23:00	783.44
10/31/19 0:00	783.43
10/31/19 1:00	783.44
10/31/19 2:00	783.45
10/31/19 3:00	783.45
10/31/19 4:00	783.45
10/31/19 5:00	783.46
10/31/19 6:00	783.48
10/31/19 7:00	783.48
10/31/19 8:00	783.48
10/31/19 9:00	783.47
10/31/19 10:00	783.47
10/31/19 11:00	783.46
10/31/19 12:00	783.46
10/31/19 13:00	783.45

CONSTANTINE HYDROELECTRIC PROJECT RESERVOIR ELEVATION DATA

10/31/19 14:00	783.45
10/31/19 15:00	783.46
10/31/19 16:00	783.47
10/31/19 17:00	783.46
10/31/19 18:00	783.49
10/31/19 19:00	783.51
10/31/19 20:00	783.48
10/31/19 21:00	783.49
10/31/19 22:00	783.51
10/31/19 23:00	783.54

Yayac, Maggie

Subject: FW: Request for DO and temperature data from Initial Study Report

From: Lee Emery <Lee.Emery@ferc.gov>
Sent: Wednesday, August 12, 2020 7:58 AM
To: Jonathan M Magalski <jmmagalski@aep.com>
Subject: [EXTERNAL] Request for DO and temperature data from Initial Study Report

Hi Jon,

On April 14, 2020, the Initial Study Report for the Constantine Project was filed with the Commission. In Appendix A (Combined Continuous Water Temperature and Dissolved Oxygen Plots) and Appendix B (Continuous Water Temperature and Dissolved Oxygen Plots by Monitoring Station) of the Water Quality Report, there were figures that showed water temperature and dissolved oxygen (DO) levels recorded in the: (1) reservoir; (2) power canal; (3) tailrace; (4) bypassed reach upstream of the Fawn River; and (5) bypassed reach downstream from the Fawn River. If the data is available, would you please file the data used to create these plots of continuous water temperature and DO for the months of May, June, July, August, September, and October. If possible, please file the data with the Commission in a xlsx format (Excel spreadsheet).

If you have any questions about this request, please call me or contact me by email.

lee

Lee Emery
Fishery Biologist
Office of Energy Projects
Federal Energy Regulatory Commission
Phone (202) 502-8379
FAX (202) 219-0205

American Electric Power
1 Riverside Plaza
Columbus, OH 43215
aep.com

Via Electronic Filing

August 13, 2020

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

Subject: Constantine Hydroelectric Project (FERC No. 10661)
Request for Water Quality Data from the Initial Study Report

Dear Secretary Bose:

Indiana Michigan Power Company (I&M), a unit of American Electric Power (AEP), is the licensee, owner, and operator of the Constantine Hydroelectric Project (Project) (FERC Project No. 10661), located on the St. Joseph River in St. Joseph County, Michigan. The Project is operated under a license issued by the Federal Energy Regulatory Commission (FERC or Commission). The existing FERC license for the Project expires on September 30, 2023.

I&M has elected to utilize the Integrated Licensing Process (ILP) for the relicensing of the Project as defined in 18 Code of Federal Regulations (C.F.R.) Part 5. In accordance with the Commission's regulations at 18 C.F.R. § 5.15 and the Commission's April 9, 2019 Study Plan Determination (SPD), I&M filed the Initial Study Report (ISR) with FERC on April 14, 2020. Additionally, I&M held an Initial Study Report Meeting (ISR Meeting) with participants and FERC staff via Webex on April 23, 2020. An ISR Meeting summary was filed with FERC on May 8, 2020. By letter dated June 9, 2020, FERC provided comments on the ISR. I&M provided responses to FERC's comments on the ISR on July 13 and July 27, 2020. In a follow-up email on August 12, 2020 FERC requested that I&M provide the continuous water temperature and dissolved oxygen data used to generate the graphs in the Water Quality Study Report. I&M is hereby providing the attached Excel files including all of the raw data for the continuous water temperature and dissolved oxygen collected at the Project from May through October 2019.

If there are any questions regarding this filing, please do not hesitate to contact me at (614) 716-2240 or jmmagalski@aep.com.

Sincerely,

Jonathan M. Magalski
Environmental Specialist Consultant
American Electric Power Services Corporation, Environmental Services

Attachment – Continuous Water Temperature and Dissolved Oxygen Data

Cc: Distribution List
Liz Parcell (AEP)
Rob Quiggle (HDR)

Constantine Hydroelectric Project (FERC No. 10661)
Distribution List

Federal Agencies

Mr. John Eddins
Office of Federal Agency Programs
Advisory Council on Historic Preservation
401 F Street NW, Suite 308
Washington, DC 20001-2637

Ms. Kimberly Bose
Secretary
Federal Energy Regulatory Commission
888 1st St NE
Washington, DC 20426

FEMA Region 5
536 South Clark Street, 6th Floor
Chicago, IL 60605

Mr. Michael Pentony
Regional Administrator
NOAA Fisheries Service
Greater Atlantic Regional Fisheries Office
55 Great Republic Drive
Gloucester, MA 01930-2276

Mr. Martin J. Rosek
State Soil Scientist
US Department of Agriculture
Natural Resources Conservation Service
3001 Coolidge Road, Suite 250
East Lansing, MI 48823

Ms. Mary Manydeeds
Bureau of Indian Affairs, Midwest Region
US Department of the Interior
Norman Pointe II Building
5600 W. American Boulevard, Suite 500
Bloomington, MN 55437

Office of the Solicitor
US Department of the Interior
1849 C Street, NW
Washington, DC 20240

Mr. Lindy Nelson
Regional Environmental Officer, Office of
Environmental Policy & Compliance
US Department of the Interior
Philadelphia Region
Custom House, Room 244
200 Chestnut Street
Philadelphia, PA 19106

Ms. Liz Pelloso
Wetland/Environmental Scientist, Region 5
US Environmental Protection Agency
77 West Jackson Boulevard (E19-J)
Chicago, IL 60604

Mr. Ken Westlake
Chief, NEPA Implementation Section - Region 5
US Environmental Protection Agency
77 West Jackson Boulevard (E19-J)
Chicago, IL 60604

Mr. Jack Dingledine
Assistant Field Office Supervisor/Michigan
Ecological Services Field Office
US Fish and Wildlife Service
2652 Coolidge Road, #101
East Lansing, MI 48823

Ms. Alisa Shull
Chief, Endangered Species - Midwest Region
(Region 3)
US Fish and Wildlife Service
5600 American Boulevard West, Suite 990
Bloomington, MN 55437-1458

Mr. Derrick Hubbell
Michigan Water Science Center
US Geological Survey
5840 Enterprise Drive
Lansing, MI 48911

Mr. Tom Weaver
Michigan Water Science Center
US Geological Survey
5840 Enterprise Drive
Lansing, MI 48911

US Geological Survey
1451 Green Road
Ann Arbor, MI 48105

Hon. Aaron Miller
US Congressman, 59th District
US House of Representatives
N-993 House Office Building
PO Box 30014
Lansing, MI 48909

Constantine Hydroelectric Project (FERC No. 10661)
Distribution List

Mr. Michael Reynolds
Acting Director, Headquarters
US National Park Service
1849 C Street, NW
Washington, DC 20240

Hon. Gary Peters
US Senate
Hart Senate Office Building
Washington, DC 20510

Hon. Debbie Stabenow
US Senate
713 Hart Senate Office Building
Washington, DC 20510-2204

State Agencies

Michigan Department of Agriculture
525 West Allegan Street
Lansing, MI 48933

Mr. Chris Antieau
Great Lakes Shorelands Unit - Water Resources Division
Michigan Department of Environmental Quality
525 West Allegan Street
PO Box 30473
Lansing, MI 48909-7973

Kalamazoo District Office
Michigan Department of Environmental Quality
7953 Adobe Road
Kalamazoo, MI 49009-5025

Ms. Jessica Mistak
Michigan Department of Natural Resources
PO Box 30028
Lansing, MI 48909

Mr. Kyle Kruger
Senior Fisheries Biologist
Michigan Department of Natural Resources
Mio Field Office
191 S. Mt. Tom Road
Mio, MI 48647

Ms. Kesiree Thiamkeelakul
Michigan Department of Natural Resources
Mio Field Office
191 S. Mt. Tom Road
Mio, MI 48647

Mr. Brian D. Conway
State Historic Preservation Officer, Lansing Office
State Historic Preservation Office
735 East Michigan Avenue
PO Box 30044
Lansing, MI 48909

Local Governments

Ms. Korie Blyveis
District Manager
Cass County Conservation District
1127 East State St.
Cassopolis, MI 49031

Mr. Robert Hile
Mayor
City of Sturgis
130 North Nottawa
Sturgis, MI 49091

Friends of the St. Joe River Association, Inc.
PO Box 1794
South Bend, IN 46634

St. Joseph County
PO Box 189
Centreville, MI 49032

Ms. Carolyn Grace
Administrator
St. Joseph County Conservation District
693 E. Main Street
Centerville, MI 49032

Mr. Mark R. Brown
Supervisor
Township of Constantine
425 Centreville Street
Constantine, MI 49042

Constantine Hydroelectric Project (FERC No. 10661)
Distribution List

Mr. George E. Morse
Supervisor
Township of Sturgis
70669 Stubey Road
Sturgis, MI 49091

Mr. Donald E. Gloy, Jr.
Supervisor
Township of White Pigeon
16825 Tomahawk Trail
White Pigeon, MI 49099

Mr. Mark Honeysett
Village Manager
Village of Constantine
115 White Pigeon Street
Constantine, MI 49042

Ms. Marcia Skelton
Village of Constantine
115 White Pigeon Street
Constantine, MI 49042

Mr. Tyler Royce
President
Village of White Pigeon
103 South Kalamazoo
PO Box 621
White Pigeon, MI 49099

Tribes

Mr. Michael LaRonge
Tribal Historic Preservation Officer
Forest County Potawatomi Community
5320 Wensaut Lane
PO Box 340
Crandon, WI 54520

Ms. Kelly Curran
Pokagon Band of Potawatomi Indians
58620 Sink Road
PO Box 180
Dowagiac, MI 49047

Nottawaseppi Huron Band of the Potawatomi
1485 Mno-Bmadzewen Way
Fulton, MI 49052

Non-governmental Organizations

Mr. John Seebach
American Rivers
1104 14th St NW, Suite 1400
Washington, DC 20005

Mr. Kevin Richard Colburn
National Stewardship Director
American Whitewater
PO Box 1540
Cullowhee, NC 28779

Michigan Audubon Society
2311 Science Parkway, Suite 200
Okemos, MI 48864

Michigan Citizens for Water Conservation
PO Box 1
Mecosta, MI 49332

Michigan Environmental Council
602 West Ionia Street
Lansing, MI 48933

Mr. Bob Stuber
Fisheries Biologist
Michigan Hydropower Relicensing Coalition
1620 High Street
Traverse City, MI 49684

Michigan Loon Preservation Association
10181 Sheridan Road
Millington, MI 48746

Michigan Nature Association
2310 Science Parkway, Suite 100
Okemos, MI 48864

Mr. Matt Meersman
Director
St. Joseph River Basin Commission
227 West Jefferson Boulevard
1120 County-City Boulevard
South Bend, IN 46601

ATTACHMENT
CONTINUOUS WATER TEMPERATURE AND DISSOLVED OXYGEN DATA

American Electric Power
1 Riverside Plaza
Columbus, OH 43215
aep.com

Via Email March 8, 2021

Ms. Amira Oun
Environmental Engineer
Michigan Department of Environment, Great Lakes, and Energy
525 West Allegan Street
P.O. Box 30473
Lansing, MI 48909

Ms. Kesiree Thiamkeelakul
Resource Analyst
Michigan Department of Natural Resources
Constitution Hall
525 West Allegan Street
P.O. Box 30028
Lansing, MI 48909

Mr. Scott Hicks
Field Supervisor, Michigan Ecological Services Field Office
U.S. Fish and Wildlife Service
2652 Coolidge Road, #101
East Lansing, MI 48823

Subject: Constantine Hydroelectric Project (FERC No. 10661)
Updated Study Report and Updated Study Report Meeting

Dear Secretary Bose:

Indiana Michigan Power Company (I&M), a unit of American Electric Power (AEP), is the Licensee, owner, and operator of the 1.2 megawatt Constantine Hydroelectric Project (Project) (FERC Project No. 10661). The Project is located along the St. Joseph River in St. Joseph County, Michigan.

I&M operates and maintains the Project under a license from the Federal Energy Regulatory Commission (FERC or Commission). The Project's existing license expires on September 30, 2023. I&M is pursuing a subsequent license for the Project using the Commission's Integrated Licensing Process (ILP) as defined in 18 Code of Federal Regulations (CFR) Part 5.

I&M has conducted studies as provided in the March 15, 2019 Revised Study Plan (RSP) and approved in the Commission's April 9, 2019 Study Plan Determination (SPD) for the Project. In accordance with 18 CFR § 5.15, I&M filed the Initial Study Report (ISR) with the Commission on April 14, 2020. Additionally, I&M held an Initial Study Report Meeting (ISR Meeting) with participants and FERC staff via Webex on April 23, 2020. An ISR Meeting summary was filed with FERC on May 8, 2020. The deadline to submit any disputes or requests to amend studies was June 13, 2020. The only comment letter received was from FERC, dated June 9, 2020. I&M

provided responses to FERC's comments on the ISR on July 13, 2020. In their response letter, I&M requested an additional 14 days to further analyze Project operational data to provide a response to FERC's question related to water quality. On July 27, 2020, I&M provided additional responses to FERC's comments on the ISR. In a follow-up email on August 12, 2020, FERC requested that I&M provide the continuous water temperature and dissolved oxygen data used to generate the graphs in the Water Quality Study Report. I&M provided the raw data for the continuous water temperature and dissolved oxygen on August 13, 2020. No additional information or studies were requested by FERC or stakeholders.

The Commission's Process Plan and Schedule directs I&M to prepare and file an Updated Study Report (USR) by April 14, 2021, describing the overall progress in implementing the approved study plan and the data collected. The Process Plan and Schedule also directs I&M to hold an USR Meeting within 15 days of the USR filing. As noted above, I&M completed the eight FERC-approved studies in accordance with the methods described in the RSP and subsequently approved in the SPD. All of the studies were completed in 2019 and final study reports were filed with the ISR on April 14, 2020. No requests for additional studies or study modifications were received, and I&M does not have additional study information to provide in an USR or present at an USR Meeting. For these reasons, I&M is proposing to forego the filing of an USR and does not intend to hold an USR Meeting.

At this time, I&M is seeking your concurrence that an USR and USR Meeting are not warranted for the Project. I&M respectfully requests your written (email) concurrence on or before March 19, 2021.

If there are any questions regarding this filing, please do not hesitate to contact me at (614) 716-2240 or jmmagalski@aep.com.

Sincerely,

Jonathan M. Magalski
Environmental Specialist Consultant
American Electric Power Services Corporation, Environmental Services

Cc: Hon. K. Bose (FERC)
Liz Parcell (AEP)
Rob Quiggle (HDR)

Hanson, Danielle

From: Lee Emery <Lee.Emery@ferc.gov>
Sent: Friday, March 12, 2021 7:33 AM
To: Jonathan M Magalski
Subject: [EXTERNAL] Correction to USR email

Hi Jon
I caught a minor typing error in the email I sent you yesterday. The section of the regs should be 5.15 and not 15.5. I made the correction to the email below.
Have a good weekend.

lee
From: Lee Emery
Sent: Thursday, March 11, 2021 2:53 PM
To: Jonathan M Magalski <jmmagalski@aep.com>
Subject: FW: No need for second study, an Updated Study Report, or Updated Study Meeting for the Constantine Project

Hi Jon:
In response to your letter dated March 8, 2021, regarding the need to prepare an Updated Study Report (USR) and hold an Updated Study Report Meeting for the Constantine Project (P-10661), neither action is required. Based on the requirements of section **5.15** of the Commission's regulations, (*Conduct of Studies*), there were no comments on the first season study report or requests for study modifications, and no second study season was needed because the studies were complete. Therefore, there is no need to prepare an Updated Study Report or to hold an Updated Study Report Meeting.

Let me know if you have any additional questions.

Lee
Lee Emery
Fishery Biologist
Office of Energy Projects
Federal Energy Regulatory Commission
Phone (202) 502-8379
FAX (202) 219-0205

Lee Emery
Fishery Biologist
Office of Energy Projects
Federal Energy Regulatory Commission
Phone (202) 502-8379
FAX (202) 219-0205

Hanson, Danielle

From: Jonathan M Magalski <jmmagalski@aep.com>
Sent: Monday, April 12, 2021 12:21 PM
To: Thiamkeelakul, Kesiree (DNR) <ThiamkeelakulK@michigan.gov>; Hicks, Scott <scott_hicks@fws.gov>; Kohlhepp, Gary (EGLE) <KOHLHEPPG@michigan.gov>
Cc: Elizabeth B Parcell <ebparcell@aep.com>; Hanson, Danielle <Danielle.Hanson@hdrinc.com>
Subject: RE: Constantine Updated Study Report and Meeting

Thank you, Kesiree. Apologies for the slow reply, I was on vacation.

Gary, we will have you added to the relicensing distribution list. Could you please confirm your address and telephone? Also, here is a link to our website that contains Project information and the major filings (Constantine Hydro Plant (aephydro.com). Please let me know if you have any questions or would like to discuss the Project.

We look forward to working with you all through the remainder of the relicensing process….Jon

AMERICAN ELECTRIC POWER
BOUNDLESS ENERGY

JONATHAN M MAGALSKI | **ENVIRONMENTAL SPEC CONSULT**
JMMAGALSKI@AEP.COM | D:614.716.2240
1 RIVERSIDE PLAZA, COLUMBUS, OH 43215

From: Thiamkeelakul, Kesiree (DNR) <ThiamkeelakulK@michigan.gov>
Sent: Friday, April 2, 2021 12:10 PM
To: Jonathan M Magalski <jmmagalski@aep.com>; Hicks, Scott <scott_hicks@fws.gov>; Kohlhepp, Gary (EGLE) <KOHLHEPPG@michigan.gov>
Subject: [EXTERNAL] RE: Constantine Updated Study Report and Meeting

Hi Jon,
I apologize for the late response. MDNR can wait until the Draft License Application filing to provide comments. Also, Amira is no longer handling water quality issues at FERC-regulated dams. Gary Kohlhepp is covering her duties until new staff is hired.

Best,
Kesiree

From: Jonathan M Magalski <jmmagalski@aep.com>
Sent: Friday, March 12, 2021 3:04 PM
To: Hicks, Scott <scott_hicks@fws.gov>; Thiamkeelakul, Kesiree (DNR) <ThiamkeelakulK@michigan.gov>; Oun, Amira (EGLE) <OunA@michigan.gov>
Subject: Constantine Updated Study Report and Meeting

Good afternoon Scott, Kesiree and Amira,

I hope you are doing well and Happy Friday. I am reaching out to make sure you didn't miss the attached filing. In summary, since the time of filing the Initial Study Report (ISR) and holding the ISR meeting, we did not complete any additional studies or collect additional information. As such, we have nothing additional to report in an Updates Study Report (USR), so we are proposing to forgo filing an USR and holding an USR meeting. Assuming you agree, the next opportunity for you to file comments or recommendations would be when we file the Draft License Application (DLA) in early May 2021.

Please let me know if you have questions or would like to discuss further. A response to our proposal is much appreciated. Have a great weekend….Jon

JONATHAN M MAGALSKI | **ENVIRONMENTAL SPEC CONSULT**
JMMAGALSKI@AEP.COM | D:614.716.2240
1 RIVERSIDE PLAZA, COLUMBUS, OH 43215