Exhibit E
ENVIRONMENTAL SETTING OF THE PROJECT

BOYNE RIVER HYDROELECTRIC PROJECT
(FERC PROJECT NO. 3409)

APPLICATION FOR SUBSEQUENT LICENSE
FOR MINOR WATER POWER PROJECT, 1.5 MW OR LESS

INFORMATION ADDED JUNE 15, 2020

Contents

1 Environmental Setting of the Project §4.61(d)(2)(i)

Introduction and Overview

The Boyne River Dam is located in Boyne Valley Township, Michigan, on the Boyne River in Charlevoix County. The Project, owned by Boyne USA, Inc. consists of a reservoir with a storage capacity of 356 acre-feet and an area of 68 acres at a pool elevation of 636.80 feet (NAVD 88). The Boyne River Hydroelectric Project is a minor project with an installed power capacity of 250kW and an existing dam embankment Approximately 610 feet long (left) and 180 feet long (right) of the spillway. The channel leading to the various spillway structures is paved with concrete and the embankment sections are earthen. There is also a 2.5-mile-long 12.47 kV transmission line and appurtenant facilities. Figure 1, below, includes a map of the surrounding area and general location of the Project. It should be noted that much of the work to inventory and characterize the environment within the Project was completed by Public Sector Consultants (PSC) with field work being completed between mid 2018 and mid 2019 with the remainder being picked up in January of 2020. Although most of their work is presented in the body of Exhibit E, their entire report is presented in Appendix A. Likewise, JMB Associates completed much of the Recreation and Land Use portions of Exhibit E, with their full Recreation Resources Study Report (RRSR) being presented in Appendix B.

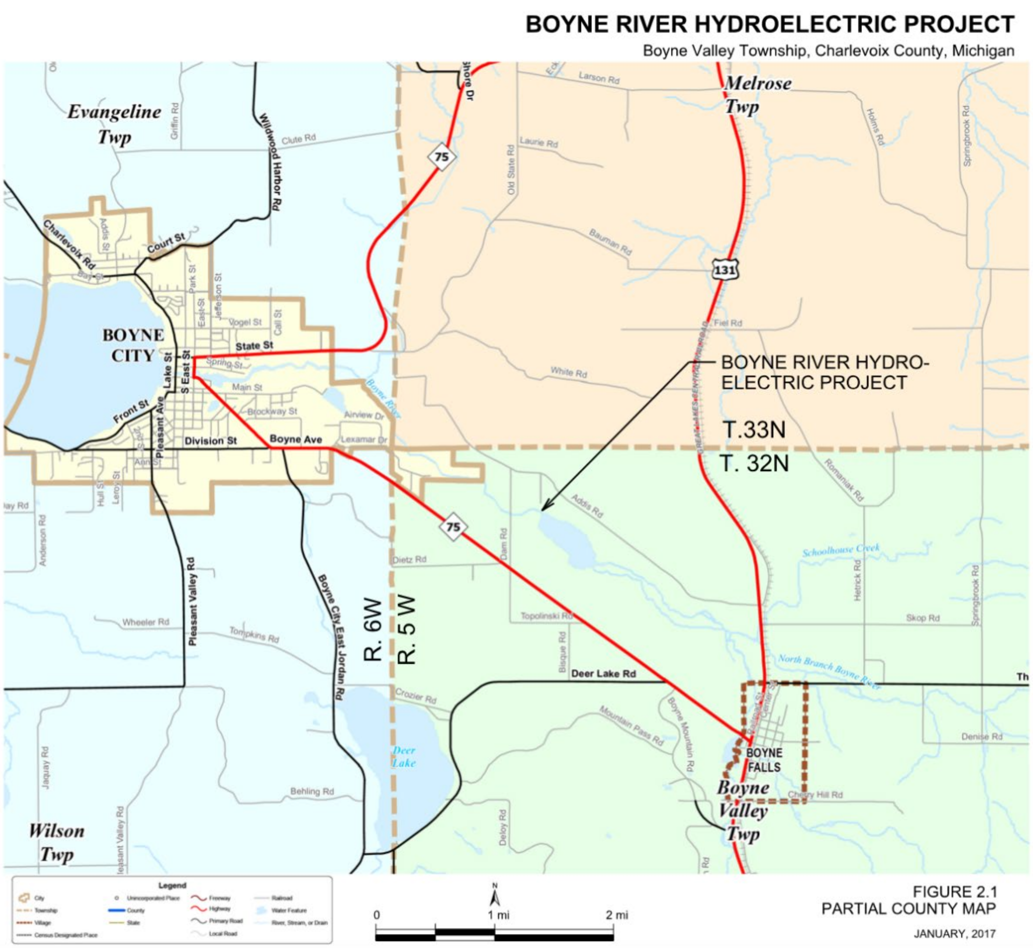

Figure 1. Boyne River Dam Area Map

1.1 MAPS OF LAND USE WITHIN PROJECT BOUNDARIES

There are no Federal or Indian Reservation lands within the project boundaries. A land use (zoning) map [1] is shown in Figure 2 and aproject boundary map is provided in Figure 3. A more detailed view of the project boundary in the area of the dam and reservoir is provided in Figure 4.

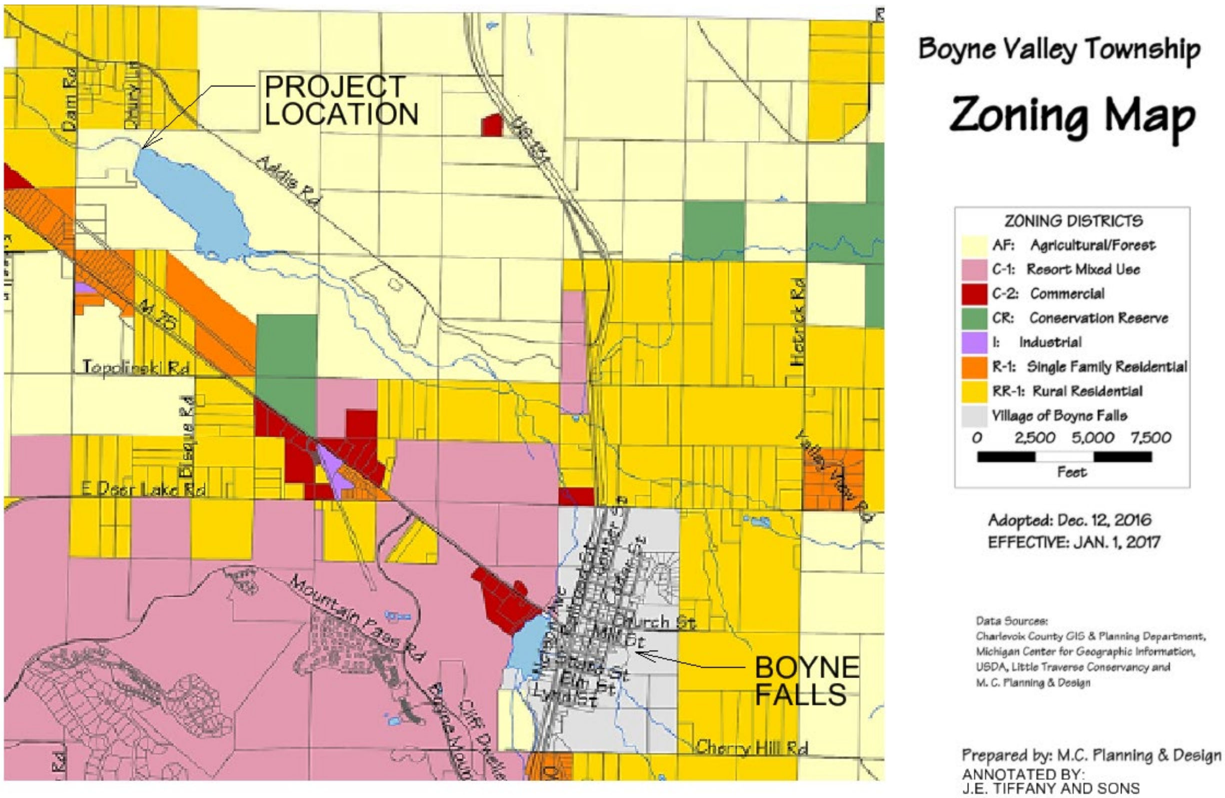

Figure 2. Boyne Valley Township Zoning Map (Partial)/ Project Area Land Use

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[1] *Boyne Valley Township Zoning Ordinance, effective January 1, 2017.*

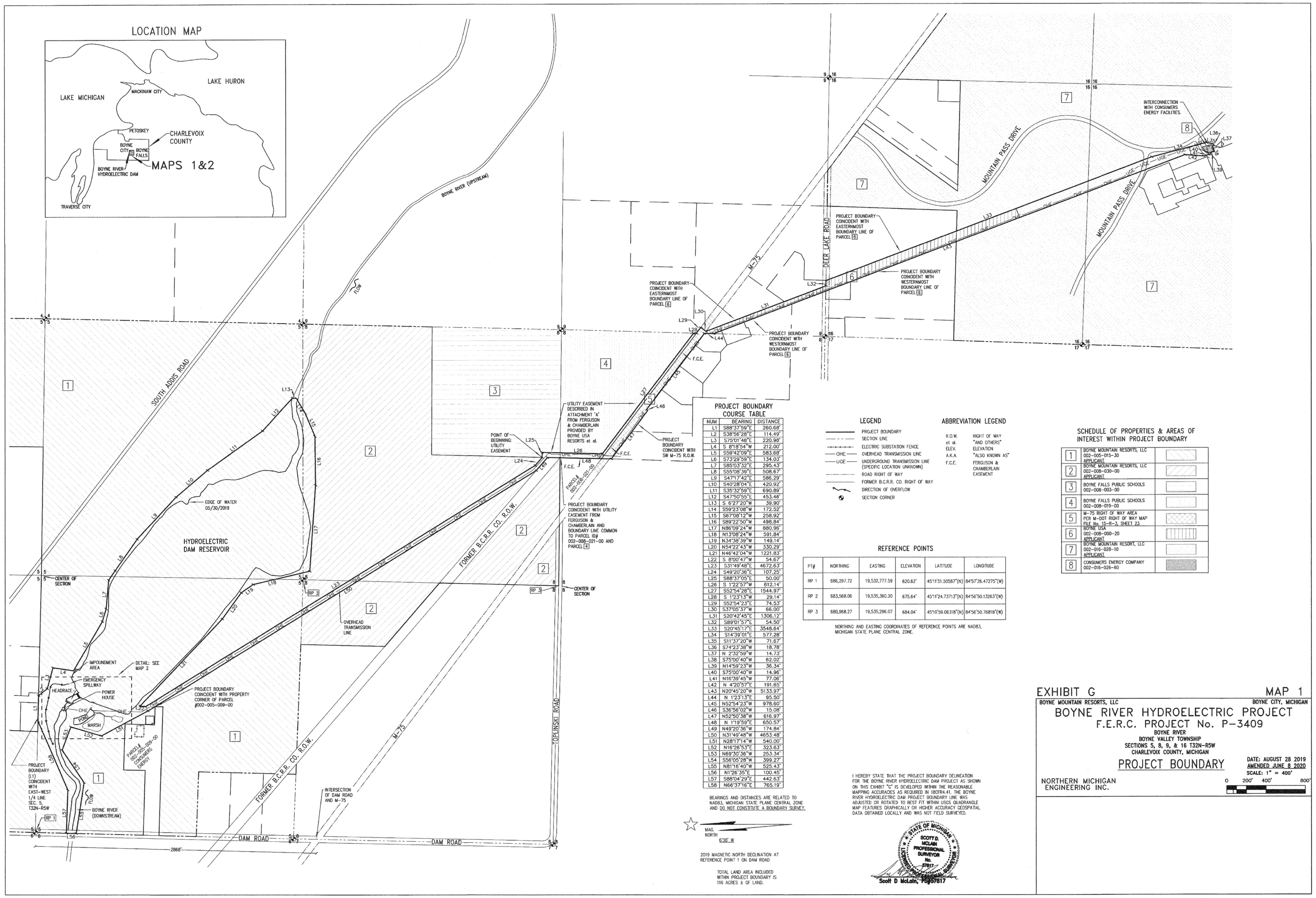


Figure 3. *Project Boundary Map*

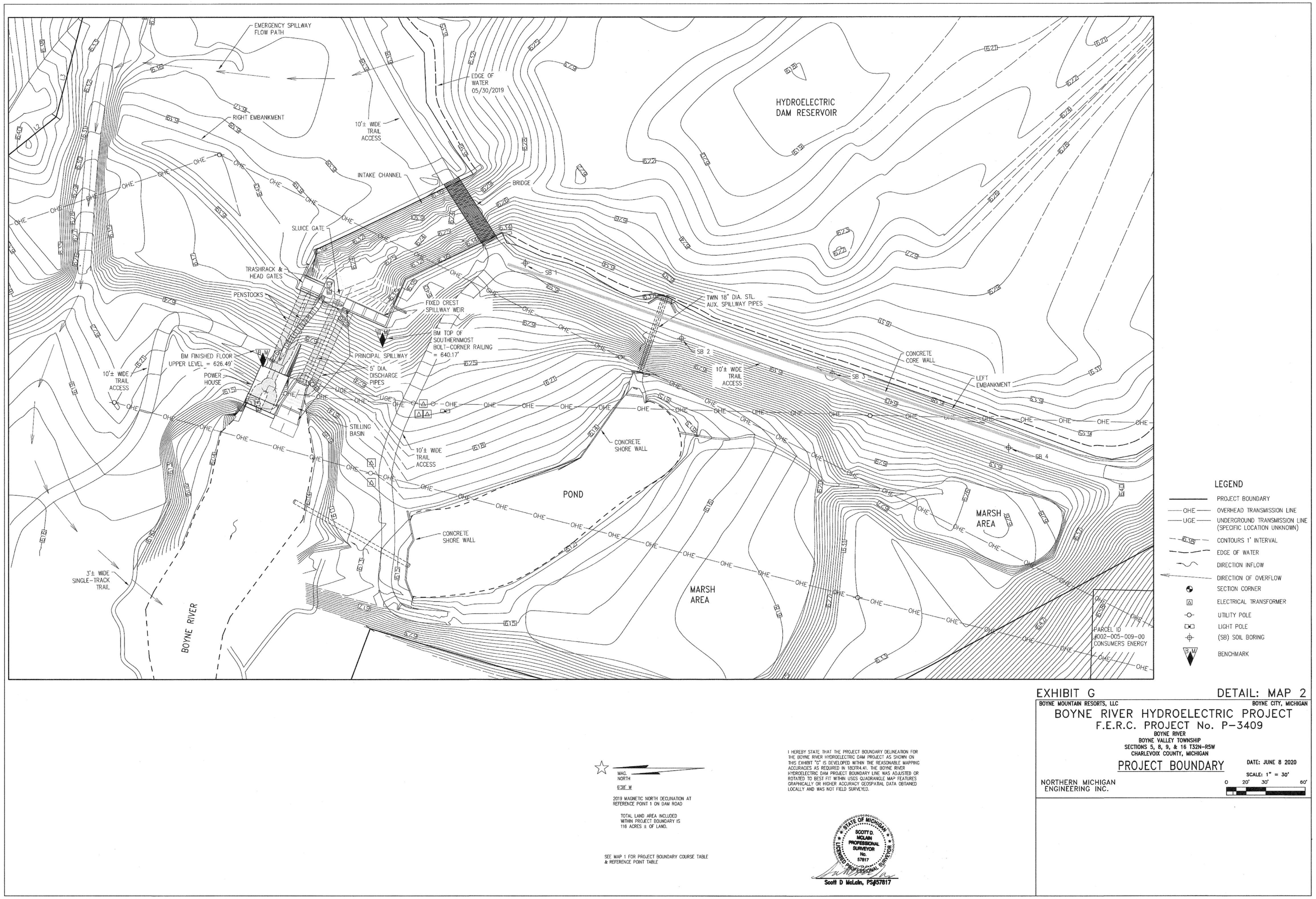


Figure 4. Aerial Overview and Project Boundary--Dam and Reservoir Area

1.2 CURRENT AND PROPOSED PROJECT OPERATION

The Boyne River Power dam is manually controlled by Boyne Mountain staff in a run-of-the-river mode. The existing normal operating range on the NAVD 88 datum is from elevation 636.29 (15.2 Gage) to elevation 637.11 (16.02 Gage). Adjustments to flow through the turbine or spillways are made during twice daily visits to the dam as a means of maintaining the normal target water level. A pressure transducer provides pool elevation input into an ABB Commander 1900 circle chart recorder for documenting pool elevation. Alarm conditions (high and low water levels) are transmitted to the area manager and base operator of Boyne Mountain via an auto-dialer system.

A summary of operating elevations is provided in Table 1:

Table 1. Operating elevations

Operating Point	Gage	Elevation (NAVD 88)
"Low" Operating Level (Alarm, Generator Trips Off)	15.20	636.29
Spillway Overflow Weir	15.44	636.53
"High" Operating Level (Alarm Condition)	16.02	637.11

The plant is operated with a manual start up. Adjustments to flow through the turbine or spillways are made during twice daily visits to the dam as a means of maintaining the normal target water level. There is a flow control gate upstream of the turbine that controls the flow through the turbine. The gate has settings range from 1 (closed) to 8.5 (fully open). There is a threaded rod on the hydraulic cylinder gate actuator that prevents closure of the gate past a setting of 2.5. This arrangement and setting, that was previously established during conversations with the FERC, ensures that there is run of the river flow downstream of the dam, even when the project is not generating power.

Staff makes adjustments to power generation and spillway operations to maintain the impoundment water surface below the High Operating Level elevation of 637.11 (16.02 gage height). The fixed crest spillway has an overflow elevation of approximately 636.53. When the impoundment water level exceeds that elevation, there is discharge over the fixed crest spillway without regulation. Based recent historical operational data, the twin 18 inch auxiliary spillway pipes are typically opened by Boyne personnel when the water level reaches elevation 636.9. If the water level continues to climb, trained staff will open the principal spillway sluice gate and stay on site until the water level returns to the normal range. The Project's turbine is operated in the range of 30 cfs to 140 cfs. The flow is adjusted to maintain a stable pool elevation. The median flow is 39 cfs but is increased during periods of high inflow into the impoundment. In the case of a major flood event, the emergency spillway will start to flow at an impoundment elevation of approximately 637.75.

As a means of maintaining the impoundment above the Low Operating Level elevation of 636.29 (15.2 gage height), Boyne Staff throttles the flow and the power generation automatically shuts down if the flow is reduced below a minimum generator operating threshold.

The Michigan Department of Natural Resources is requesting that the operating band be reduced from the current 0.82 feet to 0.50 feet (a plus or minus 0.25 feet deviation from the normal level). Boyne staff believe it should be no problem to maintain a 0.5 feet operating range during typical flows and is willing to make adjustments to implement such a scheme. The Low Operating Level and

High Operating Level alarm condition can be adjusted accordingly. However, as demonstrated in the Design Flow section above, the water surface elevation will rise to about elevation 638 as the dam discharges the One Percent Chance Peak Flow of 700 cfs and even slightly more for less frequent storms. For infrequent rainfall events (10 Percent Chance Peak Flows and greater), water surface elevations above the normal high would be impossible to avoid, even with a more aggressive sluice gate opening schedule. Even the existing upper operating range of 637.11 is not realistic for very infrequent rainfall events. It should be noted that the emergency spillway does not come into play until the water reaches about elevation 637.75.

The target elevation mentioned by the MDNR corresponds to elevation 636.53 NAVD 88 (15.44 gage height) which is the elevation of the top of the fixed crest timber boards of the fixed crest spillway. Boyne accepts the suggested new normal range which would be from elevation 636.28 (15.19 gage height) to elevation 636.78 (15.69 gage height), a range of 0.5 feet, excluding major flood events (greater than the 10 Percent Chance Peak Flow).

1.3 Ecoregion

The project watershed is located in what is known as the North Central Hardwoods Ecoregion. Ecoregions are contiguous areas that may cross state boundaries, but they share common features such as climate, mineral availability (soils and geology), vegetation, topography and land use. Because they share these commonalities, they also have in common many characteristics of aquatic biology, and, as would be expected, similar terrestrial ecology.

Ecoregion classifications are helpful in that observations in one area of an ecoregion can often lead to predictions or inferences about other areas within the same ecoregion and to develop land use/resource quality correlations. Careful study of ecoregions can lead to management practices that improve ecosystems. Omernik and Gallant, in a document entitled "Ecoregions of the Upper Midwest States", 1988, presented important advances in describing the ecoregions in the Great Lakes region and the importance of their classification. Excerpts from that work that describe the North Central Hardwoods Ecoregion are presented here:

> *"The North Central Hardwood Forests Ecoregion is transitional between the predominantly forested Northern Lakes and Forests Ecoregion and the agricultural ecoregions to the south (Photos 16-18). This 36,000 square-mile ecoregion consists of nearly level to rolling glacial till plains, lacustrine basins, outwash plains, and rolling to hilly moraines and beach ridges. Clusters of lakes dominate the landscape in many parts of the region, particularly the western half. Local topographic relief is minimal in the plains, and generally 100 to 200 feet in morainal areas. Elevation ranges from approximately 600 feet above sea level, along the Lake Michigan shoreline, to over 2,000 feet in the extreme western portion of the ecoregion. The region averages 24 to 32 inches of annual precipitation, occurring primarily during the growing season.*
>
> *Stream density and stream flow are highly variable throughout the ecoregion. Density ranges from virtually no streams, as in kettle/wetland terrain, to more than two miles of perennial streams per square mile. Stream flow, while entirely intermittent in some portions of the ecoregion, is entirely perennial in others. Streams with watersheds contained completely within the ecoregion generally drain less than 600 square miles.*
>
> *This ecoregion has mixed land use potential. Almost one-third of the land is cultivated...Wet bottom1ands, steep slopes of stream valleys and moraines, and extensive sandy areas remain forested and are used for woodlots and pulp and timber production.*

The North Central Hardwood Forests Ecoregion is named for its dominant forest species, although the region is a mosaic with patches of many vegetation types that are more common in some surrounding ecoregions. Some areas of wet soils have tamarack, white cedar, and other conifers...The overstory in the hardwood lowlands...typically [includes] some combination of sugar maple, yellow birch, American beech, American basswood, oak, white ash, and hemlock.

Soils have been derived from glacial materials of many different particle sizes. A few areas are covered by sandy outwash or capped by silty loess. Peat bogs are sometimes numerous...."

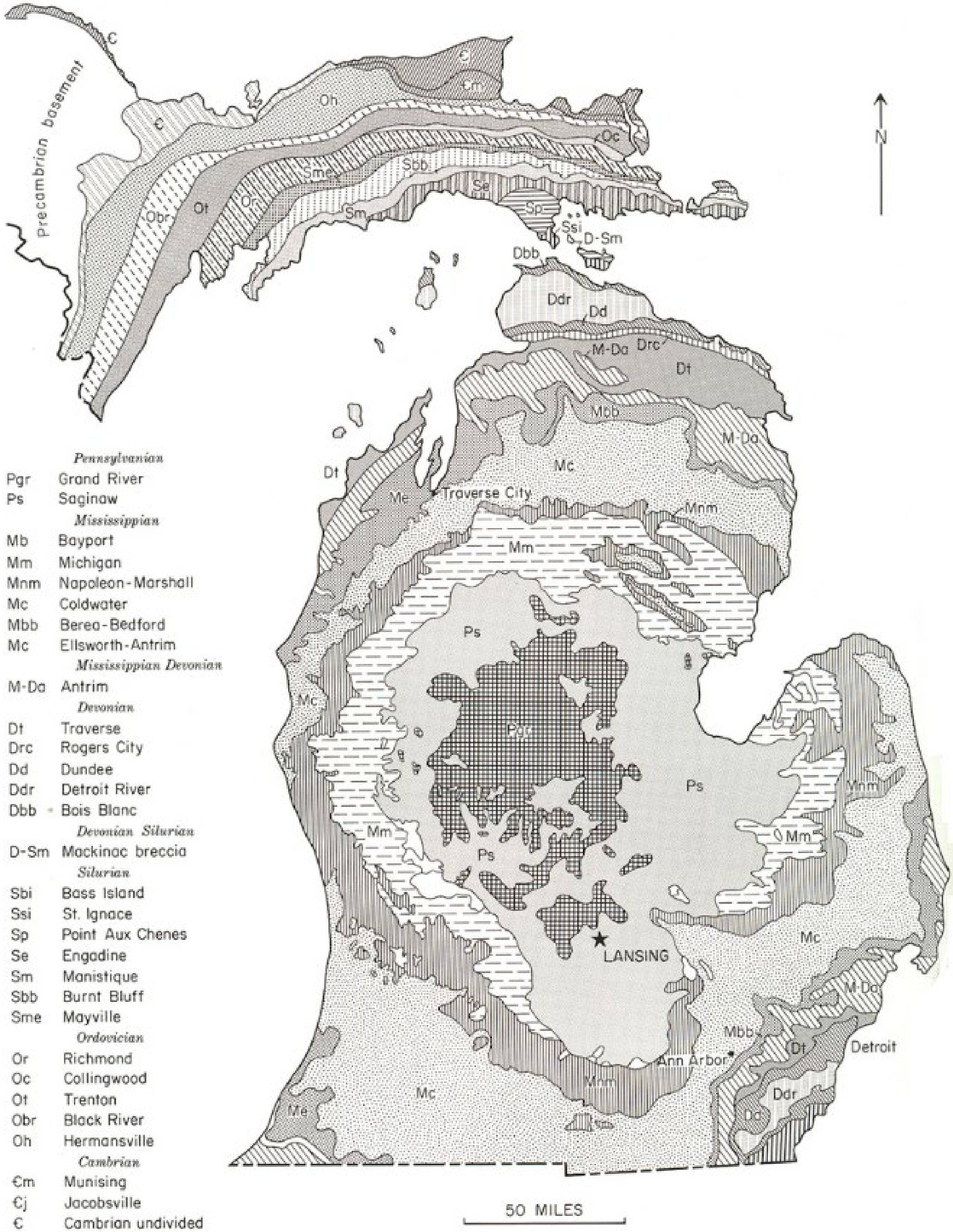
1.4 Geology and Soils

1.4.1 Description of geological features

The project is located in an area known as the Northern Lower Peninsula Tunneled Uplands and is characterized by hills and intervening plains formed by glacial depositional, and meltwater erosional, processes, often underlain by thick sequences of glacial drift. High relief area of large, broad, generally flat-floored valleys between uplands formed in thick, sandy drift. Upland areas are steep-sided, gullied and/or hummocky.

This part of Michigan is known as the Sedimentary Michigan Basin Rock Formation with bedrock being Upper Devonian Rock consisting of Antrim Shale. Figure 5 is a map of bedrock formations in Michigan.

Quaternary geology generally consists of unconsolidated material deposited during continental glaciation with the project area characterized by fine textured glacial till and glacial outwash sand/gravel and post-glacial alluvium.



Source: Unknown

Figure 5. Map of Michigan Bedrock Formations

1.4.2 Description of soil types

Soils information for the vicinity of the project is provided in the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) customized soils report for the project vicinity found in Appendix C.

1.4.3 Description of reservoir shorelines and streambanks

The shorelines of the reservoir are gently sloping except for the southwest side which has slopes averaging approximately 1 vertical to 3 horizontal. Soils are mostly sandy. Vegetation includes wooded, shrub or grassed areas.

Stream banks in the vicinity of the project are flat to very flat. The soils consist of muck or sands or some combination thereof.

There is no mass soil movement, slumping, other forms of instability or significant erosion along the reservoir shorelines or stream banks in the project vicinity with the exception of the two following cases:

- Some erosion of the upstream slope of the left embankment has occurred because of the relatively steep slope combined with wind-driven wave action.
- Historically, there has been some erosion of the left stream bank downstream of the spillway discharge presumably caused by spillway discharge and/or heavy foot traffic from fishing activity during some seasons of the year.

Boyne's proposed continuation of run-of-the-river operation, and resulting stable lake levels, is anticipated to promote the embankment's integrity and minimize any impacts to the area's topography, geology and soils.

1.4.3.1 Shoreline Erosion Inventory

Inventory Method

An inventory of shoreline erosion was completed by Public Sector Consultants to document existing conditions within the Project Area. The inventory was completed using a boat to traverse the entire perimeter of the impoundment. The banks of the Boyne River, between the powerhouse and Dam Road, were assessed for erosion by walking the entire reach.

Results and Discussion

The entire shoreline of the impoundment was assessed by boat, with specific attention focused on the western end near the earthen dam and outlet. Only one notable area of bank erosion was observed just south of the spillway (Figure 6). Boyne Mountain plans to address the erosion problem with the addition of riprap along the shoreline with the estimated capital cost provided in Exhibit A.

In the Boyne River below the dam, streambank erosion is common and widespread, but mostly not excessive. Similar to most rivers with dams, the Boyne is incised in this downstream section and higher-volume flows have little access to a floodplain. While most process-driven erosion appears to be historic and has been addressed in past years with fieldstone toe protection and other erosion control methods, the streambanks are heavily traversed by anglers and trampling of streambanks is evident, despite the existence of access stairs to the river. Natural erosion rates are very low, and no streambanks were identified as needing protection due to erosive flows.

Figure 6. Areas of Excessive Erosion

1.5 WATER RESOURCES

1.5.1 DRAINAGE AREA

The river at the dam has a total drainage area of 63.6 square miles but only 45.6 square miles of that area is considered to be contributing to the discharge from the dam (EGLE correspondence 7/11/2019). Parts of the watershed lie in Charlevoix, Antrim and Otsego Counties. Approximately 1.3 miles upstream of the reservoir the main stem of the Boyne River splits into a North Branch and a South Branch. From the North Branch and the South Branch there are several tributaries, some named, but most unnamed, on the USGS Quadrangle Map. The drainage area is shown in Figure 7.

The drainage area is part of the federally designated Boardman-Charlevoix watershed that has a Hydrologic Unit Code (HUC) of 04060105. There are two designated sub-basins in the project drainage area. The main stem of the Boyne River in the project vicinity and the South Branch of the Boyne River are designated as HUC 04060105-205. The North Branch of the Boyne River is designated as HUC 04060105-0203.

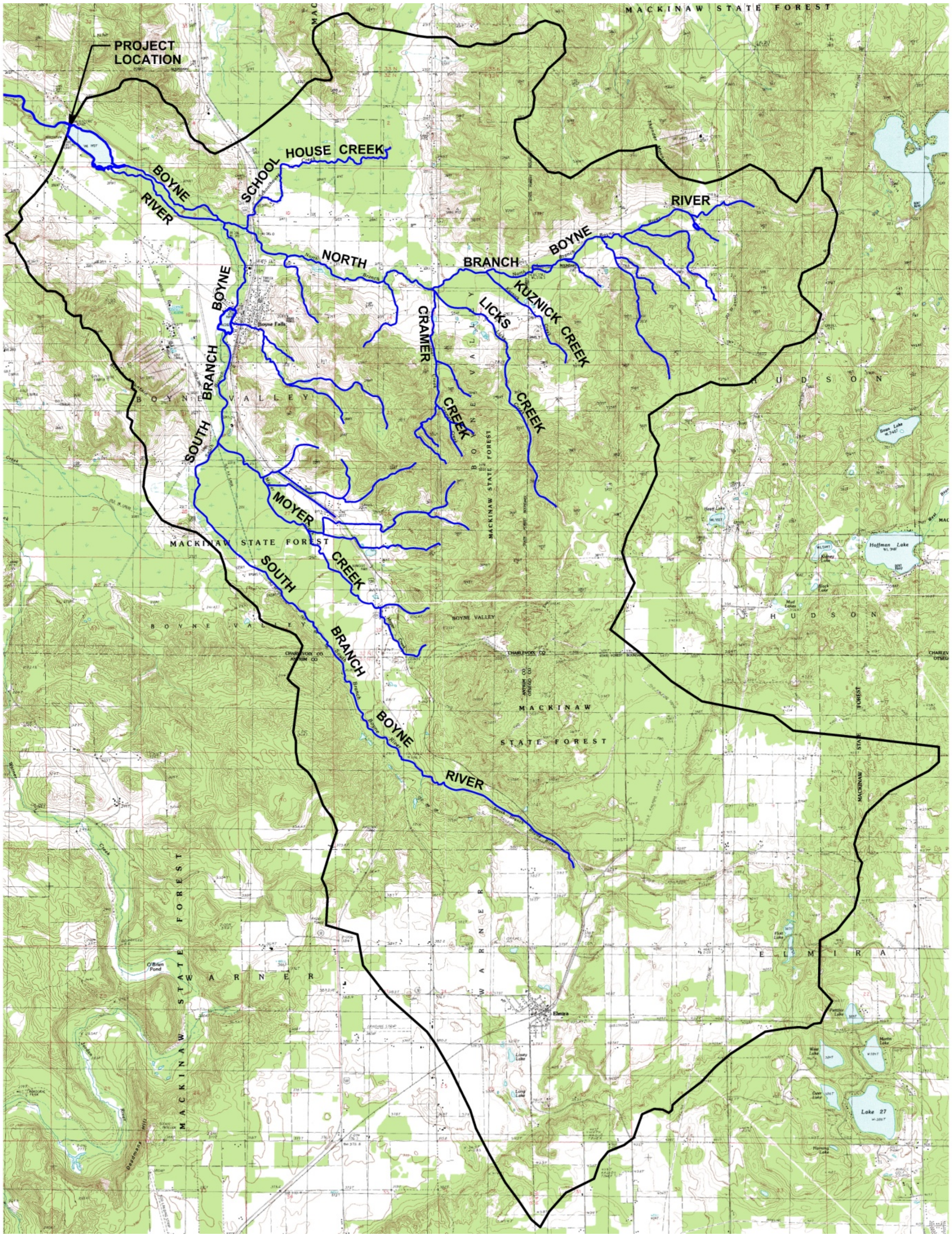


Figure 7. Drainage Area Contributing to the Project

1.5.2 THE MONTHLY MINIMUM, MEAN, AND MAXIMUM RECORDED FLOWS IN CUBIC FEET PER SECOND OF THE STREAM

The United States Geological Survey (USGS) formerly operated a stream gaging station on the Boyne River at Dam Road, approximately 1,300 feet downstream of the spillway discharge of the dam. However, the recorded data is limited to the annual peak stream flow from 1975 to 1991, supplemented by periodic field measurements of flow by USGS staff. The annual maximum for the period of record is presented in Table 2.

Table 2. Annual Peak Flow Measurements (1975 Through 1991)

YEAR	PEAK FLOW (CFS)
7/19/1975	662
3/27/1976	431
1977	No Record
9/18/1978	314
3/21/1979	422
4/9/1980	294
4/4/1981	478
4/17/1982	297
5/7/1983	365
3/21/1984	190
9/8/1985	327
3/26/1986	363
10/3/1986	362
1987	No Record
4/4/1988	336
3/28/1989	417
3/12/1990	590
3/28/1991	522

Recent records have made it possible to provide flow statistics (mean, median, minimum and maximum flows) in units of cubic feet per second (cfs) for the period of December, 2016 through March, 2020 in the following table:

Table 3. Flow Statistics

Average	67.6
Median	58.8
Minimum	12.9
Maximum	310.4

The same statistics computed for each month, for the same time period, are provided in Exhibit F, Part 3 – Hydrologic and Hydraulic Report.

1.5.3 A MONTHLY FLOW DURATION CURVE

Aside from USGS stream gaging records, monthly flow duration curves have been developed from the project operating records. These are provided in Exhibit F, Part 3 – Hydrologic and Hydraulic Report.

1.5.4 EXISTING AND PROPOSED USES OF PROJECT WATERS FOR IRRIGATION, DOMESTIC WATER SUPPLY, INDUSTRIAL AND OTHER PURPOSES

No project waters are used for irrigation, domestic water supply, industrial and other purposes.

1.5.5 EXISTING INSTREAM FLOW USES OF STREAMS IN THE PROJECT AREA THAT WOULD BE AFFECTED BY PROJECT OPERATION

There are no existing instream flow uses of streams in the project area.

1.5.6 WATER QUALITY DATA, INCLUDING WATER TEMPERATURE AND DISSOLVED OXYGEN AND SEASONAL VERTICAL PROFILES IN THE RESERVOIR

1.5.6.1 HISTORICAL WATER TEMPERATURE MONITORING

According to the Lake Charlevoix Watershed Management Plan (2012), the average minimum and maximum air temperature of the area in January is 13°F and 28°F respectively, and in July it is 55°F and 80°F. During the summer months of 1999, the Friends of the Boyne River (FOBR) recorded baseline water temperatures at 7 sites along the Boyne River, using temperature data logging equipment provided by Boyne USA. The purpose of these measurements was to determine the warming effects of various impoundments along the Boyne River system[2].

Two of those sites are in the vicinity of the Project. The location of each of these sites is presented in Figure 8 below. As illustrated, Site 6 was immediately downstream of the dam and Site 5 was just upstream of the impoundment. According to the results, during the last 16 days of July, the average peak daily temperature at Site 6 was approximately 5.1°F greater than Site 5. During August, the average peak daily temperature at Site 6 was 4.5°F greater and during the first 23 days of September, the average peak daily temperatures at Site 6 were 3.3°F higher than for Site 5. This illustrated a limited warming effect of the dam on the Boyne River.

[2] *Friends of the Boyne River. "River Data". http://boyneriver.org/river-data/*

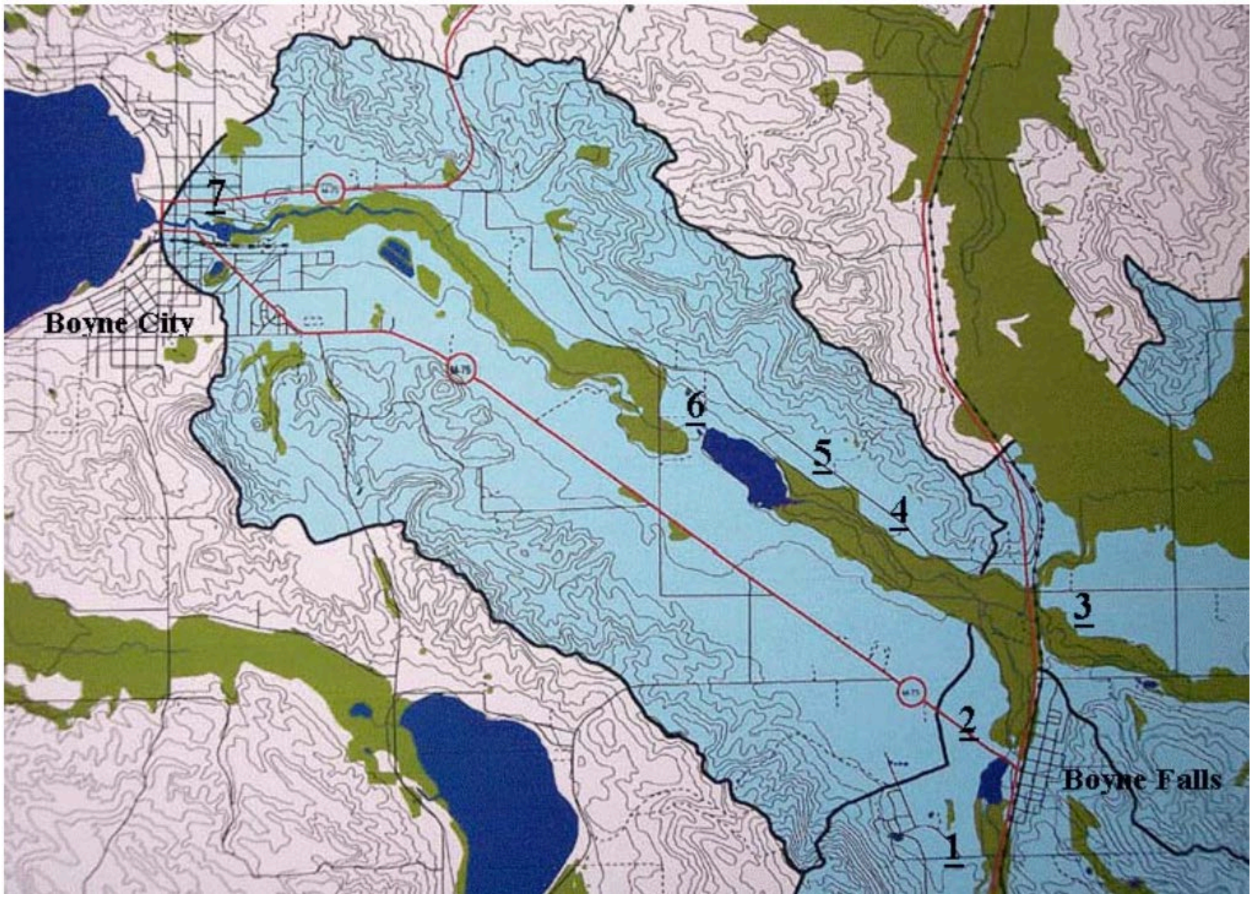


Figure 8. FOBR baseline temperature recording sites along the Boyne River (1999)[3].

1.5.6.2 Recent Water Temperature Monitoring

Method

Public Sector Consultants recorded water temperature on an hourly basis in three locations: in the tailrace, in the Boyne River upstream of the impoundment, and in the Boyne River downstream of the impoundment (Figure 9) from June 1, 2018, to May 31, 2019. Onset Hobo U22 temperature loggers were deployed at all sites. Data were compared to Michigan's Water Quality Standards and were used to thermally classify the stream reaches based upon criteria described in the MDNR's Fisheries Research Report 2091 (cold, cold-transitional, etc.) (Zorn, Seelbach, and Wiley 2009).

[3] *Friends of the Boyne River. "River Data".* http://boyneriver.org/river-data/

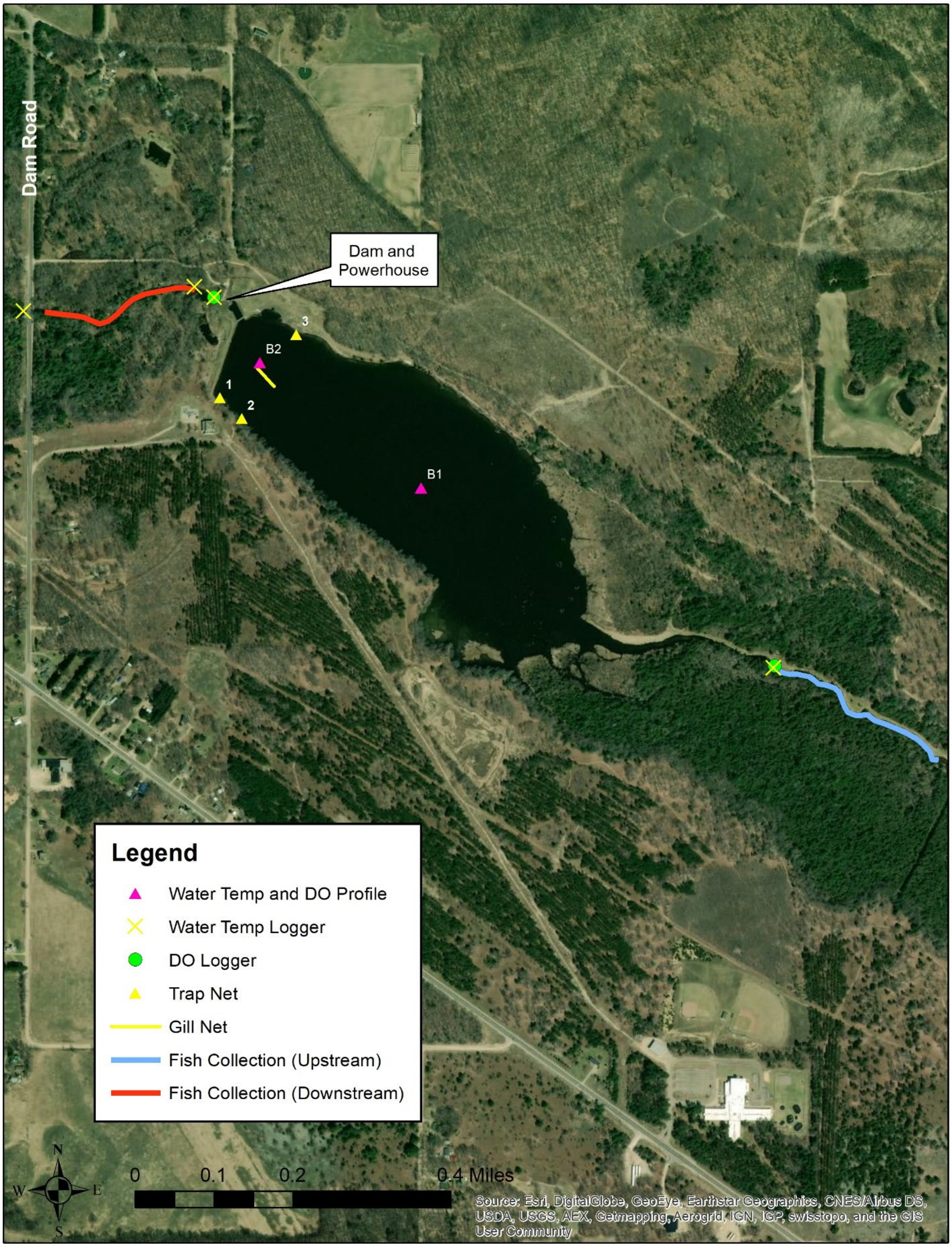


Figure 9. Sampling Sites within Project Area

Results and Discussion

Coldwater fisheries are protected as a designated use under State of Michigan law.

> *"Coldwater fishery use" means the ability of a waterbody to support a balanced, integrated, adaptive community of fish species which thrive in relatively cold water, generally including any of the following: (i) trout . . . ”*

The Boyne River, within and proximate to the Project Area, is considered a designated trout stream under the authority of Section 48701(o), as amended, being Sections 324.48701(o) of the Michigan Compiled Laws.

The MDNR’s Fisheries Division classifies streams according to water temperature (Zorn et al. 2009). The following definitions were adopted, with minor changes:

Table 4. Stream Segment Classifications

Segment Classification	July Mean Water Temperature	Typical Summer Fish Assemblage
Cold Stream	Does not exceed 63.5° F	Five to eight species including: daces, juvenile salmon, trout, and sculpins
Cold Transitional Stream	Between 63.5° F and 67.1° F	Ten to 18 fish species: some cold-adapted (juvenile salmon, trout, and sculpins), and several that are well-adapted to grow and reproduce at cool temperatures (daces, chubs, suckers, mudminnows, and sculpins)
Cool Stream	Between 67.1°F and 69.8°F	15–20 fish species, most adapted to transitional and somewhat variable temperatures (minnows, daces, chubs, suckers, bullheads, mudminnows, and darters), and a few warm-adapted (shiners, chubs, pike, and sunfishes)
Warm Stream	Greater than 69.8ºF	15–18 tolerant fish species, including several adapted to transitional temperatures (chubs, minnows, daces, bullheads, mudminnows, and darters), and a few warm-adapted species (shiners, pikes, pirate perch, and sunfishes)

The Upstream water temperature exceeded 68°F for a total of about 77 hours (3.5%) during June, July and August (warm weather months). The longest continual duration of time in excess of 68°F was 13 hours and there was a period from June 29 to July 5 where the water temperature exceeded 68°F for 63 out of 148 hours.

The Tailrace water temperature exceeded 68°F, the water quality standard, for a total of about 388 hours (17.6%) during the warm weather months. The longest continual duration of time in excess of 68°F was 186 hours, from 16:41 on June 29 to 09:41 on July 7; the average water temperature during this period was 71.8°F. This occurred during the same hot weather period that peaked water temperatures at the Upstream sampling station.

Of the 388 hours, water temperatures at the Upstream site were below 68°F for 320 of those hours, meaning that the Tailrace was out of compliance with water quality standards, for exceeding 68°F, for 320 hours. In addition, the Tailrace and the Upstream site were above 68°F, concurrently, for 68 hours; for 44 of those 68 hours, the Tailrace was at least 2.0°F warmer than the Upstream site, meaning that the Tailrace was out of compliance for an additional 44 hours. In total, the Tailrace exceeded the water quality standard for water temperature for about 364 hours (15.2 days) from June 1 to August 31.

Table 5. Water Temperature Summary for the Upstream and Tailrace Sites, 2018–2019

	Upstream Site			Tailrace Site			Difference		
	Mean Temp. (°F)	Min. Temp. (°F)	Max. Temp. (°F)	Mean Temp. (°F)	Min. Temp. (°F)	Max. Temp. (°F)	Mean Temp. (°F)	Min. Temp. (°F)	Max. Temp. (°F)
Jan. 2019	33.1	31.8	37.9	33.8	32.3	36.7	0.7	0.5	-1.2
Feb. 2019	33.3	31.8	37.6	33.3	32.4	34.5	0.0	0.6	-3.1
Mar. 2019	35.3	31.8	42.5	35.5	32.3	40.0	0.2	0.5	-2.5
Apr. 2019	42.3	33.3	55.3	43.2	35.3	52.7	0.9	2.0	-2.6
May 2019	50.6	41.5	63.3	52.5	43.0	61.8	1.9	1.5	-1.5
June 2018	59.3	50.2	72.8	63.6	56.6	72.9	4.3	6.4	0.1
July 2018	62.4	55.2	72.7	67.8	61.3	76.6	5.4	6.1	3.9
Aug. 2018	61.1	54.9	68.8	65.3	60.7	69.9	4.2	5.8	1.1
Sept. 2018	57.2	48.1	67.5	60.8	50.5	67.6	3.6	2.4	0.1
Oct. 2018	47.6	40.5	60.0	47.8	42.4	60.3	0.2	1.9	0.3
Nov. 2018	38.3	31.8	45.6	38.5	34.0	45.7	0.2	2.2	0.1
Dec. 2018	36.5	33.0	40.3	36.6	34.3	38.8	0.1	1.3	-1.5

Within the Tailrace (Downstream) site, average July water temperature was 67.8°F, classifying the stream as cool. The site was consistently warmer than the Upstream site during warm weather months and averaged 5.4°F warmer in July. The site was cooler than the Upstream site during cold weather months. This observation illustrates the impact of groundwater input to the Upstream site, and the influence of the impoundment on the Tailrace site. A comparison of water temperatures (Upstream, Impoundment, and Tailrace) recorded on the nine dates of impoundment data collection is provided in Table 6.

July air temperature in Boyne Falls, Michigan was higher than normal, with daily highs averaging 87.8°F. The normal average high in July is 82.9°F–4.9°F degrees cooler than the daily highs of 2018. Figure 11 illustrates that the water temperature at the Upstream and Tailrace sites only exceeded 70°F if the air temperature rose above 90°F. The unusually hot weather undoubtedly raised stream temperatures above their long-term average for July.

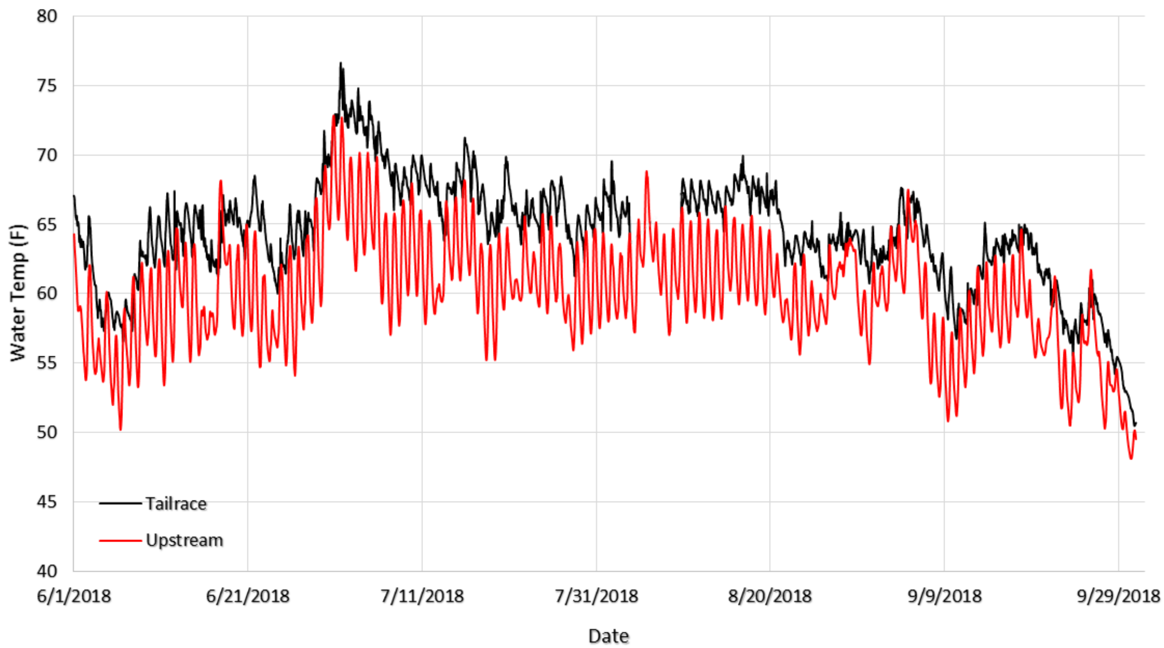


Figure 10. Water Temperatures (°F) at the Upstream and Tailrace Sites, June 1 to September 30, 2018

Table 6. Water Temperature Summary for the Impoundment (Site B2), Upstream and Tailrace Sites, 2018

Date	Maximum Daily Air Temp (°F)	Upstream Water Temp (°F)	Impoundment Surface Water Temp (°F)	Tailrace Water Temp (°F)	Tailrace—Upstream (°F)
June 12	88	56.4	67.5	62.7	6.3
June 24	72	61.4	69.4	61.4	0
July 10	87	59.9	71.8	68.7	8.8
July 24	84	61.3	69.3	63.9	2.6
Aug. 9	87	59.7	69.6	65.7	6
Aug. 20	88	61.4	72.0	67.9	6.5
Sept. 3	84	61.8	70.3	63.9	2.1
Sept. 17	86	59.3	69.4	63.1	3.8
Sept. 30	52	49.4	52.0	51.1	1.7

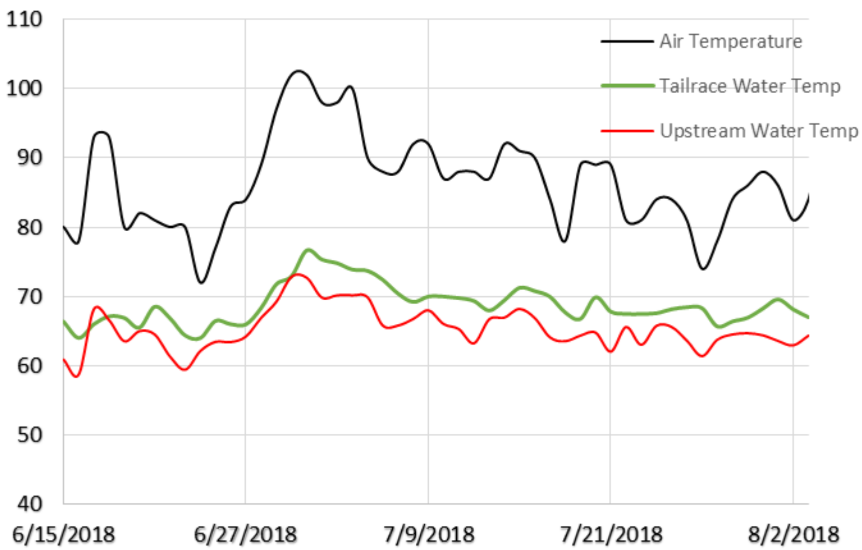


Figure 11. Example of Effect of Maximum Daily Air Temperatures (°F) on Maximum Daily Water Temperatures (°F) at the Upstream and Tailrace Sites, June 1 to August 3, 2018

1.5.6.3 Historical Dissolved Oxygen Monitoring

Available water quality data indicates the Boyne River watershed ecosystems are healthy[4]. The Boyne River Hydroelectric Project is located in the vicinity of one of the many sites (Dam Road) along the Boyne River monitored by the Tip of the Mitt Watershed Council (TOMWC), The State's Department of Environment, Great Lakes and Energy (EGLE, formerly MDEQ), Little Traverse Bay Bands of Odawa Indians (LTBB) and the U.S. Fish and Wildlife Service (USFWS). Data collected by these agencies and groups have displayed that all sites monitored along the river, including the Dam Road location, consistently meet Michigan Water Quality Standards (WQS) [5].

Historically, all readings from various locations along the Boyne River, including Dam Road, have been consistently above Michigan WQS for dissolved oxygen (DO). Figure 12, below shows the various survey points along the Boyne River that have been surveyed by the above agencies. The historical dissolved oxygen data is presented in Table 7, below.

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[4] *Lake Charlevoix Watershed Advisory Committee. July 2012. "Lake Charlevoix Watershed Management Plan". https://www.watershedcouncil.org/lake-charlevoix-watershed-management-plan.html*

[5] *Claucherty, M., Cronk, K. L., Myers, D. Tip of the Mitt Watershed Council. June 1, 2015. "Lake Charlevoix Tributary Monitoring Study 2013 – 2014". https://www.watershedcouncil.org/uploads/7/2/5/1/7251350/lakecharlevoixtributarymonitoringprojectreport2015_final-optimized.pdf*

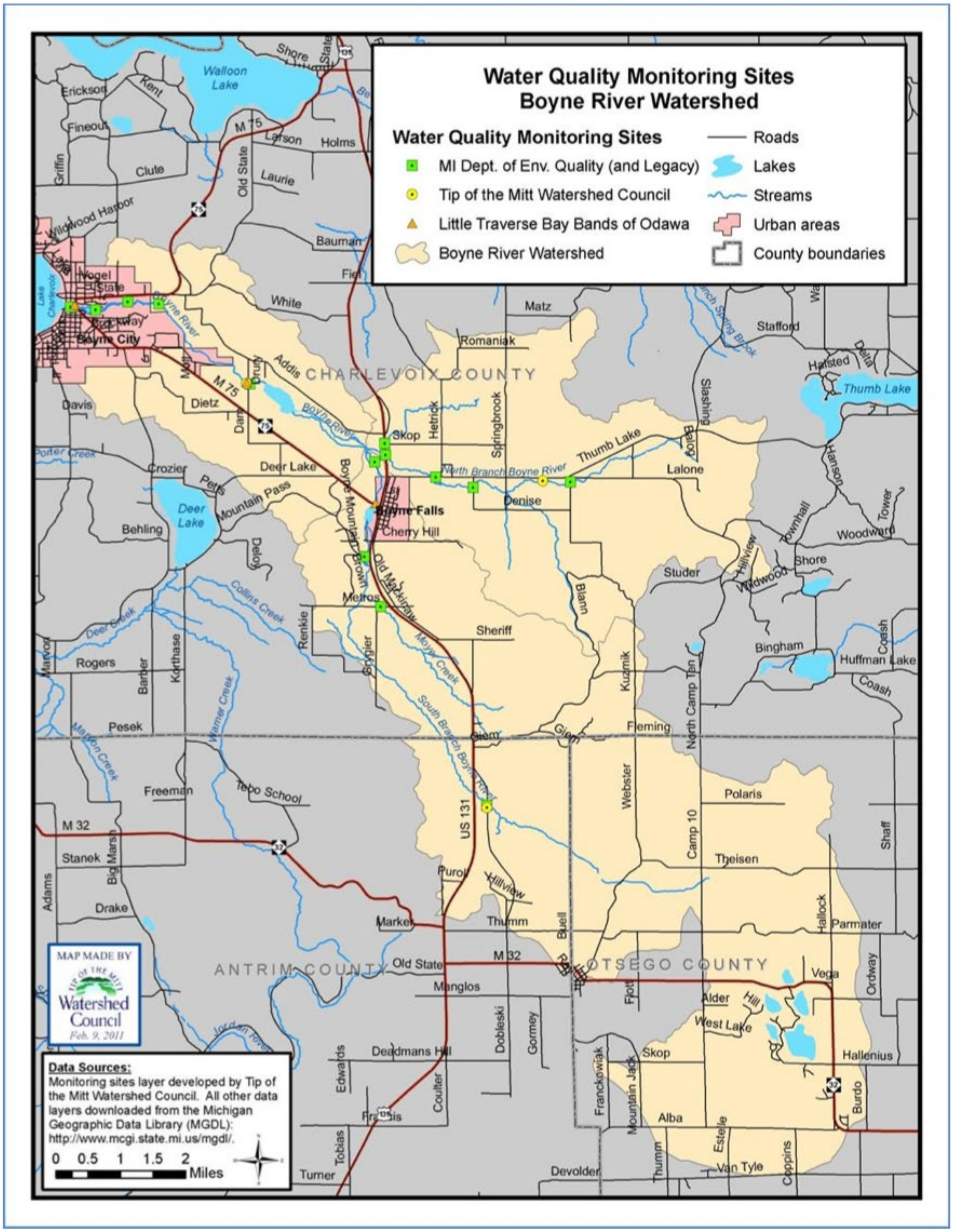

Figure 12. Water quality monitoring sites for Boyne River Watershed (Lake Charlevoix Watershed Management Plan, Page 53)

Table 7. Dissolved Oxygen data for the Boyne River (Lake Charlevoix Tributary Monitoring Study, Page 13)

River Section	Location	Data Sources	Low*	High*	Average	Time Period
North Branch	Thumb Lake Rd	DEQ†	11.8	11.8	11.8	1967
North Branch	US131, Boyne Falls	DEQ†	8.4	11.8	9.6	1967-1970
South Branch	M75, Boyne Falls	LTBB, USFWS	9.2	18.0	11.4	2004-2013
Main Branch	Dam Road	DEQ†, LTBB, USFWS	8.2	14.7	10.4	1997-2013
Main Branch	Spring St	USFWS	7.6	11.4	9.7	1977-2010
Main Branch	East St	USFWS	7.9	11.5	9.5	1990-2013
Main Branch	Boyne City Park	DEQ†, LTBB, TOMWC, USFWS	8.3	14.0	11.4	1977-2013
Main Branch	Lake St, mouth	DEQ†	7.5	13.7	10.0	1968-2006

** units: milligrams per liter or parts per million.*
†DEQ data include legacy data from USEPA.

1.5.6.4 Recent Dissolved Oxygen Monitoring

Method

Public Sector Consultants monitored dissolved oxygen (DO)on a continual basis, from June 1 to September 30, 2018, at two locations—in the dam tailrace and in the river upstream of the impoundment Figure 9). Onset Hobo U26 DO data loggers were installed and programmed to record data at ten-minute intervals. These loggers also record water temperature and provide redundancy. Loggers were downloaded once every two weeks and data were compared to Michigan's Water Quality Standards for coldwater streams.

Results and Discussion

The State of Michigan's Part 4 Rules, specify water quality standards which shall be met in all waters of the state. Specifically, regarding DO, R 323.1064 "Dissolved Oxygen in Great Lakes, Connecting Waters, and Inland Streams," states:

> *"Rule 64. (1) A minimum of 7 milligrams per liter of dissolved oxygen in all Great Lakes and connecting waterways shall be maintained, and, except for inland lakes as prescribed in R 323.1065, a minimum of 7 milligrams per liter of dissolved oxygen shall be maintained at all times in all inland waters designated by these rules to be protected for coldwater fish. In all other waters, except for inland lakes as prescribed by R 323.1065, a minimum of 5 milligrams per liter of dissolved oxygen shall be maintained."*

At the Upstream site, data show that the DO concentration dropped below seven milligrams per liter (mg/L) on several occasions (Figure 13). However, it is believed that the data may have been affected by improper function of the logger, rather than actual environmental conditions. During several of the data download events, significant accumulation of sediment and organic materials were noted to be covering the sensor of the data logger. Following the drop in DO levels on August 4, the sensor was replaced and the logger recalibrated. From August 22 to August 30, the data indicate that the DO was consistently below 7 mg/L, often falling to 0–2 mg/L. If these data were correct, it is likely that a mass die-off or migration of trout would have occurred. Boyne Outfitters, a local fly-fishing outfitter, led fishing trips on this section of river during the anomalous event, and reported that fish were present and active (E. Winchester, pers. comm.). Other than during these two periods, the DO concentration continuously exceeded the water quality standards at this site.

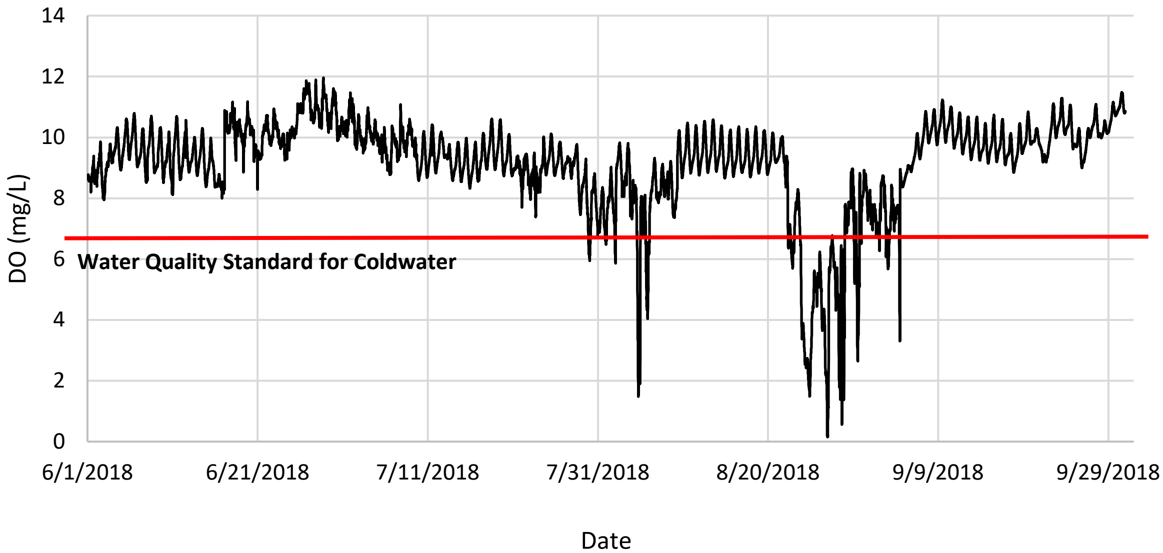

Figure 13. DO Concentrations (mg/L) for the Upstream Site, June 1 to September 30, 2018

In the Tailrace, DO concentration was recorded from 12:01 AM on June 1 until about 9:00 PM on August 3, when the data logger was stolen from the site. A new logger was installed at 5:40 PM on August 9, which recorded continually until its removal on September 30. The nearly six-day data gap is apparent in Figure 14. At no time during the monitoring period, even during the hottest of weather, did the DO concentration fall below the water quality standard of 7 mg/L. As such, there is no reason to believe that the DO may have fallen below the standard during the time that data were not being recorded. Based upon the 2018 data, this site met the water quality standards for DO 100 percent of the time.

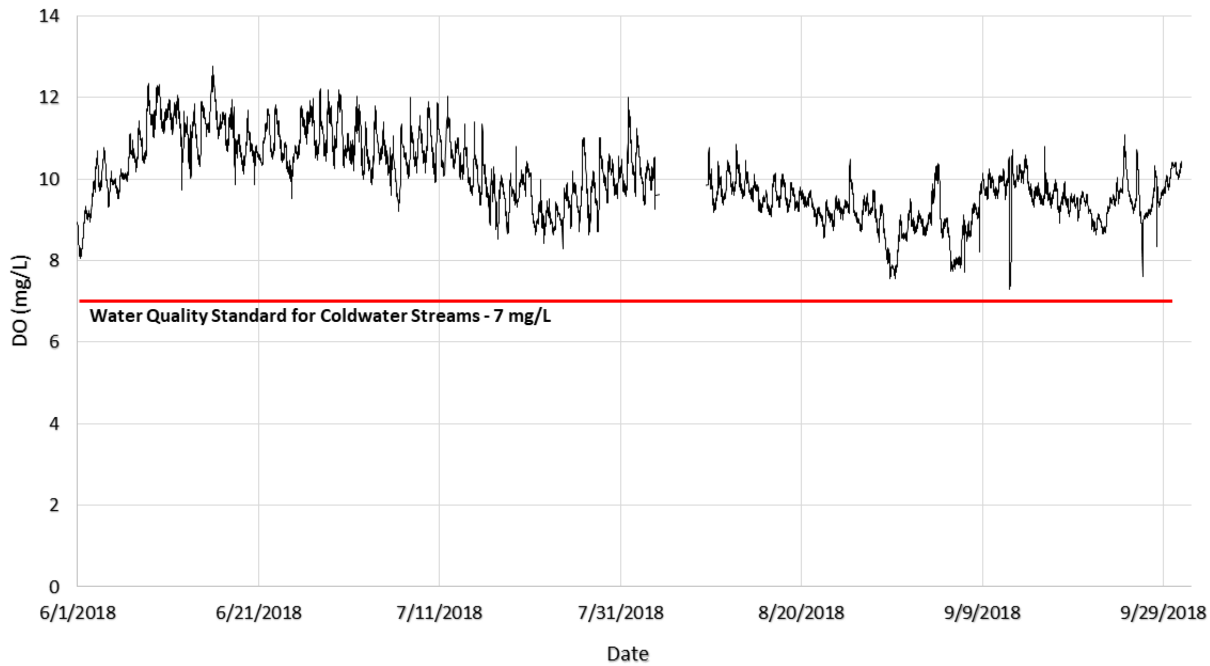

Figure 14. DO Concentrations (mg/L) for the Tailrace Site, June 1 to September 30, 2018

Diel fluctuations in DO concentration appeared to be directly related to water temperature, the two parameters being inversely proportional. Most of the time, the highest DO concentration occurred early in the morning, corresponding to the lowest water temperature (Figure 15). This is a typical relationship for flowing waters with little aquatic vegetation or organic decay to drive photosynthetic or biochemical oxygen-demand-related DO sags.

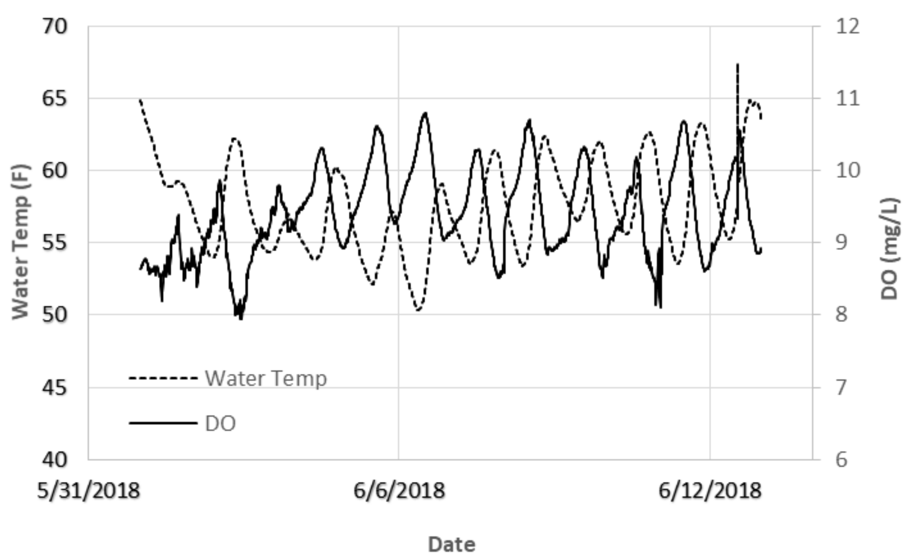

Figure 15. Typical Inverse Relationship between DO Concentrations (mg/L) and Water Temperature (°F), Upstream Site

Summary

During the monitoring period, DO concentrations in the Tailrace site met water quality standards for coldwater streams 100 percent of the time. Based upon the data collected, the impoundment consistently has an adequate oxygen supply for coldwater organisms.

DO concentrations in the impoundment were always in excess of 7 mg/L at Site B1 during data collection. The DO concentration in the deeper waters (11–18 feet) of Site B2 dropped below 7 mg/L on five sampling dates.

At the Upstream site, data show that the DO concentration dropped below 7 mg/L on several occasions. However, it is believed that the data may have been affected by improper function of the logger, rather than actual environmental conditions.

1.5.6.5 Water Temperature and Dissolved Oxygen in the Impoundment

Method

Public Sector Consultants identified two locations within the impoundment for water temperature and DO profiles (Figure 9). A watercraft was launched to access the two sites on a biweekly basis between June 1 and September 30, 2018, for a total of nine samples over 17 weeks.

Results and Discussion

Based upon the bathymetry of the impoundment, it was determined that only two monitoring sites would be required to characterize the water temperature and DO profiles. Site B1 was located in about nine feet of water near the center of the impoundment (Figure 9). All the water to the east of Site B1 is less than or equal to nine feet in depth. Site B2 was located in the deepest hole within the impoundment, near the outlet. Water depth was measured to be about 18 feet at this site. North and east of Site B2, the impoundment quickly shallows. In the direction of Site B1, the water gradually shallows from 18 feet to nine feet.

Data were collected approximately every two weeks on nine dates during June, July, August, and September. Data collection occurred at various times of the day, but always between the hours of 9:30 AM and 5:00 PM.

The highest water temperature recorded (71.6°F) at Site B1 occurred at 9:30 AM on July 10 (Figure 16), following 11 days of exceptionally hot weather, during which daily high air temperature averaged over 95°F. Also, at 9:30 AM, the water temperature in the Tailrace hit its daily maximum of 68.7°F; this temperature corresponded to the temperature four feet under the surface in the impoundment. The water temperature at the Upstream site was 59.9°F at this time. The maximum air temperature on July 10 was 87°F.

The deepest four-foot section of water (from five to nine feet in depth) at Site B1 only once (July 10) exceeded the upper thermal limit (67.1°F) for the cold-transitional classification. While the classification is not necessarily intended for lakes, it is used here for comparison purposes. Otherwise, this deeper water stayed below 67.1°F. The upper four feet of the water column regularly exceeded this water temperature over the duration of the monitoring period. DO concentration never fell below 8 mg/L during monitoring of Site B1, well above the water quality standard of 7 mg/L for coldwater fisheries (Figure 17).

At Site B2, the water temperature reached 72°F on July 10 and August 20. The upper five feet of the water column regularly exceeded the upper thermal limit for the cold-transitional classification. The deepest 12-foot section of water (from six to 18 feet in depth) never exceeded 66.4°F and most often fell into the cold classification (Figure 18). The upper 11 feet (from zero to 11 feet in depth) always had DO concentrations above 7 mg/L (Figure 19). Thus, a layer of water between the depths of six and 11 feet always met the criteria for cold-transitional and the water quality standards for DO concentration.

Based upon the data collected, it appears that depths of the impoundment that exceed five feet are almost always colder than 67°F and have an adequate oxygen supply for coldwater organisms.

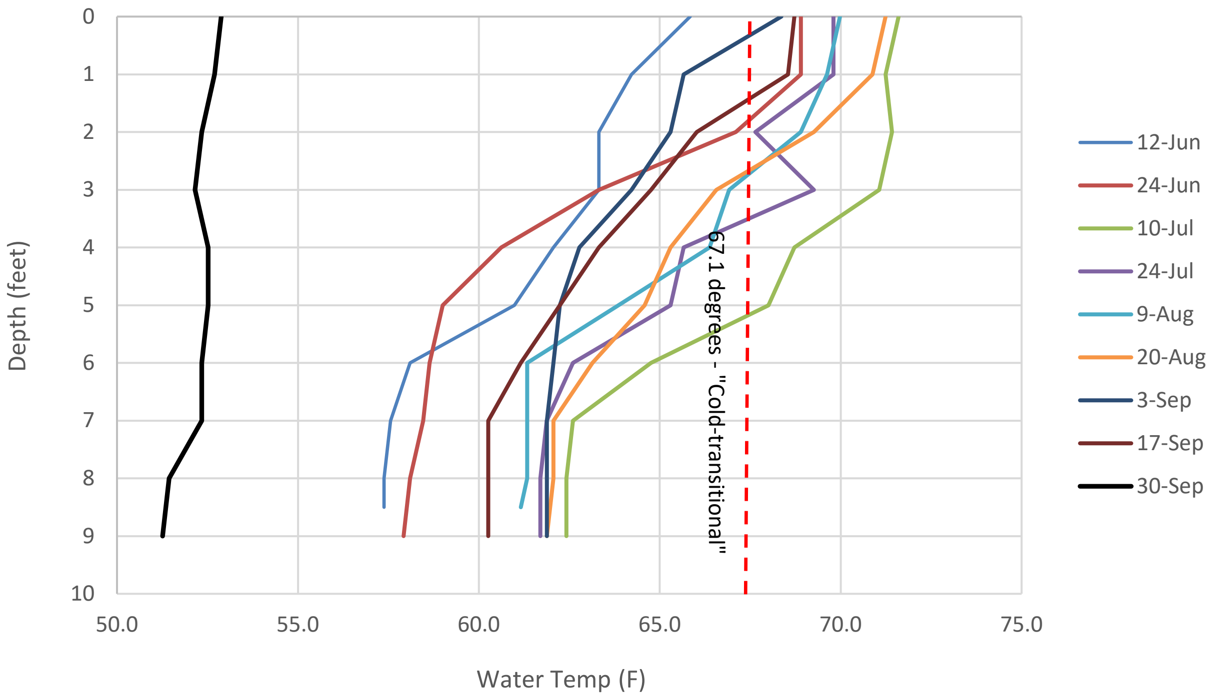

Figure 16. Water Temperature Profiles for Site B1, June–September 2018

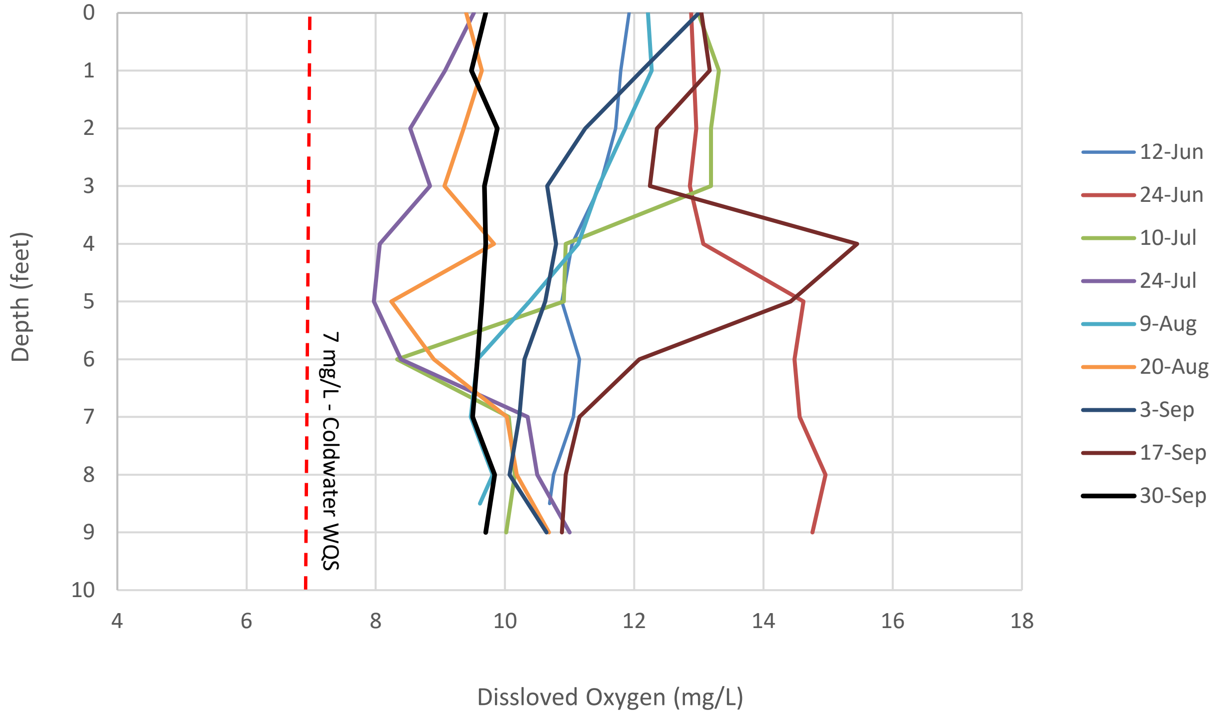

Figure 17. Dissolved Oxygen Profiles for Site B1, June–September 2018

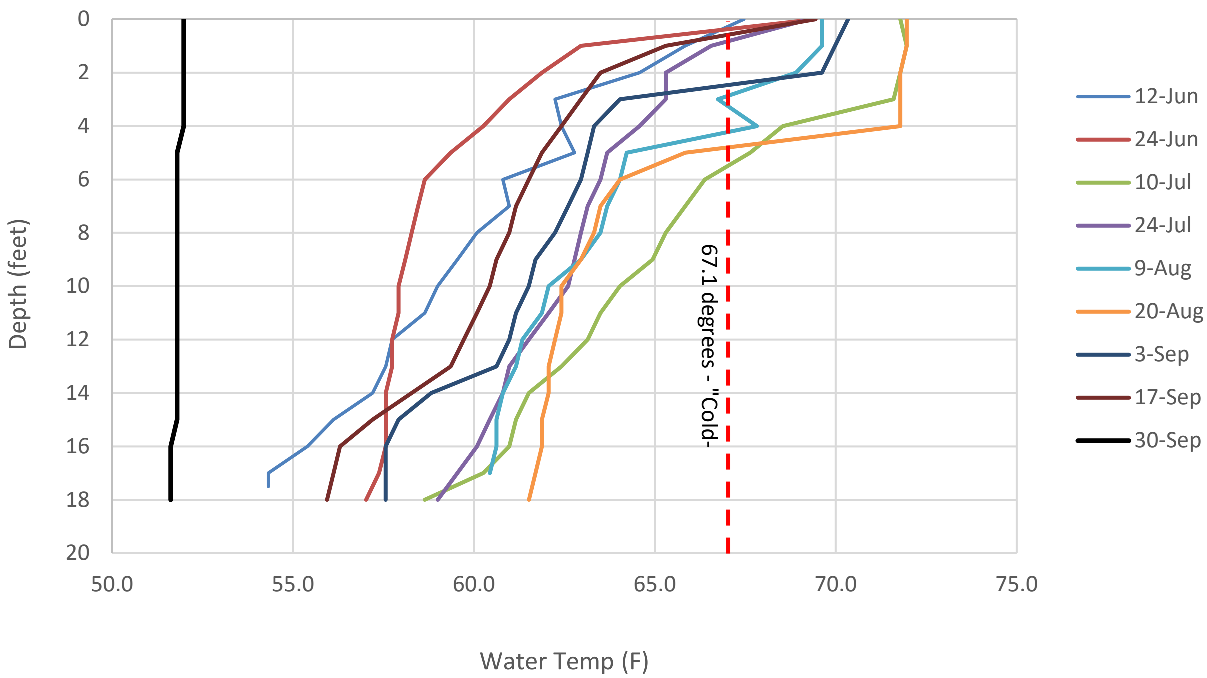

Figure 18. Water Temperature Profiles for Site B2, June–September 2018

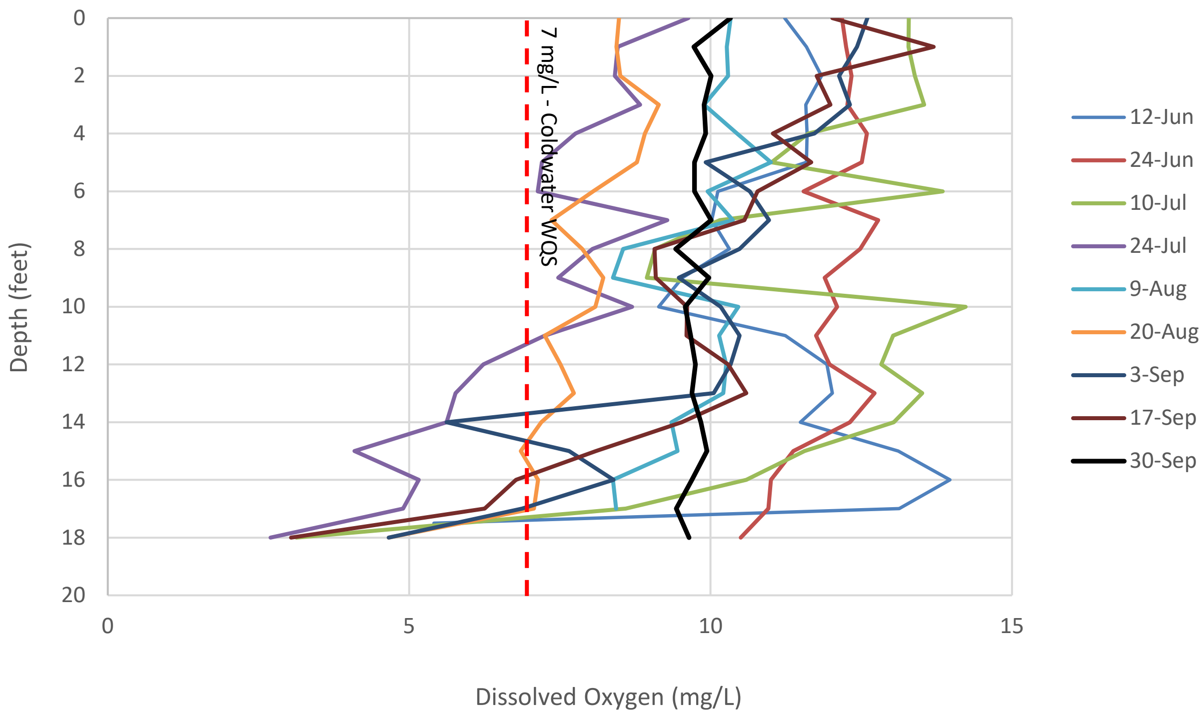

Figure 19. Dissolved Oxygen Profiles for Site B2, June–September 2018

1.5.6.6 Water Temperature Modeling

The dam is currently configured to draw water from impoundment depths ranging from zero feet (water surface) to 11.5 to 12 feet. However, flow data from measurements at the trash rack indicate that most of the water entering the turbine is being drawn from the upper, warmer, half of the water column.

Using water temperature data collected for this project, along with bathymetric mapping and average daily flows through the spillway, an effort was made to determine the potential for using the deep, cold water within the impoundment to cool downstream receiving waters. As previously discussed, the average July water temperature at the Tailrace site was 5.4°F warmer than the measurement at the Upstream site. It can be assumed that this is due, in large part, to warming of the impoundment itself.

Bathymetric data indicates that the average depth of the impoundment is 5.2 feet, and the maximum depth is 18.5 feet. Total residence time of water in the impoundment (355.6 acre-feet) is three days.

Water temperature profiles from the impoundment show that any water deeper than about five feet is almost always below 67.1°F, the upper thermal limit for a cold-transitional stream. About 60 percent (40.5 acres) of the impoundment is less than five feet deep, and an estimated 101 acre-feet (4.42 million cubic feet) of cold water is stored below the five-foot depth contour (Table 7). This 101 acre-feet is equivalent to the volume of flow through the impoundment over a 24-hour period at the median July flow of 50 cfs.

Table 8. Volume of Water Stored in Each One-foot Strata, below the Five-foot Depth Contour in the Boyne River Impoundment

Depth Range (ft.)	Acre-feet	Cubic Feet	Avg. Water Temp. (06/24/18 and 07/10/18)
5–6	25.2	1,096,162	67
6–7	19.8	860,895	66.1
7–8	15.6	678,345	65.6
8–9	12.0	521,258	65.1
9–10	8.6	376,622	64.5
10–11	6.1	266,822	63.8
11–12	4.5	194,109	63.3
12–13	3.4	148,624	62.8
13–14	2.7	117,547	62.0
14–15	1.7	74,985	61.3
15–16	1.0	41,723	61.1
16–17	0.6	25,871	60.6
17–18.5	0.4	15,243	59.5
	101.6	4,418,179	

Downstream Temperature Mitigation

Two potential mitigation schemes come to mind. One would be to develop a way to draw colder water from lower levels of the impoundment into the headrace channel upstream of the powerhouse intake and spillways (Bottom Draw alternative). The other would involve construction of a channel that by-passes the impoundment (Bypass Channel alternative). These are both considered briefly.

Bottom Draw

The headrace channel has an overall depth of about 12 feet. Bottom Draw alternative could be as simple as a curtain occluding the upper portion of the headrace channel near its upstream end. Warmer water from the surface of the impoundment would be prevented from entering the headrace channel. This alternative could conceivably be implemented at a modest cost. Although the limited volume of water in the impoundment (particularly at lower levels) has been mentioned previously as a limiting factor, this alternative has potential for mitigating downstream temperatures to some extent. However, in many similar situations, it should be noted that a bottom-draw scheme has only proven effective when there is a very large volume of deep, cold water relative to the flow in the stream. And, the potential for destratification within the impoundment exists, which can create other challenges for aquatic life there during warm months.

Bypass Channel

A bypass channel could be constructed that intercepts most of the flow from the river upstream of the impoundment and by-passes the flow around the reservoir to the headrace channel. This alternative would be cost-prohibitive. In addition, this scheme would have serious implications for the ecology of the impoundment that would not be receiving the cooling waters of the upper Boyne River.

Summary

The impoundment is having an impact on the water temperatures downstream of the dam. At the Upstream site, average July water temperature was 62.4°F, classifying the stream as cold (Table 4). Within the Tailrace site, average July water temperature was 67.8°F, classifying the stream as cool. While the 5.4°F increase in water temperature is significant, the Downstream site does harbor a coldwater fish community, including trout. However, the Downstream site is stocked on an annual basis.

The Upstream water temperature exceeded the water quality standard of 68°F for a total of about 77 hours (3.5%) during June, July and August. The longest continual duration of time in excess of 68°F was 13 hours and there was a period from June 29 to July 5 where the water temperature exceeded 68°F for 63 out of 148 hours.

In total, the Tailrace exceeded the water quality standard for water temperature for about 364 hours (15.2 days) from June 1 to August 31. The longest continual duration of time in excess of 68°F was 186 hours, from 16:41 on June 29 to 09:41 on July 7.

The unusually warm air temperatures most likely increased the average July water temperature of the Tailrace site enough to change the classification from cold-transitional to cool. The site exceeded the cold-transitional classification (67.1°F) by 0.7°F. The average daily high temperatures for July 2018 were 4.9°F warmer than the long-term average.

The volume of cold water in the impoundment appears to be limited for mitigating downstream temperatures. Installing a curtain within the headrace channel, forcing deeper water to be discharged from the dam, may mitigate warmer water temperatures to some extent. Withdrawing the full volume of "cold" impoundment water would likely de-stratify the impoundment. As a result of de-stratification, negative ecological impacts within the impoundment would be possible.

1.5.7 Other Physical and Chemical Parameters

Historical monitoring of alkalinity, hardness and pH data for the Boyne River classify it as a moderately alkaline stream, showing relatively high levels of calcium carbonate ($CaCO_3$) [6]. Overall, the river has very hard water and a high buffering capacity. The following data for the Boyne River is from the EGLE:

Average alkalinity: 188 PPM $CaCO_3$

Average hardness: 202 PPM $CaCO_3$

Average pH: 8.1

Conductivity monitoring data available from the EGLE, LTBB and TOMWC show an average of 392 microSiemens (µS) of conductivity at the Dam Road survey location[7]. There has been a slight increase in conductivity levels in the last 15 years. Data for chloride levels is limited for the Dam

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[6] *Lake Charlevoix Watershed Advisory Committee. July 2012. "Lake Charlevoix Watershed Management Plan". https://www.watershedcouncil.org/lake-charlevoix-watershed-management-plan.html*

[7] *Claucherty, M., Cronk, K. L., Myers, D. Tip of the Mitt Watershed Council. June 1, 2015. "Lake Charlevoix Tributary Monitoring Study 2013 – 2014". https://www.watershedcouncil.org/uploads/7/2/5/1/7251350/lakecharlevoixtributarymonitoringprojectreport2015_final-optimized.pdf*

Road location however data at several other locations upstream and downstream of the dam have showed chloride concentrations at a range of 0 – 11.4 PPM. Locations downstream of the dam have increased from an average of 2.9 PPM during the 1970s to 9.0 PPM during the late 2000s[8].

Phosphorus and Nitrogen have been well monitored along the Boyne River by the EGLE and TOMWC. An overall decline in phosphorous concentration has been recorded over the past several decades. The average concentration from 1968 to 1978 and 1993 to 2010 is 18.4 PPB and 7.0 PPB respectively[9]. This decline may be attributed to decreased phosphorus inputs due to improved regulation and education, and changes to the river ecosystem via invasive species. Total nitrogen concentration averages 528 PPB for the Boyne River. These levels are elevated likely due to nutrient pollution via agricultural activity in the surrounding watershed area.

Heavy metal concentrations for the Boyne River have all been recorded well below maximum allowable limits outlined by Michigan WQS. The one exception to this is mercury, which has been found to exceed the standard wildlife value three times before 1993[10]. The United States Environmental Protection Agency (USEPA) released an “Impaired Waterbody History Report” for the Boyne River which outlined six instances from 2002 to 2012 where the cause of impairment was PCBs in fish tissue.

1.6 Boyne River Dam

The Boyne River Dam is a complete migration barrier to all upstream migrating fish and other aquatic organisms. The disruption to free passage can be harmful to many native or recreational important species, but can also serve as a control to prohibit invasive species from reaching upstream habitats.

The Boyne River, below the dam, is host to at least 13 species of fish, nine of them native. The ecosystem also contains non-native, but desirable recreational, fish including brown and rainbow trout and Pacific salmon. Brook trout are a notable native species, and Atlantic salmon have also been stocked during periods in history. As well, three native species of freshwater mussel have been documented. Upstream of the dam, between the impoundment and the river, about 17 species of fish and three native mussels are known. The fish community of the impoundment includes 13 native species, while the river is home to at least six native species, along with brown and rainbow trout. Most of these fish probably occupy the impoundment and river channel during periods of the year or their life history.

Invasive species present below the dam include rusty crayfish, zebra mussel, Asiatic clam. The sea lamprey can probably be found in the river, as well. The zebra mussel has found its way above the dam and can be found within the impoundment, but is unknown in the upstream river channel. Thus far, it appears that the dam has prevented the spread of rusty crayfish and Asiatic clam and, probably, the sea lamprey.

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[8] *Claucherty, M., Cronk, K. L., Myers, D. Tip of the Mitt Watershed Council. June 1, 2015. “Lake Charlevoix Tributary Monitoring Study 2013 – 2014”.* https://www.watershedcouncil.org/uploads/7/2/5/1/7251350/lakecharlevoixtributarymonitoringprojectreport2015_final-optimized.pdf

[9] *Lake Charlevoix Watershed Advisory Committee. July 2012. “Lake Charlevoix Watershed Management Plan”.* https://www.watershedcouncil.org/lake-charlevoix-watershed-management-plan.html

[10] *ibid*

Fish passage systems at dams have a myriad of benefits and drawbacks, either real or perceived. Fish ladders or bypass channels can serve as conduits to restore connectivity of habitats for a variety of species. This means that desirable, or undesirable, fish and aquatic organisms can pass. Sometimes a species that is desirable in one location can move to new locales and compete with native fish for habitat or food sources. For example, anglers, riparian owners and other user groups have a long history of debate regarding issues of expanding the number of river miles available to Pacific salmon versus blocking their passage to favor stream trout populations.

For decades, fish passage systems have targeted recreationally important species, such as trout and salmon, which are able to jump through the step-pool type systems. More recently, bypass channels are being designed to mimic more natural river conditions and pass fish that are less capable swimmers. Free-flowing river systems allow migration for all aquatic organisms, between habitats that are necessary to complete reproductive cycles, to reach more diverse food sources and to spread genetic diversity, among other things.

Specific to the Boyne River Dam, site conditions and a variety of social, ecological and economic factors would have to be weighed in considering fish passage options. None of these have been studied to date and, thus, no real options have been considered for fish passage.

1.6.1 Impingement/Entrainment Evaluation

Method

Fish speed and endurance are important considerations in the development and design of fish screens, bar racks, etc. to exclude fish from harmful environments, such as dam intakes. Both factors vary among species, body morphology, fish length, and water temperature, among other variables. Swimming speeds are typically classified as burst, prolonged, or sustained. Burst is the highest speed that fish can attain over very short times (<20 sec), and are used to capture prey, avoid danger, or to negotiate high water velocities. Sustained (cruising) speeds can be maintained indefinitely without fatigue and are used for routine activities, such as foraging, holding, and schooling. The intermediate category of swimming speeds is known as prolonged, with fish endurance up to around 30 minutes and ending in fatigue.

Using flow data and swimming speed data for the fish community (species, size, abundance, etc.) of the impoundment, a brief analysis of the potential for fish to be impinged or entrained was completed.

Using flow data collected at the trash rack and swimming speed data for the fish community (species, size, abundance, etc.) of the impoundment, a brief analysis of the potential for fish to be impinged or entrained was completed. Water velocity was measured across the face of the trash rack on January 15, 2020, using a Marsh-McBirney (201D) portable water current meter. The trash rack was divided into a grid of cells measuring two feet by two feet, and water velocity was measured in the center of each cell. Measurements were conducted while the dam turbine was operating at minimum (40 kilowatts (kW)), average (77 kW) and maximum (300 kW) power generation settings.

Results and Discussion

The trash rack area is located on the right side of the headrace channel immediately upstream of the penstock intake. The bottom elevation of the opening to the penstocks is 624.7. The water surface elevation at any given time determines the depth of flow at the trash racks. The overall width of the area leading to the penstocks at the trash racks is 16.65 feet. There are 13 trash rack panels, each with 10 vertical bars, except for the southerly most panel which has 12 bars. This yields a total of 132 vertical bars, each bar being 3/8 inch thick.

Public Sector Consultants measured water velocity leading up to and through the trash/debris rack three settings of the turbine, based upon operational data collected from January 7, 2016 to January 26, 2019: minimum power generation of 40 kW, average power generation of 77 kW and maximum power generation of 300 kW (Figure 20, Figure 21, Figure 22, and Table 8). Water velocities range from -0.14 to 1.75 feet per second. Comparing these velocities to five-second swimming speeds of the adult fish found in the impoundment, it does not appear that any of the fish species, if healthy, would have difficulty escaping the water intake structure (Table 9). Mottled sculpin, the species with the lowest mean sustained swimming speed, is a substrate-oriented species and could navigate the velocities associated with the bottom half of the trash rack, even at the highest operational setting of the turbine.

Juvenile fish of several species, including the American brook lamprey, largemouth bass, northern pike, pumpkinseed, rockbass and smallmouth bass, could have difficulty navigating portions of the immediate trash rack area during maximum power generation. However, much of the surface area of the trash rack has lower velocities allowing easy escape, the burst rate for these species is greater than the five-second swimming speed and the dam infrequently operates at maximum output. Therefore, it is unlikely that the operation of the dam causes impingement or entrainment of any fishes of the impoundment.

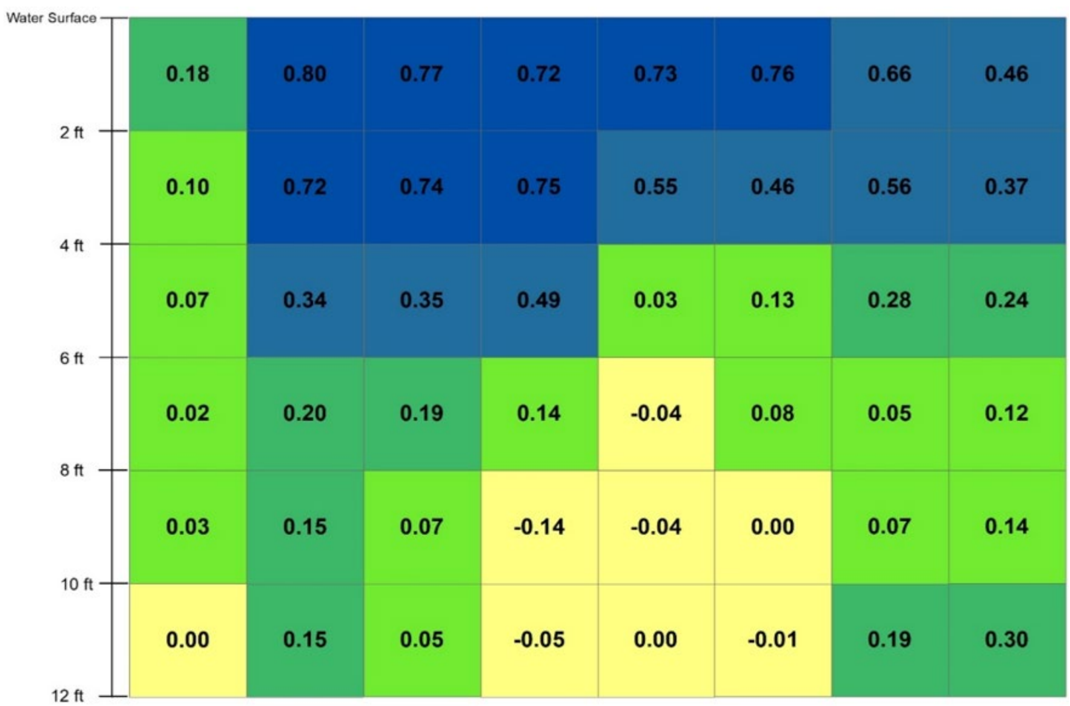

Figure 20. ***Water Velocity Profile, in feet per second, looking west toward the Trash Rack, during minimum (40 kilowatt) power generation.***

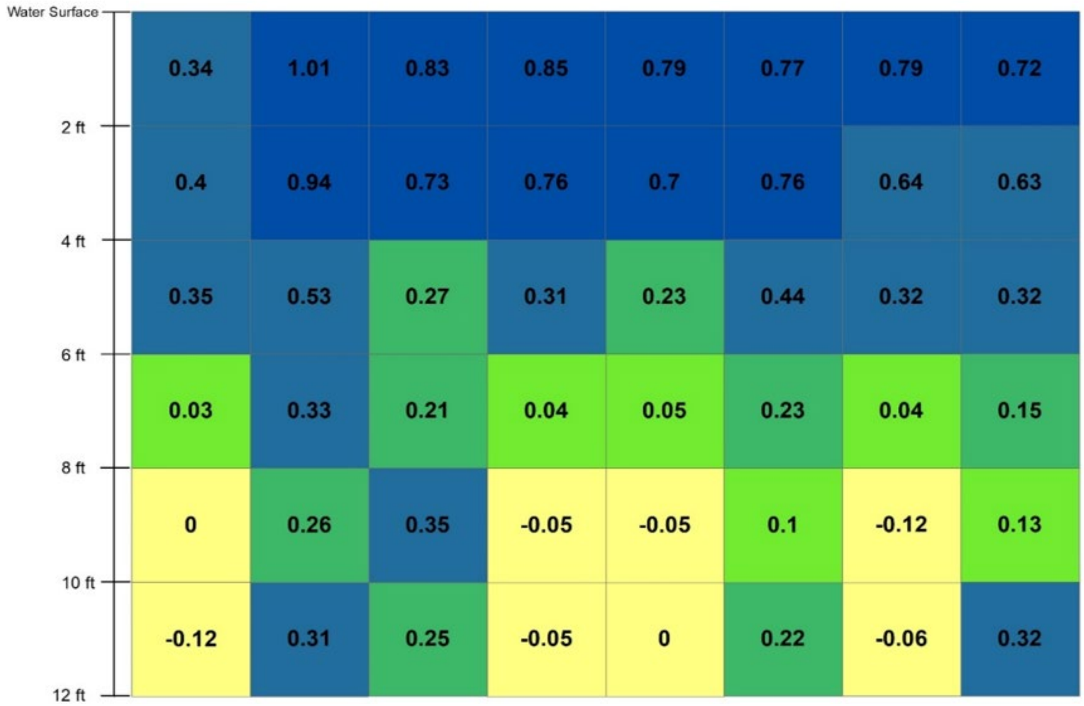

Figure 21. Water Velocity Profile, in feet per second, looking west toward the Trash Rack, during average (77 kilowatt) power generation.

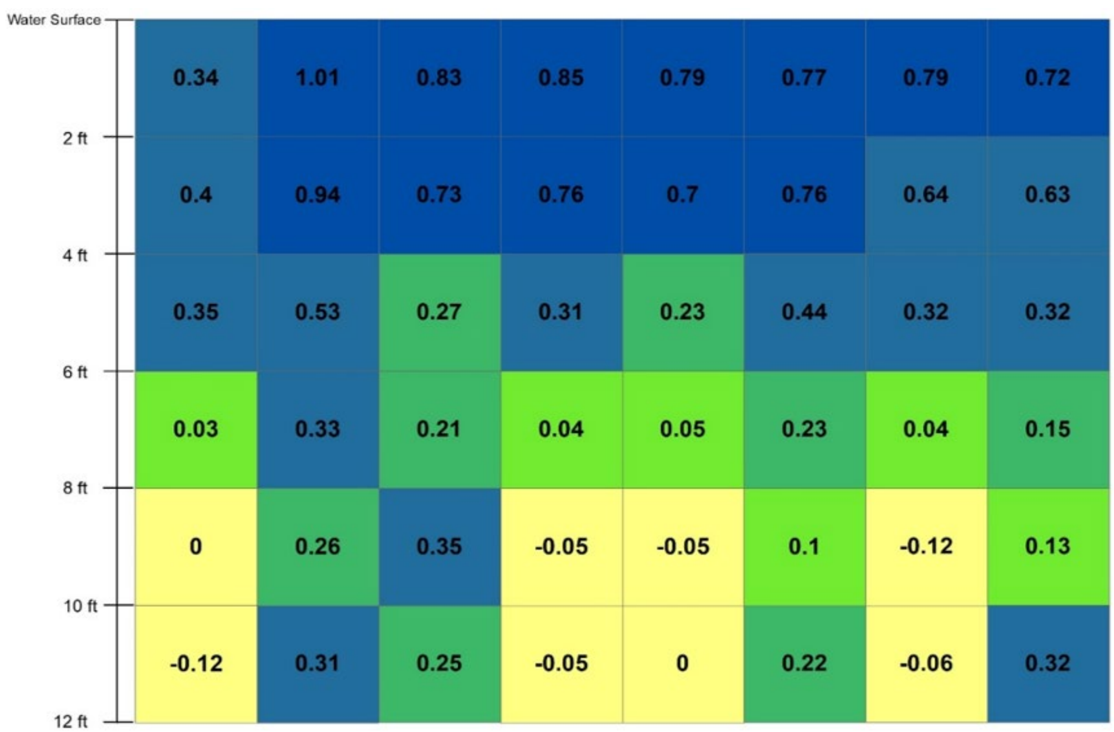

Figure 22. Water Velocity Profile, in feet per second, looking west toward the Trash Rack, during maximum (300 kilowatt) power generation.

Table 9. Measurement of Water Velocities at the Trash Rack Opening during Various Flows Through the Boyne River Dam (Nominal Rated Capacity 250 Kilowatts [kW])

kW	Velocity Range at Trash Rack (ft./s.)
40	-0.14 to 0.8
77	-0.12 to 1.01
300	-0.07 to 1.75

Table 10. Critical Swimming Speeds of Fish Species Found within the Boyne River Impoundment

Species	Estimated Mean Sustained (Five Second) Swimming Speed of Juvenile (ft./s.)	Estimated Mean Sustained (Five Second) Swimming Speed of Adult (ft./s.)
American brook lamprey*	1.3	5.2
Bluntnose minnow**	1.9	3.9
Central mudminnow**	1.9	3.9
Common shiner**	1.9	3.9
Golden shiner**	1.9	3.9
Largemouth bass	1.5	6.2
Mottled sculpin	N/A	1.0
Northern pike	1.5	8.2
Pumpkinseed***	1.5	3.1
Rock bass***	1.5	3.1
Smallmouth bass	1.5	5.2
White sucker	2.3	6.2
Yellow perch	1.9	3.8

**Sea lamprey data*
***Creek chub data*
****Bluegill data*

Summary

Water velocities range from -0.14 to 1.75 feet per second, depending on location on the trash rack and operational setting of the turbine. Comparing these velocities to five-second swimming speeds of the adult fish found in the impoundment, it does not appear that any of the fish species, if healthy, would have difficulty escaping the water intake structure.

- Juvenile fish of several species, including the American brook lamprey, largemouth bass, northern pike, pumpkinseed, rockbass and smallmouth bass, could have difficulty navigating the immediate trash rack area during maximum power generation. However, much of the surface area of the trash rack has lower velocities allowing easy escape, the burst rate for these species is greater than the five-second swimming speed and the dam infrequently operates at maximum output. Therefore, it is unlikely that the operation of the dam causes impingement or entrainment of any fishes of the impoundment.

1.6.2 Gradient for Affected Downstream Reaches

The river gradient between the dam and Lake Charlevoix downstream is quite flat at about 4.9 feet per mile.

1.6.3 Data with Respect to Existing Lake

The pertinent data is provided in an outline format for the impoundment:

Table 11. Pertinent Impoundment Data

Specification	Value
Surface Area	58 acres at elevation 636.8
Volume	356 acre feet at elevation 636.8
Maximum Depth	Approximately 19 feet
Mean Depth	Approximately 5.2 feet
Flushing Rate	Once every 3.0 days (approx. median flow of 60 cfs)
Shoreline Length	1.6 miles
Substrate Composition	Not Known

1.7 Fish and Aquatic Resources

1.7.1 Historical Identification of Existing Fish and Aquatic Communities

Fishing on the Boyne River is open year-round, however; possession of certain species such as Atlantic salmon, brown trout and brook trout is allowed from the last Saturday in April until September 30th every year[11]. The MDNR have outlined size requirements for fish possession in their 2012 Fisheries Survey for the Boyne River at Dam Road.

The Boyne River has been extensively surveyed and studied over the years. The most recent fisheries and aquatic community surveys were completed by Boyne during the summer or 2018 below the dam, within the impoundment and upstream of the impoundment. The results of those surveys are summarized below and presented in their entirety in the Environmental Studies report provided in Appendix A.

Other recent surveys include those done in 1998, 2004, 2007, 2012 and 2015.

Upstream of the Dam-

MDNR conducted fish surveys on Thumb Road (MDNR 2007) and Springbrook Road (MDNR 2015) on the North Branch of the Boyne River. Neither of the sites are stocked with trout and rely on natural reproduction to sustain the populations. In 2007, 19 brook trout (range = 2.2-7.4 inches), 58 brown trout (range = 1.9-12.4 inches) and 40 mottled sculpin were collected. None of the brook trout were of legal size, while 14% of brown trout exceeded the 8-inch minimum legal length requirement. Aging of the fish showed that 11 of the brook trout were Age 0, six were Age I and two were Age II. Fourteen brown trout were Age 0, 17 were Age I, 16 were Age II, four were Age III and one was Age IV. Both brook and brown trout were found to be growing slower than the state average. In 2015, the catch consisted of 12 brook trout (average = 6.5 inches), 57 brown trout (average = 5 inches) and 57 mottled sculpin. Two (17%) of the brook trout and 14% of the brown trout were of legal size for harvest. The numbers of trout collected were said to be higher than in any previous surveys conducted at the location.

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[11] *Michigan Department of Natural Resources. 2012. Boyne River at Dam Road – 2012 Fisheries Survey.* *http://boyneriver.org/wp-content/uploads/Fisheries-Survey-2012-Heather-Hettinger.pdf*

Downstream of the Dam-

The main branch of the river has a long stocking history. The MDNR Fisheries Division has annually stocked the Boyne River with Atlantic salmon, steelhead and brown trout. During the 2012 fisheries survey conducted by the MDNR, it was found that there were no changes to the fish community since the stream was previously surveyed[12]. Although natural reproduction is still occurring downstream of the dam, especially salmon[13], it is not enough to fully sustain the fishery on its own[14]. Therefore, the MDNR has recommended to continue the current stocking protocol because of the popularity of the site and limited spawning habitat. They have suggested surveying the river every five to ten years, in addition to evaluating the water quality, to analyze the success of stocking efforts and overall health of fish populations[15].

Table 11, below, is from the MDNR's 2012 Fisheries Study of the Boyne River. The results show all the fish species that are present in the Boyne River downstream of the Boyne River dam. The table shows number of fish collected, along with average weight and length range.

Table 12. Fish collected by the MDNR for their 2012 Fisheries Study of the Boyne River[16]

Species	Number collected	Percent by number	Weight (lb.)	Percent by weight	Length range (in.)	Percent legal size
Brook trout	2	0.5	0.2	0.4	5-6	0
Black bullhead	1	0.3	0.1	0.2	5-5	0
Bluegill	14	3.7	0.7	1.7	2-4	0
Blacknose dace	1	0.3	0	0.1	3-3	0
Brown trout	72	18.9	13.1	33.5	2-14	21%
Brown bullhead	I	0.3	0.2	0.5	7-7	100%
Chinook salmon	27	7.1	0.3	0.9	2-4	0
Coho salmon	53	13.9	0.4	1	2-4	0
Creek chub	29	7.6	0.9	2.3	2-5	0
Common shiner	4	I	0.1	0.3	3-5	0
White sucker	18	4.7	4.1	10.5	5-10	100%
Green sunfish	2	0.5	0.1	0.2	3-4	100%
Longnose dace	36	9.4	0.7	1.8	2-5	0
Logperch	1	0.3	0	0	3-3	0
Pumpkin seed	5	1.3	0.2	0.6	3-4	100%
Rainbow trout	61	16	3.7	9.5	1-11	11%
Steelhead (Skamania)	2	0.5	12	30.6	25-25	100%

[12] *Michigan Department of Natural Resources. 2012. Boyne River at Dam Road – 2012 Fisheries Survey. http://boyneriver.org/wp-content/uploads/Fisheries-Survey-2012-Heather-Hettinger.pdf*

[13] *Friends of the Boyne River. Fish. http://boyneriver.org/fish/*

[14] *Michigan Department of Natural Resources. 2012. Boyne River at Dam Road – 2012 Fisheries Survey. http://boyneriver.org/wp-content/uploads/Fisheries-Survey-2012-Heather-Hettinger.pdf*

[15] *ibid*

[16] *ibid*

Species	Number collected	Percent by number	Weight (lb.)	Percent by weight	Length range (in.)	Percent legal size
Rockbass	22	5.8	1.6	4.2	2-7	100%
Sculpin	25	6.6	0.6	1.4	2-4	0
Smallmouth bass	5	1.3	0.1	0.3	2-5	0
Totals:	381		39.1			

Brook trout and brown trout are found upstream in both the North and South branches of the Boyne River. Brook trout are typically found upstream of the Boyne River dam due its more suitable coldwater temperatures in the summer. It is likely that any of these fish found downstream of the dam are those who have passed over the spillway[17]. Brown trout are found abundantly in the main branch of the river, likely due to stocking by the MDNR, however natural reproduction has been known to occur as well. Rainbow trout populations, although still evident in the river system, have declined over the years likely due to discontinued stocking and their inability to successfully reproduce in large numbers upstream of the dam[18]

As mentioned previously, comprehensive fish surveys and surveys of other aquatic organisms were completed during the summer of 2018 for the impoundment and the river reaches upstream and downstream of the impoundment.

Aquatic surveys of the Boyne River and the dam impoundment, conducted by Public Sector Consultants (PSC), included fish, macroinvertebrates, freshwater mussels, and macrophytes. The communities and survey results are summarized below. The complete report is presented in Appendix A.

1.7.2 Aquatic Survey of the Impoundment

1.7.2.1 Fish Community

Method

Public Sector Consultants surveyed the fish community of the impoundment using boat-mounted electrofishing gear to collect fish in shallow water and near-shore areas. Fyke nets were placed in four locations around the shoreline of the impoundment, and a gill net was placed in the deepest portion of the impoundment (Figure 9).

Pulsed direct current was used during the survey to minimize trauma to the fish. Electroshocking duration was automatically recorded as the total seconds of electricity that was discharged from the electrofisher for each transect. Electrofishing was conducted in the evening, which is more effective than shocking during daylight hours (Sanders 1992; Dumont and Dennis 1997).

Fyke nets were fished overnight. The nets were placed along the shoreline in locations where drop-offs (i.e., access to deeper water) were typically located close to the shoreline. Two fyke nets were constructed of two-inch stretch mesh and the hoop diameter measured four feet with a 50-foot long center lead, and two six-foot by 25-foot wing leads. Two additional fyke nets were constructed of

17 *Friends of the Boyne River. Fish. http://boyneriver.org/fish/*

18 *ibid*

0.125-inch ace-type nylon mesh coated with green latex net dip, where the lead was 15 feet long and two feet high. The frame and the cab were ten feet long when fully extended.

A multiple panel monofilament gill net of varying mesh size was fished in the deepest portion of the impoundment. The gill net consisted of five six-foot by 25-foot panels ranging from 1.5-inch to six-inch stretch mesh. The gill net was set overnight and was fished for approximately 12 hours.

Catch per unit effort (CPUE) is used as an index of fish abundance. Fish sampling efforts were standardized to units consistent with the MDNR sampling protocol (Schneider et al. 2000a).

Results and Discussion

Electrofishing of the impoundment was conducted during the evening (after sunset) of July 10, along the shoreline and throughout shallow water areas (approximately less than six feet in depth). The total shocking time was 3,087 seconds of electricity discharge into the water. Four fyke nets were deployed, for a total of four net nights, from July 10 through July 12, and one gill net was deployed for a total of one net night from July 10 through July 11.

A total of 450 fish, comprising 13 species, were caught among all sample gear within the impoundment, where pumpkinseed sunfish (*Lepomis gibbosus*), yellow perch (*Perca flavescens*), and rock bass (*Ambloplites rupestris*) were the most frequently observed species (Table 12). Most of the fish collected during the survey were captured using electrofishing gear. The catch rate using electrofishing gear for all species was 5.9 fish per minute of electrofishing. The catch rate using fyke nets was approximately 35 fish per net night.

Table 13. Fish Captured in the Impoundment, by Each Sampling Method, July 2018

Common Name	Electrofishing	Fyke Net	Gill Net	Grand Total
American brook lamprey	3			3
Bluntnose minnow	6	1		7
Central mudminnow	1			1
Common shiner	1			1
Golden shiner	1			1
Largemouth bass	2			2
Mottled sculpin	1			1
Northern pike	8	4	4	16
Pumpkinseed	124	109		233
Rock bass	34	20		54
Smallmouth bass	5	5		10
White sucker	13			13
Yellow perch	105		3	108
Grand Total	304	139	7	450

Pumpkinseed sunfish ranged in length from 1.8 to 5.6 inches, with an average length of 3.3 inches (sample size *n* = 233; standard deviation *s* = 0.6 inches), and ranged in weight from 0.03 to 4.2 ounces, with an average weight of 0.5 ounces (*s* = 0.4 ounces). Approximately 65 percent of the pumpkinseed sunfishes were four inches in length (Figure 24), and their size within the impoundment was consistent with state average-sized pumpkinseed sunfishes (Figure 17).

Yellow perch ranged in length from 1.6 to 8.6 inches, with an average length of 5.2 inches (*n* = 108; *s* = 1.4 inches), and ranged in weight from 0.1 to 4.1 ounces, with an average weight of 1.1 ounces (*s* =

0.9 ounces). Approximately 77 percent of the yellow perch were between five and seven inches in length (Figure 18), and their size within the impoundment was consistent with state average–sized yellow perch (Figure 19).

Rock bass ranged in length from 2.1 to 8.3 inches, with an average length of 4.3 inches (*n* = 54; *s* = 1.7 inches), and ranged in weight from 0.1 to 8.1 ounces, with an average weight of 1.5 ounces (*s* = 1.9 ounces). Approximately 86 percent of the rock bass were between three and six inches in length (Figure 20), and their size within the impoundment was consistent with state average–sized rock bass (Figure 21).

The fish community described here is typical for an impounded coldwater river. Though, it is unusual for bluegill (*Lepomis macrochirus*) to be missing from any lentic environment in lower Michigan; the reason for this is unknown. Most of the fish collected in the impoundment were less than eight inches in length. The lack of larger panfish in the population is likely related to habitat suitability; the preference of deeper water in maturing panfish forces them into a relatively small basin that is already occupied by large predators, while the small panfish find refuge in the abundant vegetation of the littoral zone. Several northern pike (*Esox lucius*) were captured, with a maximum observed length of 32 inches, and a few smallmouth bass (*Micropterus dolomieu*) were captured as well, which ranged to 18 inches.

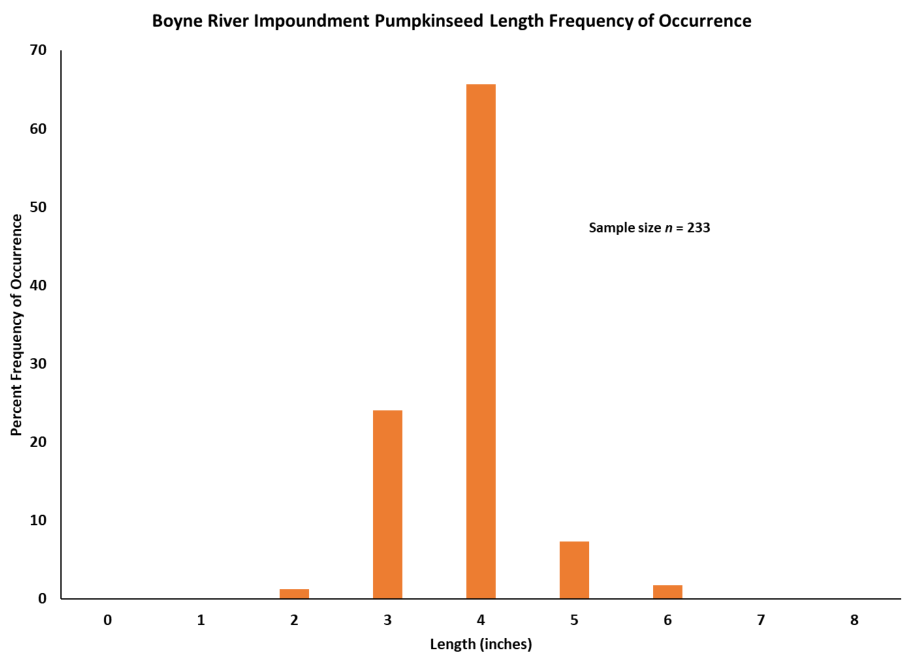
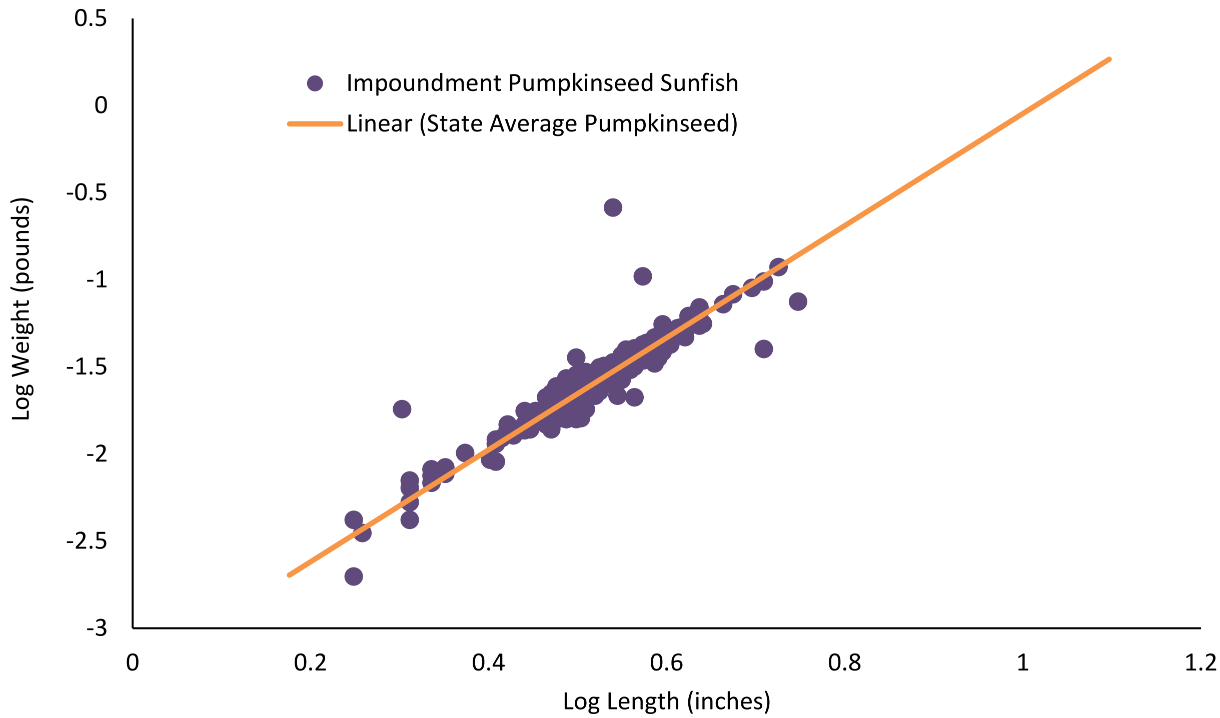


***Figure 23.** Length Frequency Distribution of Pumpkinseed Sunfish within Boyne River Impoundment, July 2018*



Source: Schneider et al. 2000b

Figure 24. Pumpkinseed Sunfish Length-weight Regression for Boyne River Impoundment, July 2018, and State Average Length-weight Relationship for Michigan

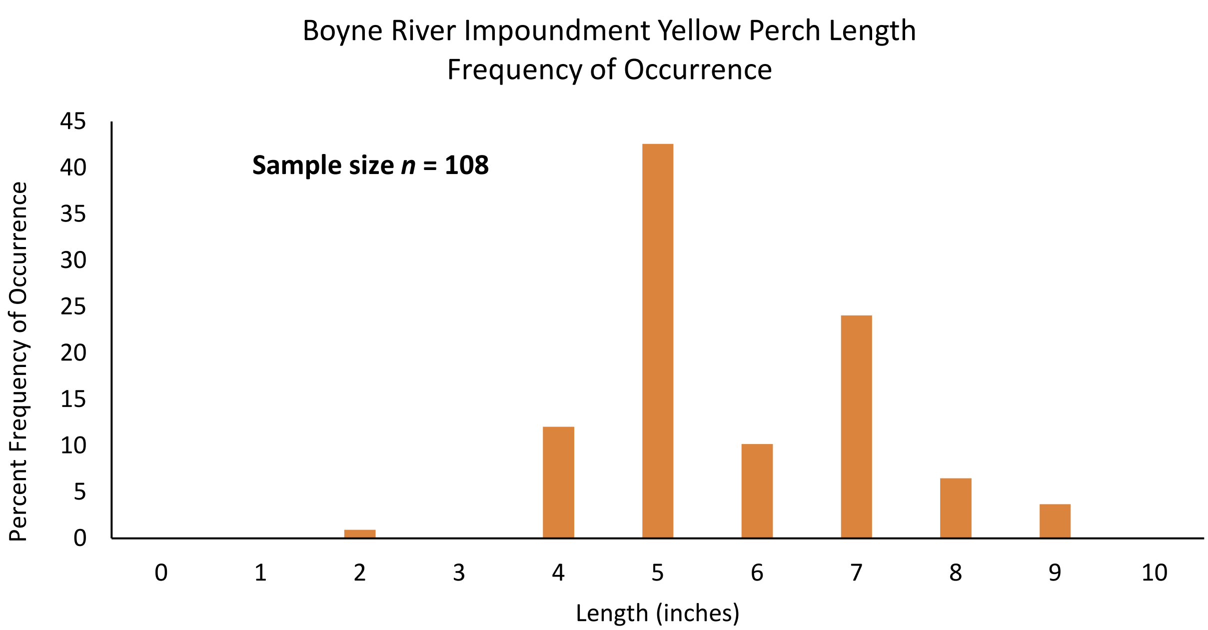
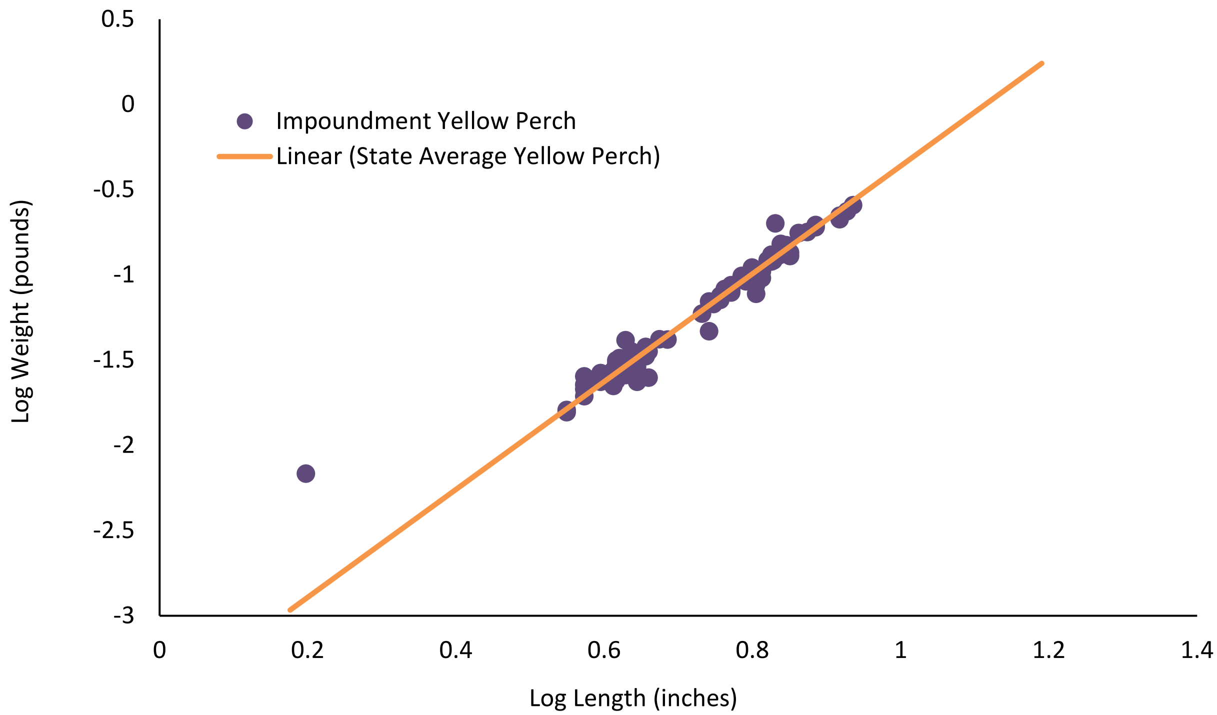


Figure 25. Length Frequency Distribution of Yellow Perch within Boyne River Impoundment, July 2018



Source: Schneider et al. 2000b

Figure 26. Yellow Perch Length-weight Regression for Boyne River Impoundment, July 2018, and State Average Length-weight Relationship for Michigan

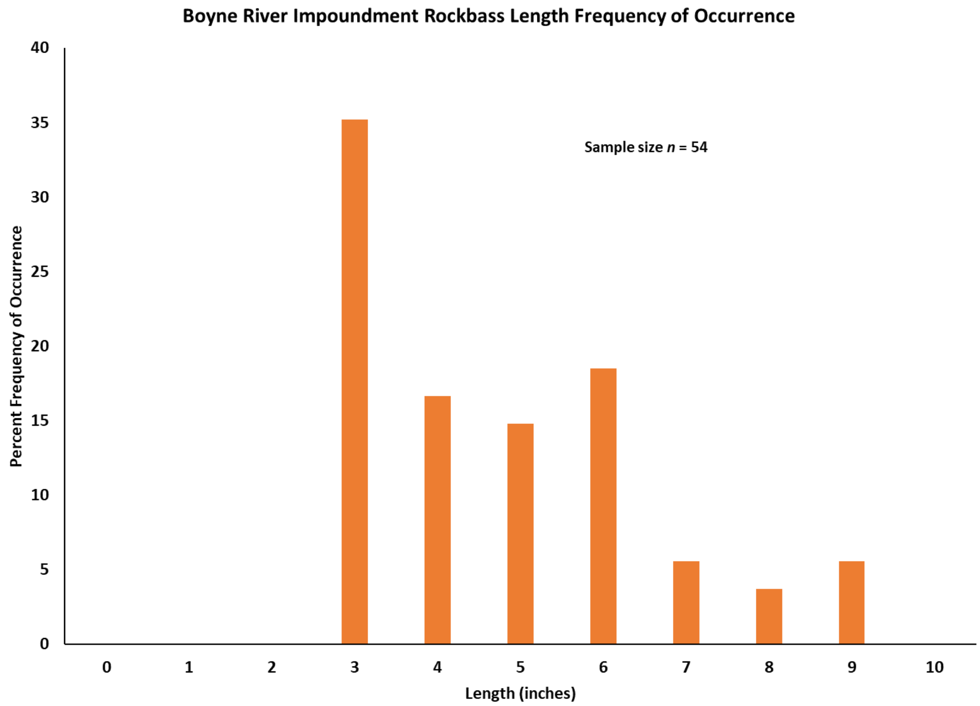
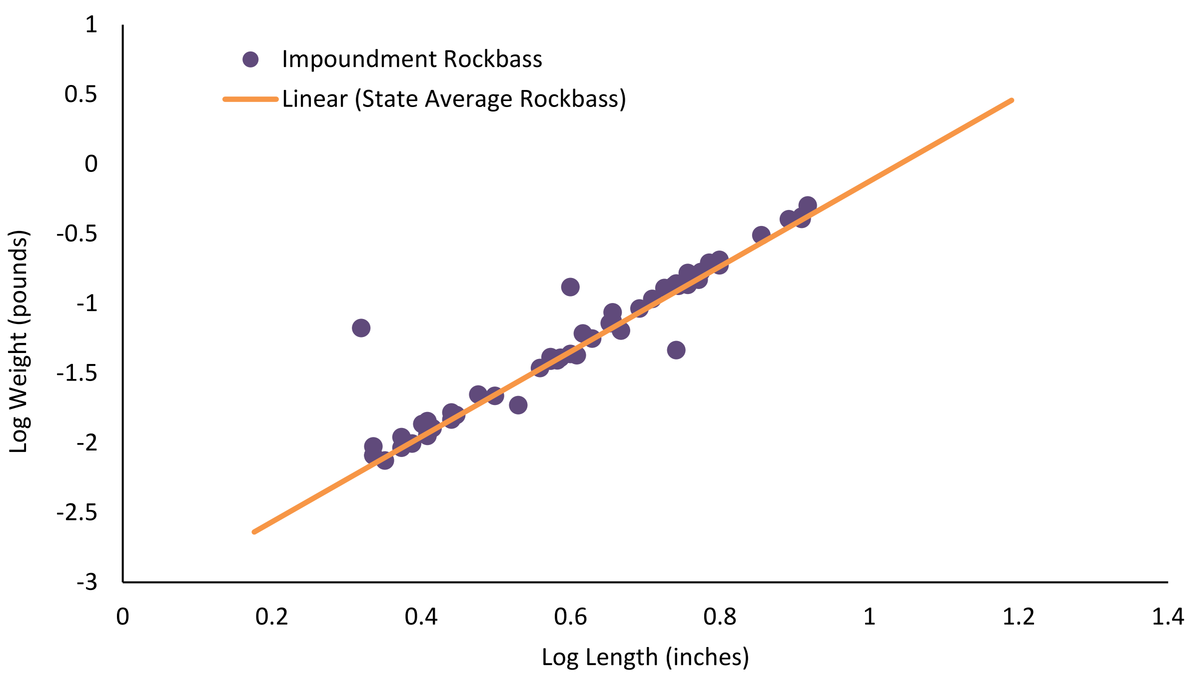


Figure 27. Length Frequency Distribution of Rock Bass within Boyne River Impoundment, July 2018



Source: Schneider et al. 2000b

Figure 28. Rock Bass Length-weight Regression for Boyne River Impoundment, July 2018, and State Average Length-weight Relationship for Michigan

Summary

A total of 450 fish, comprising 13 species, were caught within the impoundment. Pumpkinseed and yellow perch were, by far, the dominant species. The fish community of the impoundment is dominated by species that prefer cool water.

1.7.2.2 Macroinvertebrate Community

Method

Public Sector Consultants collected grab samples within the littoral margins of the impoundment by wading and using D-framed kick nets, generally, following the Great Lakes Environmental Assessment Section (GLEAS) Procedure 51 (P51) protocol established for nonwadable rivers (MDEQ 2013). In addition, a Petite Ponar Grab Sampler was used, from a boat, to collect sediment samples at five locations at different water depths. Collected specimens were stored in labeled, one-gallon zipper bags in a cooler of ice. After all samples were collected, insects were removed from each bag, identified using various taxonomic references, and enumerated (Merritt and Cummins 2008; Bright 2018).

Results and Discussion

Macroinvertebrate sampling was completed on July 12. Dip-netting was conducted for 30 minutes and five sediment samples were collected from a boat. A total of 475 organisms, representing 21 taxa, were collected (Table 13). The shallow water samples were dominated by water boatman (*Corixidae*), spread-winged damselflies (*Lestidae*), and water mites (*Hydracarina*). Deep water samples were dominated by nonbiting midges (*Chironomidae*) and water mites (Hydrachnidae). Two families of mayfly, *Baetidae* and *Ephemeridae* (e.g., *Hexagania*), and two families of caddisfly, *Limnephilidae* and *Phryganeidae*, were also found. During nighttime fish sampling, large hatches of both *Emphemeridae* and *Baetidae* were observed. Overall, the macroinvertebrate community is quite typical of a pond, lake, or impoundment; is relatively diverse; and would be expected to provide high-quality biomass for fish.

Table 14. Macroinvertebrate Collections from the Impoundment on the Boyne River, 2018

Taxa	Impoundment
Annelida (segmented worms)	
Hirudinea (leeches)	8
Arthropoda	
Crustacea	
Amphipoda (scuds)	16
Decapoda (crayfish)	10
Arachnoidea	5
Hydracarina	76
Insecta	
Ephemeroptera (mayflies)	
Baetidae	42
Ephemeridae	5
Odonata	
Anisoptera (dragonflies)	
Libellulidae	2
Zygoptera (damselflies)	
Lestidae	44
Hemiptera (true bugs)	
Belostomatidae	2
Corixidae	163
Notonectidae	1
Veliidae	3
Megaloptera	
Sialidae (alder flies)	9
Trichoptera (caddisflies)	
Limnephilidae	3
Phryganeidae	1
Coleoptera (beetles)	
Dytiscidae (total)	4
Diptera (flies)	
Athericidae	1
Ceratopogonidae	12
Chironomidae	65
Mollusca	
Physidae	3
Total Individuals	475

Summary

A total of 475 macroinvertebrates, representing 21 taxa, were collected during sampling in the impoundment. Overall, the macroinvertebrate community is quite typical of a pond, lake, or impoundment; is relatively diverse; and would be expected to provide high-quality biomass for fish. No rusty crayfish were captured or observed.

1.7.2.3 Freshwater Mussel Community

Method

Public Sector Consultants completed a Reconnaissance Mussel Survey within the impoundment by wading the littoral zone and collecting live and dead specimens (Hanshue et al. 2018). An attempt was made to sample each habitat type along the perimeter of the impoundment to ensure documentation of all species. Each species was identified, enumerated, and photographed before being returned, in its proper orientation, to its suitable habitat. In total, two hours and ten minutes were spent surveying 700 feet of shoreline. Most time was spent on the western end of the impoundment, where suitable habitat hosted the highest density of mussel species.

Results and Discussion

A reconnaissance mussel survey was completed on July 12. There were no known previous surveys of mussels or occurrences of listed mussel species in this area. Two surveyors spent a total of two hours and ten minutes surveying approximately 700 feet of the shallow littoral zone, searching for evidence of mussels. Most of the time was spent on the western end of the impoundment, where typically suitable habitat was found and safe wading could occur. The water was extremely clear until the sediments were disturbed, making the water very turbid and the sighting of mussels impossible. Thus, the shallowest water was used for trekking and mussels were spotted along the drop-off, where they could be collected before disturbing the sediments. The collection included 25 live cylindrical papershell (*Anodontoides ferussacianus*), 12 live giant floater (*Pyganodon grandis*), and eight live fatmuckets (*Lampsilis siliquoidea*), along with many shells from dead mussels of these same species. Many live zebra mussels (*Dreissena polymorpha*) and empty shells were observed.

An August 28, 2018, memo was submitted to Kyle Kruger, an MDNR fisheries biologist, describing results of the survey. Response was received in the form of a January 10, 2019, email from another biologist, Scott Hanshue, indicating that no further mussel investigation is necessary.

Summary

Freshwater mussels of the impoundment included 25 live cylindrical papershell, 12 live giant floater, and eight live fatmuckets, along with many shells from dead mussels of these same species. Zebra mussels were also found in the impoundment.

1.7.2.4 Macrophyte Community

Method

Public Sector Consultants completed a survey of the impoundment using the MDEQ’s procedures for aquatic vegetation surveys (MDEQ 2005). The macrophyte community was assessed in 19 similarly sized, individual Aquatic Vegetation Assessment Sites (AVAS) that averaged about 320 feet in width (Figure 29). In each unit, visual observations and rake tows were used to document all plant species and their densities. Densities were determined by using the following code:

- **found**: One or two plants of a species found in an AVAS, equivalent to less than 2 percent of the total AVAS surface area
- **sparse**: Scattered distribution of a species in an AVAS, equivalent to between 2 percent and 20 percent of the total AVAS surface area

- **common**: Common distribution of a species, where the species is easily found in an AVAS, equivalent to between 21 percent and 60 percent of the total AVAS surface area
- **dense**: Dense distribution of a species, where the species is present in considerable quantities throughout an AVAS, equivalent to greater than 60 percent of the total AVAS surface area.

Results and Discussion

The impoundment was broken into 19 similarly sized cells for assessment (Figure 29). A total of 13 different plant species were documented (Table 14). Muskgrass (*Chara spp*.), which is a macroscopic algae, is the only species that was found in each cell and is very abundant throughout the impoundment. Nearly the entire littoral zone of the northern and eastern shores contains dense mats of *Chara* on the bottom and in floating mats. *Chara* makes good juvenile fish and macroinvertebrate habitat and is useful for stabilizing the soft substrate. American elodea (*Elodea canadensis*) and clasping-leaf pondweed (*Potamogeton richardsonii*) were also found in most cells.

Figure 29. Individual Assessment Units for Macrophyte Survey within the Boyne River Impoundment

Narrowleaf cattail (*Typha angustifolia*) is the only documented, non-native, species that is considered to be invasive. Eurasian watermilfoil (*Myriophyllum spicatum*) or curly-leaf pondweed (*Potamogeton crispus*), two of the most widespread and highly invasive aquatic plants in Michigan, were not found in the impoundment. Starry stonewort *(Nitellopsis obtusa*), a more recent invasive species to cause significant problems in Michigan lakes, is also absent at this time.

Table 15. Plant Species Found within Each Survey Cell of the Boyne River Impoundment, July 2018

		Assessment Cell Number																		
Common Name	**Scientific Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
Coontail	Ceratophyllum demersum							B	A	A	A	A	A	A	A	A	D	A		A
Muskgrass	Chara spp.	D	D	D	D	D	D	D	D	D	D	D	D	D	A	D	D	B	D	D
American elodea	Elodea canadensis	A	A	A	A	B	A	D	C	A	A	A	A	A	A	A	A	A		
Iris spp.	Iris spp.	A			A				A									A	A	
Common naiad	Najas flexilis																	D	D	
Leafy pondweed	Potamogeton foliosus							A	A	A	A	A	A	A						B
Clasping-leaf pondweed	Potamogeton richardsonii		A					D	A	D	D	D	D	D	A	A	D	D	D	D
Hardstem bulrush	Schoenoplectus acutus	A																		
Softstem bulrush	Schoenoplectus tabernaemontani	B	C	A	A															C
Bur-reed	Sparganium	A																		
Narrowleaf cattail	Typha angustifolia	A	B	A						B	B	B	B						A	B
Broadleaf cattail	Typha latifolia	A																	A	
Wild celery	Vallisneria Americana	A		A																A

A = found
B = sparse
C = common
D = dense

Summary

- In the impoundment, narrowleaf cattail is the only non-native aquatic plant species that was documented; the species is considered to be quite invasive.

1.7.3 AQUATIC SURVEY OF THE BOYNE RIVER

1.7.3.1 FISH COMMUNITY

Method

Public Sector Consultants surveyed the fish community of the Boyne River at two sites (Figure 9). The purpose of the Boyne River fish survey was to describe fish community composition and relative abundance as well as to estimate the population size of trout. The Michigan Natural Features

Inventory County Element List was reviewed to determine if any threatened, endangered, or special-concern aquatic species have been documented within or near the Project Area.

Fish Collection Site One (Downstream) was 1,100 feet in length and about 0.9 acres in surface area. The reach is located from a point about 75 feet upstream of the Dam Road crossing, upstream to a point approximately 100 feet below (downstream of) the dam. Fish Collection Site Two (Upstream) was 1,330 feet in length and also covered about 0.9 acres. The point of beginning for the site was a location outside the influence of the still water of the impoundment.

A barge-mounted electrofisher was used to collect fish throughout each study reach. Shocking was conducted in an upstream direction to minimize fish avoidance of gear.

For trout population estimates, a mark-recapture study was conducted over two days. All species were identified, enumerated, and measured for length and weight, and trout were marked with a tail clip prior to release (Chapman 1951). The full PSC report details the method used to capture fish and estimate the trout population.

Upon completion of the fish sampling, macroinvertebrates were collected according to GLEAS P51 for wadable streams and rivers (MDEQ 2008). An attempt was made to collect at least 300 organisms from both the Upstream and Downstream sites using D-framed kick nets.

Riparian and in-stream habitats were qualitatively described for the Upstream and Downstream sites based on P51 scores interpreted from ten habitat metrics.

A Reconnaissance Mussel Survey was completed at both the Upstream and Downstream sites, on July 12, using sampling techniques outlined by Hanshue et al. (2018). There were no known previous surveys of mussels or occurrences of listed mussel species in this area. At the Downstream site, each surveyor began at Dam Road, the downstream end of the stream reach, with one surveyor working upstream in a meandering path along each bank to the center of stream. Surveyors proceeded upstream until they reached the dam. At the Upstream site, the entire fish sampling site was inspected. Any time evidence of mussels was found, an intensive search for live mussels ensued. Each species was identified, enumerated, and photographed before being returned, in its proper orientation, to its suitable habitat.

Results and Discussion

Electrofishing surveys of the Upstream and Downstream fish collection sites (Figure 9) were conducted on July 9 and 10. Water temperatures at the Upstream site ranged from 57-60°F during sampling, with pH of 8.7 and conductivity of 357 (Siemens (S) per meter (m)). At the Downstream site, water temperatures ranged from 67-69°F during sampling, with pH of 8.5 and conductivity of 390 S/m.

The Upstream sampling site is located above the dam, so migratory fish such as Pacific salmon and steelhead (*Oncorhynchus mykiss*), or invasive fish like the round goby (*Neogobius melanostomus*), cannot naturally access the site. The site is unique in that it is a privately managed fishery. *Boyne Outfitters* has sole access to the private property and adheres to a strict stocking and management program. Thus, numbers and sizes of trout are atypical, and results of this study cannot be directly compared to other sites along the Boyne River or in northwestern Michigan. For more relevant comparison, results of recent fish community surveys completed by MDNR were also obtained. The results are discussed below.

A total of eight species of fish was collected at the Upstream site Table 15). Brook trout (*Salvelinus fontinalis*), mottled sculpin (*Cottus bairdii*), and brown trout (*Salmo trutta*) dominated the catch.

Yellow perch were a somewhat surprising find, but are plentiful in the impoundment and, probably, in upstream ponds.

Table 16. Fish Species Collected at the Upstream Sampling Site of the Boyne River, July 9 and 10, 2018

Common Name	Scientific Name
American brook lamprey	Lethenteron appendix
Brook trout	Salvelinus fontinalis
Brown trout	Salmo trutta
Mottled sculpin	Cottus bairdii
Rainbow trout	Oncorhynchus mykiss
Rock bass	Ambloplites rupestris
White sucker	Catostomus commersonii
Yellow perch	Perca flavescens

On the first day of sampling, 22 brook trout, 18 brown trout, and eight rainbow trout were tail clipped. Of these 48 trout, 16 were recaptured on the second day of sampling. Thirteen unmarked trout were collected on day two. The recapture rate (33 percent) was high, considering that the stream is flowing very fast and there is an abundance of woody debris and other instream structure that made sampling difficult. Approximately 50 percent of brook trout were recaptured, while the recapture rates for browns and rainbows were 28 percent and 0 percent, respectively. Only one rainbow trout was captured on day two; it is unknown if they were better at avoiding capture on the second day, or if the process of electrofishing and handling was mortal. No dead fish were observed on day two.

If the population estimate is run using the number of all three trout species, there are an estimated 79 trout (variance (v) = 16) within the survey reach, which equates to 315 trout per mile, or 88 trout per acre in the Upstream site. If only brook trout are considered, the estimate is 30 brook trout (v = 2) within the survey reach, and 120 brook trout per mile, or 33 per acre.

Of the 61 total trout collected in the Upstream site, there were 28 brook trout, 24 brown trout, and nine rainbow trout. Brook trout ranged from 5.2 to 14.2 inches (mean = 11.1 inches) in length and all but one met the legal size limit of eight inches. Brown trout ranged from 5.7 to 22.4 inches (mean = 9.8 inches) in length, and 38 percent were of legal size. Rainbow trout ranged from 9.2 to 12.4 inches (mean = 11 inches) in length. Most of the fish in this sampling site are acquired from an approved private hatchery and stocked at a larger size than typical MDNR hatchery fish (E. Winchester, personal communication).

At the Downstream site, ten species of fish were collected on the first day of sampling, and coho salmon (*Oncorhynchus kisutch*), longnose dace (*Rhinichthys cataractae*) and smallmouth bass were added to the list on the second day, for a total of 13 species (Table 16). The samples were dominated by brown trout, mottled sculpin, rainbow trout, and rock bass, in descending order. One mature female chinook salmon (*Oncorhynchus tshawytscha*) was captured. Overall, this is a typical fish community in a cool/cold-transitional stream connected to Lake Michigan and is nearly identical to the community last reported by the MDNR (MDNR 2018). The fish community meets the coldwater standard established under Procedure 51, since the number of salmonids exceeds 1% of the total population. The higher number of species compared to the Upstream site is largely due to the inclusion of potamodromous fishes, slightly warmer water, and, perhaps, a lower density of larger, predatory fish. Compared to the sites on the North Branch, the Downstream site is far more diverse.

Table 17. Fish Species Collected at the Downstream Sampling Site of the Boyne River, July 9 and 10, 2018

Common Name	Scientific Name
American brook lamprey	*Lethenteron appendix*
Brook trout	*Salvelinus fontinalis*
Brown trout	*Salmo trutta*
Chinook salmon	*Oncorhynchus tshawytscha*
Coho salmon	*Oncorhynchus kisutch*
Common shiner	*Luxilus cornutus*
Creek chub	*Semotilus atromaculatus*
Longnose dace	*Rhinichthys cataractae*
Mottled sculpin	*Cottus bairdii*
Rainbow trout	*Oncorhynchus mykiss*
Rock bass	*Ambloplites rupestris*
Smallmouth bass	*Micropterus dolomieu*
White sucker	*Catostomus commersonii*

The trout population survey resulted in marking of 47 trout (three brook, 29 brown, and 15 rainbow), ranging in size from one to 19 inches. On the second day, 38 trout, eight of which were recaptures, were collected. The recapture rate (17 percent) was about half the rate of the Upstream site. The population estimate for the Downstream site is 155 trout (v = 65), equaling 745 trout per mile, or 142 trout per acre.

Of 54 individual brown trout that were captured, 38 fish (70 percent) were between five and nine inches in length, 12 fish were between nine and 11 inches in length, and four fish were more than 11 inches in length. Four (7 percent) of the brown trout were of legal size, being ten inches or larger (Type 4 trout stream). This population structure is indicative of a stocked brown trout fishery, with no naturally produced fish that are smaller than stocking size. In 2018, the Boyne River was stocked downstream of the dam, with 4,000 brown trout averaging about 7.4 inches in length (MDNR 2019). Similar to the North Branch site, the proportion of larger fish in the population declines rapidly. Mortality could be due to high water temperatures, harvest, predation, or unsuitable habitat during any portion of the year. This stretch of the river is publicly accessible, and fishing activity was commonly observed during survey work.

The Boyne River was also stocked with 8,700 rainbow trout, downstream of the dam, in 2018, averaging 7.9 inches in length. Results of this fish survey found 20 individual rainbow trout. Ten of those were between 6.9 and 9.6 inches and were presumably stocked. The remaining ten were between 1.9 and 3.6 inches and are likely the result of successful spring spawning by adult steelhead (i.e., rainbows).

Three brook trout, all between 8.7 and 9.8 inches, were captured. All three would be legal for harvest.

During site visits in September, a relatively large number of mature chinook salmon were observed in the river below the dam. These fish were on their spawning migration.

Summary

- A total of eight species of fish were collected at the Upstream site. Brook trout, mottled sculpin, and brown trout dominated the catch. Brook and brown trout are heavily stocked. The fish community is dominated by species that prefer cold water.
- At the Downstream site, a total of 13 species were collected. The samples were dominated by brown trout, mottled sculpin, rainbow trout, and rock bass, in descending order. Brown and rainbow trout are stocked by the MDNR on an annual basis. Most species are cold water dependent, but coolwater species were intermixed in the fish community.

1.7.3.2 Macroinvertebrate Community

Results and Discussion

At the Upstream site, 27 taxa were collected, including four families of mayfly, five families of caddisfly, and three families of stonefly (Table 18). These organisms are generally considered to be the most sensitive to pollution and their presence is noteworthy. Mayflies and caddisflies made up nearly 56 percent of the sample, by individual. The caddisfly, *Brachycentridae*, made up 36 percent of the sample. According to P51, the site scores a two with a community rating of acceptable.

Downstream, 21 taxa were collected, with three families of mayfly, two families of caddisfly, and one family of stonefly. Only one individual stonefly was found. About 71 percent of the sample consisted of types of mayfly and caddisfly. The most-collected organism was the mayfly, *Isonychiidae*, which made up about 35 percent of the sample. This site received a P51 score of zero, which is considered to be in the middle of the acceptable range.

While the Upstream site contains more families and individuals of pollution-sensitive organisms, the differences between the two samples could be a factor of physical habitat, a function of water quality, or their locations relative to the dam and impoundment. *Isonychiidae*, for example, was not found at the Upstream site. Its prevalence at the Downstream site is likely due to its feeding habits and location below the dam; its diet relies heavily on algae and diatoms, which would be produced in large volume in the impoundment. The abundance of stoneflies at the Upstream site may be a function of the very fast-flowing current, with an abundance of coarse wood and rocks.

Table 18. Macroinvertebrate Collections from the Upstream and Downstream Sites on the Boyne River, 2018

Taxa	Upstream	Downstream
Annelida (segmented worms)		
Hirudinea (leeches)	14	4
Arthropoda		
Crustacea		
Amphipoda (scuds)	35	1
Decapoda (crayfish)	2	9
Isopoda (sowbugs)		27
Arachnoidea	32	
Insecta		
Ephemeroptera (mayflies)		
Baetidae	3	2
Ephemerellidae	18	

Taxa	Upstream	Downstream
Heptageniidae	23	56
Isonychiidae		144
Leptophlebiidae	2	
Odonata		
Anisoptera (dragonflies)		
Aeshnidae		3
Gomphidae	1	2
Zygoptera (damselflies)		
Calopterygidae	2	1
Coenagrionidae	1	
Plecoptera (stoneflies)		
Leuctridae	6	
Perlidae	8	1
Pteronarcyidae	19	
Hemiptera (true bugs)		
Gerridae	1	4
Megaloptera	9	1
Trichoptera (caddisflies)		
Brachycentridae	142	
Glossosomatidae	10	
Helicopsychidae	1	
Hydropsychidae	21	90
Limnephilidae	1	3
Coleoptera (beetles)		
Dytiscidae (total)	4	7
Dryopidae	1	
Elmidae	24	3
Diptera (flies)		
Athericidae	13	13
Chironomidae	4	42
Tabanidae		1
Mollusca		
Gastropoda (snails)		
Physidae	2	1
Total Individuals	399	415

	Upstream		Downstream	
Metric	**Value**	**Score**	**Value**	**Score**
Total number of taxa	27	0	21	0
Number of mayfly taxa	4	0	3	0
Number of caddisfly taxa	5	0	2	-1
Number of stonefly taxa	3	1	1	0
Percentage mayfly composition	11.53	0	48.67	1
Percentage caddisfly composition	43.86	1	22.41	0
Percentage dominant taxon	35.59	-1	34.7	-1
Percentage isopod, snail, leech	4.01	0	7.71	0
Percentage surface airbreathers	1.25	1	2.65	1
Total Score		2		0
Macroinvertebrate community rating		Acceptable		Acceptable

At the Downstream site, 21 taxa were collected, with three families of mayfly, two families of caddisfly, and one family of stonefly. Differences in the macroinvertebrate communities between the two sample sites are likely a function of differences in physical habitat, water quality, and influence of the dam and impoundment. Rusty crayfish are prolific.

In the impoundment, narrowleaf cattail is the only non-native aquatic plant species that was documented; the species is considered to be quite invasive.

1.7.3.3 Freshwater Mussel Community

Method

Public Sector Consultants completed a reconnaissance mussel survey was completed on July 12. There were no known previous surveys of mussels or occurrences of listed mussel species in this area. Two surveyors spent a total of two hours and ten minutes surveying approximately 700 feet of the shallow littoral zone, searching for evidence of mussels. Most of the time was spent on the western end of the impoundment, where typically suitable habitat was found and safe wading could occur. The water was extremely clear until the sediments were disturbed, making the water very turbid and the sighting of mussels impossible. Thus, the shallowest water was used for trekking and mussels were spotted along the drop-off, where they could be collected before disturbing the sediments. The collection included 25 live cylindrical papershell (*Anodontoides ferussacianus*), 12 live giant floater (*Pyganodon grandis*), and eight live fatmuckets (*Lampsilis siliquoidea*), along with many shells from dead mussels of these same species (Photographs are included in Appendix C). Many live zebra mussels (*Dreissena polymorpha*) and empty shells were observed.

An August 28, 2018, memo was submitted to Kyle Kruger, an MDNR fisheries biologist, describing results of the survey. Response was received in the form of a January 10, 2019, email from another biologist, Scott Hanshue, indicating that no further mussel investigation is necessary. Both of these correspondence documents are included in Appendix C.

Results and Discussion

At the Downstream site, several dead shells were found in the substrate and in middens (piles of shells discarded by predators, such as muskrat) directly upstream of the Dam Road crossing. Detailed inspection, including hand grubbing, uncovered hundreds of shells in various degrees of decay, along with 12 live mussels. All mussels, live and dead, were determined to be cylindrical papershell. A few hundred feet upstream, a live fatmucket was found; this was the one specimen representing this species in the entire reach. Scattered dead cylindrical papershells were found within the remainder of the reach. Three live cylindrical papershells were found immediately below the dam. The only other mussels observed within the downstream reach were thousands of live and dead zebra mussels. A total time of four hours and 40 minutes was spent searching for evidence of mussels in the downstream reach.

At the Upstream site, despite an intensive search of approximately two hours, no evidence of native mussels was found. Additionally, no zebra mussels were found within this reach.

A January 10, 2019, email from Scott Hanshue, MDNR fisheries biologist, indicates that no further investigation is necessary at either of the Boyne River sampling sites.

Summary

- At the Downstream site, 15 live cylindrical papershell and one fatmucket were found. The only other mussels observed within the downstream reach were thousands of live and dead zebra mussels
- At the Upstream site, despite an intensive search of approximately two hours, no evidence of native mussels was found. Freshwater mussels are less common in colder waters. No zebra mussels, live or dead, were found within this reach.

1.7.4 Physical Habitat Survey

Public Sector Consultants scored the physical habitat at the Upstream site as 166/200 (excellent—nonimpaired) using the P51 metrics (Table 19). The stream averages approximately 24 feet in width. The instream habitat is ideal, with an abundance of epifaunal substrate in the form of logs, branches, cobble, boulders, undercut banks, and exposed roots. There are a number of deep pools and runs (greater than six feet in depth) along with fast and slow water. The channel is stable and the floodplain is accessible and broad. The south bank contains a cedar swamp and is heavily wooded; the canopy shades the stream for much of the day. However, the riparian area on the northern bank is highly altered. It was historically filled to create a walking/driving path, and the entire streambank is lined with a cedar post breakwall for stabilization.

From a geomorphology perspective, the riffle selected for survey (Cross Section 1) is representative of the flowing river channel upstream of the impoundment. The riffle is located far enough upstream to be entirely outside the influence of the hydrodynamic impacts of the impoundment. The riffle is also naturally formed under the existing hydrology of the watershed, unlike some nearby reaches that have been altered with habitat improvement, stabilization of streambanks, etc. Human impacts at this site do include the mowing and past tree removal on the north bank.

In this area, the stream channel flows between vast expanses of wetlands and floodplains dominated by coniferous forest. The channel is mostly stable and controlled vertically and laterally by components of the forest, including the trees and roots growing adjacent, and a large volume of fallen large woody debris. The woody debris, rather than gravel and cobble, provides the foundation for riffle development and long-term stability.

A cross-sectional survey of the riffle indicates that the bankfull channel is 41 feet wide and averages three feet in depth, with a width-to-depth ratio of 13.7 (Figure 30; Table 20). Channel slope was measured to be 0.43%. The low bank and bankfull elevations are similar and the river has the ability to utilize a vast floodplain. The river would be classified as a "C" type channel according to the Rosgen classification system.

Pebble count data is somewhat unusual due to the fact that the large woody debris plays such an important role in channel stability. The soils in this area contain a lot of clay, which can be seen moving as bedload in gravel-sized chunks. Sand is also a notable component of the bedload. The natural riffles are held together by interlocking pieces of woody debris. Accordingly, this material was counted as cobble and boulders for purposes of data entry and particle size analysis.

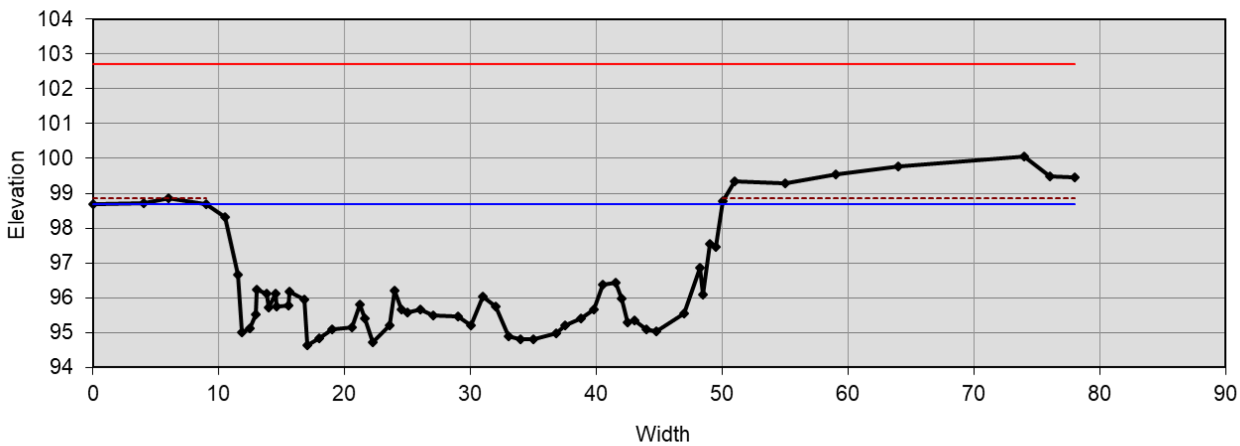


Figure 30. Cross Section 1 Data Associated with the Boyne River, Upstream of the Impoundment. Bankfull (blue line), Low Bank (dashed line), Floodprone Width (red line)

The Downstream site scored 154/200 (good—slightly impaired) and was only one point shy of excellent. Compared to the Upstream site, the channel is wider (averaging about 43 feet), shallower and the instream cover sparse; however, there is still a large quantity of woody material and coarse substrates. While there are many riffles and runs, deep holes are lacking. The riparian area is in great condition, with the exception of some bank erosion caused by human foot traffic. It is obvious that this is a popular area for wading anglers, as the footpaths, access stairs, and benches are well used.

Table 19. Procedure 51 Physical Habitat Ratings for the Upstream and Downstream Sites on the Boyne River, 2018

Habitat Metric	**Upstream**	**Downstream**
Substrate and Instream Cover		
Epifaunal substrate/available cover (20)	20	12
Embeddedness (20)*	18	15
Velocity/depth regime (20)*	18	15
Channel Morphology		
Sediment deposition (20)	19	15
Flow status—maintained flow volume (10)	10	9
Flow status—flashiness (10)	10	7
Channel alteration (20)	13	17
Frequency of riffles/bends (20)*	16	15
Riparian and Bank Structure		
Bank stability (left) (10)	7	7
Bank stability (right) (10)	10	8
Vegetative protection (left) (10)	2	7
Vegetative protection (right) (10)	10	7
Riparian vegetation zone width (left) (10)	3	10
Riparian vegetation zone width (right) (10)	10	10
Total Score (200)	166	154
Habitat Rating	Excellent (nonimpaired)	Good (slightly impaired)

Table 20. Geomorphic Variables for the Upstream and Downstream Sites on the Boyne River, 2018

	Upsteam (Cross Section 1)	**Downsteam (Cross Section 2)**	**Downsteam (Cross Section 3)**
Bankfull Width (ft)	41.0	41.9	44.5
Mean Depth (ft)	3.0	2.5	2.3
Max Depth (ft)	4.0	3.2	3.5
Cross-Sectional Area (sq ft)	122.8	104.1	104.2
Width to Depth Ratio	13.7	16.9	19
Flood Prone Area Width (ft)	800+	45.6	56.6
Entrenchment Ratio	19.5	1.1	1.3
Low Bank Height	4.2	8.2	8.8
Bank Height Ratio	1.0	2.6	2.5
Channel Slope (%)	0.43	0.11	0.05**
Bed Material			
D50 (mm)	4*	15	7.2
D84 (mm)	190*	50	42
Threshold Grain Size (mm)	31*	7	3

**large woody debris counted as bed material*
***controlled by downstream culverts*

The geomorphic survey of the downstream river section included two cross sections, the first located about 400 feet downstream of the dam (Cross Section 2), and the second located about 1,300 feet downstream of the dam (Cross Section 3).

Just below the dam, at Cross Section 2, the river is deeply entrenched and laterally contained, with little to no floodplain access. The bankfull channel width is 41.9 feet, just slightly wider than the river upstream of the impoundment (Figure 31, Table 20). The river is shallower at this location, averaging 2.5 feet, with a width-to-depth ratio of 16.9. Cross sectional area is 104.1 square feet. Due to the severe entrenchment (1.1), the floodprone width is only slightly higher than the actual bankfull channel width; the river cannot flood out of its channel at this location. The river is classified as an “F” type of channel.

The streambed is comprised of 84% gravel and cobble, with a D_{50} of 15 mm and a D_{84} of 50 mm. The bed is relatively clear of finer sediments and evidence of fall-spawning salmon was evident. Because the cross section is located just below the dam and the channel is entrenched, the clean, coarse sediment should be expected. Despite the entrenchment and presumed lack of sediment delivery from upstream, the channel bed and banks are quite stable. Historic bank erosion was observed but is mostly healed.

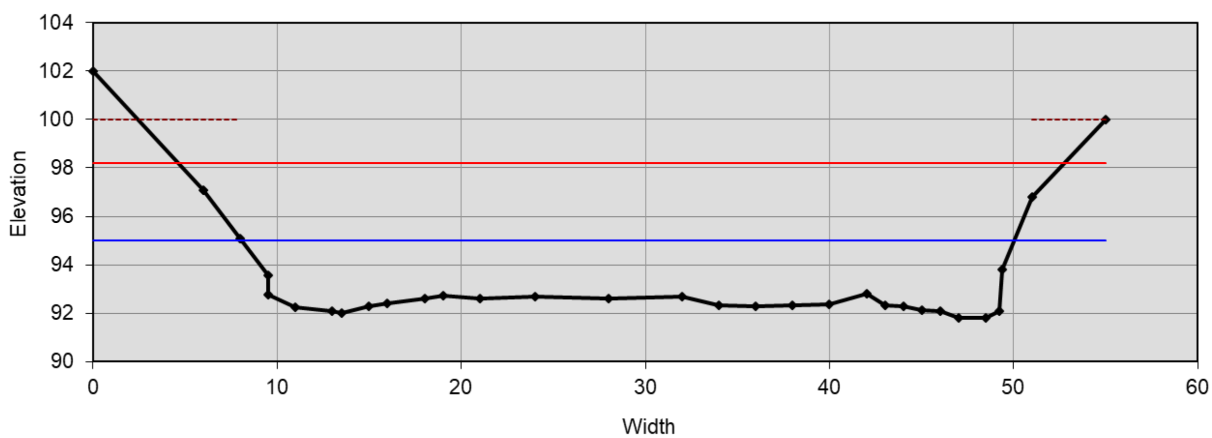


Figure 31. Cross Section 2 Data Associated with the Boyne River, 400 feet Downstream of the Dam. Bankfull (blue line), Low Bank (dashed line), Floodprone Width (red line)

A third cross section, Cross Section 3, was surveyed to determine if the morphology changes as the distance from the dam increases (Figure 32). However, the crossing of Dam Road is located about 580 feet downstream of Cross Section 3 and influences the shape and function of the stream channel at this location. The stream slope was measured at 0.05%, the lowest of the three survey locations.

The bankfull channel is 44.5 wide, but the cross-sectional area (104.2 sq. feet) is nearly identical to Cross Section 2, due to a shallower channel. Width-to-depth ratio is 19. The channel banks are slightly lower here, but the channel is still entrenched (1.3) and the floodplain is effectively disconnected from the river channel. The channel remains to be an “F” type stream.

The pebble count indicates that substrate is finer at this location compared to Cross Section 2, likely due to the decreased channel slope. The D_{50} is 7.2 mm and the D_{84} is 42 mm. The substrate consists of 70% gravel and cobble and 30% finer sediments.

Similar to upstream reaches, the channel banks and bed appear to be stable. The only notable signs of bank erosion are associated with angler access and foot traffic, but many of these sites are fixed, with signage indicating recent attempts at repair.

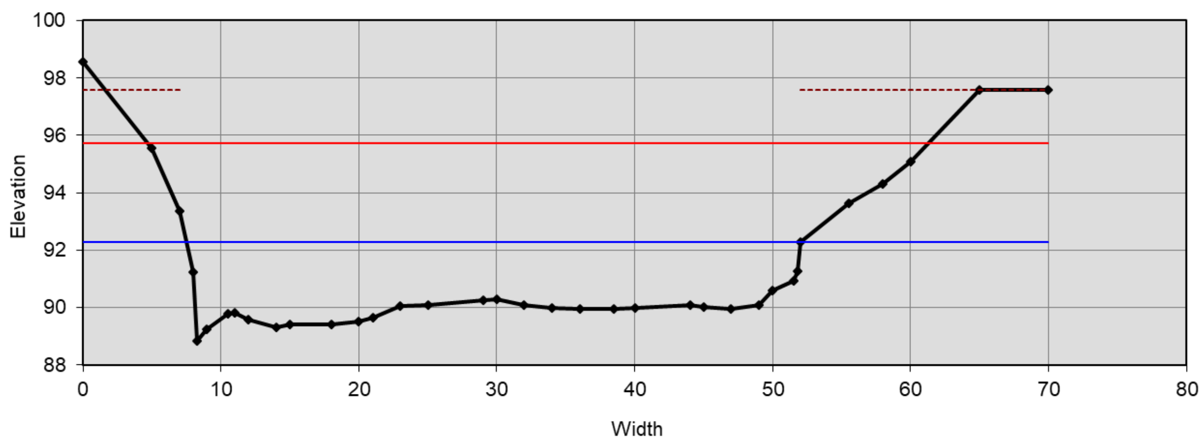


Figure 32. Cross Section Data Associated with the Boyne River 1,350 feet Downstream of the Dam. Bankfull (blue line), Low Bank (dashed line), Floodprone Width (red line)

The survey data show a considerable difference in channel morphology between the sites located upstream and downstream of the dam. Upstream, the channel is stable and winds through a wide, accessible floodplain. Downstream, the channel is confined within its channel banks, there is no functional floodplain and there is a notable decrease in stream slope. Stream slope is controlled between the dam and the culverts beneath the Dam Road crossing. Substrate downstream of the dam is coarse and indicative of the interruption in sediment transport caused by the dam and impoundment. Evidence of historic erosion suggests past instability, but the stream channel has stabilized over time. The streambanks are steep and high, but well-vegetated. Curently, the greatest threat to streambank stability appears to be impacts caused by human foot traffic.

Summary

- Physical habitat at the Upstream site scored 166/200 (excellent—nonimpaired) using the P51 metrics. The Downstream site scored 154/200 (good—slightly impaired) and was only one point shy of excellent.
- The survey data show a considerable difference in channel morphology between the sites located upstream and downstream of the dam. Upstream, the “C” type channel is stable and winds through a wide, accessible floodplain. Downstream, the “F” type channel is still stable, but confined within its channel banks, there is no functional floodplain and there is a notable decrease in stream slope.

1.7.5 IDENTIFICATION OF ESSENTIAL FISH HABITAT AS DEFINED UNDER THE MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT AND ESTABLISHED BY THE NATIONAL MARINE FISHERIES SERVICE

There are no recommendations from the National Marine Fisheries Service for the Boyne River, relative to Essential Fish Habitat, as defined under the Magnuson-Stevens Fishery Conservation and Management Act.

1.8 Floodplains, Wetlands, Riparian, and Littoral Habitat

A survey of aquatic and upland invasive species within the project boundary was completed in during the summer of 2018. The results of that survey are presented below.

1.8.1 Nuisance Plant Surveys

Method

Public Sector Consultants completed an assessment for the presence of invasive and non-native plant species on July 10 and 11, 2018, using meander searches, along approximately 2.5 miles of transmission corridor within the Project Area. The corridor was separated into five segments based on location, visible differences in plant communities, and adjacent land use (Figure 33). Meander searches were conducted on foot, and all plant species encountered were recorded, along with general notes on percentage covered by species (low, medium, or high). Photographs of each of the five corridor segments were also taken.

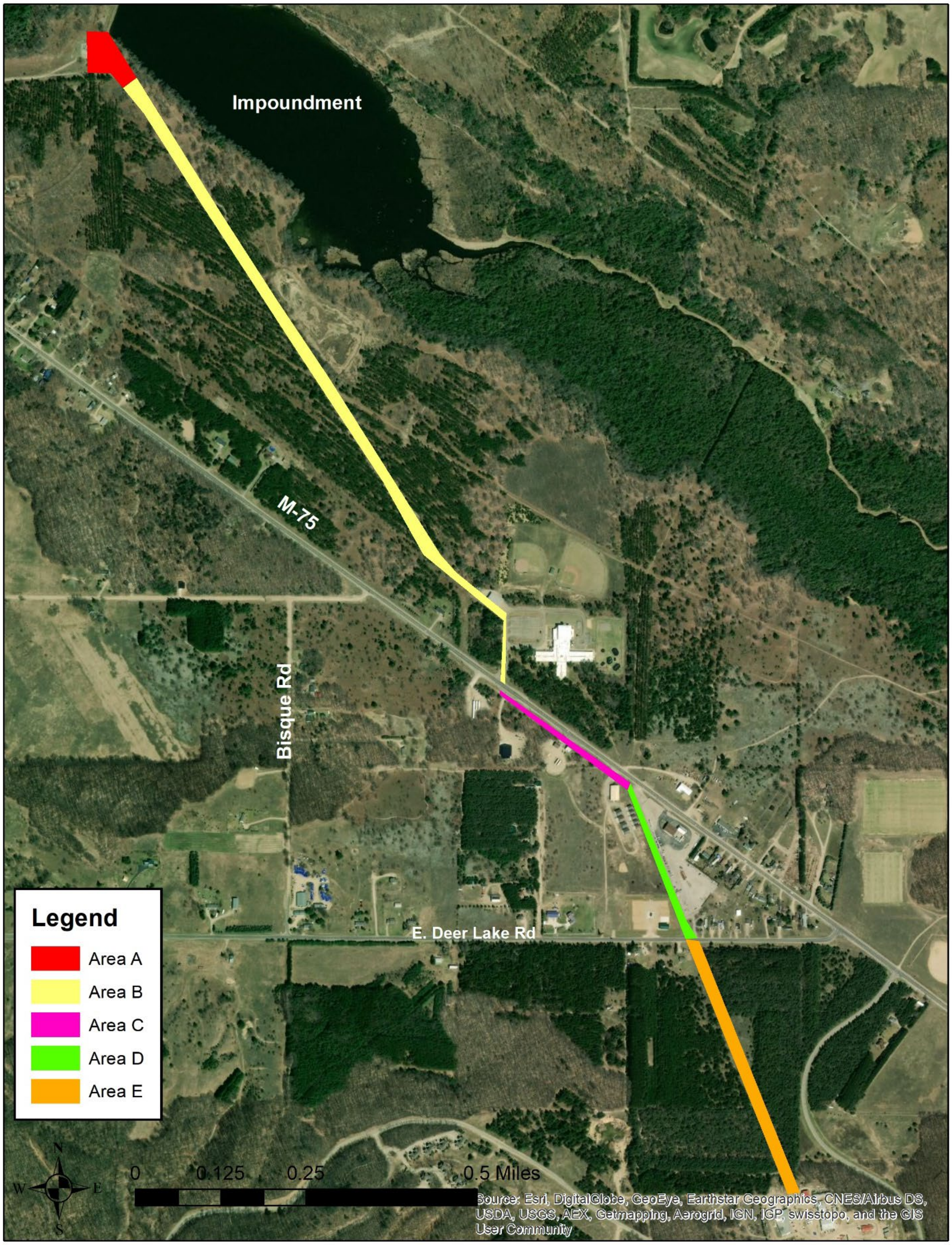


Figure 33. Transmission Corridor Areas Used for Vegetative Assessments

Results and Discussion

A total of 27 species of plant were identified within the transmission corridor (Table 21). Each of the five areas sampled (Figure 33) contain more introduced plant species than native (Table 22). Many of the introduced species are considered to be invasive, but only Autumn olive and spotted knapweed were noted as being somewhat invasive within the transmission corridor. These invasive plants are pervasive in Charlevoix County, and throughout lower Michigan, and their existence is not unique to the Project Area. Appendix E provides additional detail on plant species found in each sampling area.

Table 21. Plant Species Found within the Transmission Corridor

Common Name	Scientific Name	Native/Introduced
Autumn olive	*Elaeagnus umbellate*	Introduced
Black cherry	*Prunus serotine*	Native
Bouncing bet	*Saponaria officinalis*	Introduced
Bracken fern	*Pteridium aquilinum*	Native
Bull thistle	*Cirsium vulgare*	Introduced
Common milkweed	*Asclepias syriaca*	Native
Common mullein	*Verbascum Thapsus*	Introduced
Common sowthistle	*Sonchus oleraceus*	Introduced
Creeping bentgrass	*Agrostis stolonifera*	Introduced
Daisy fleabane	*Erigeron annuus*	Native
Hoary alyssum	*Berteroa incana*	Introduced
Horseweed	*Erigeron canadensis*	Native
Indian hemp	*Apocynum cannabinum*	Native
Little bluestem	*Schizachyrium scoparium*	Native
Quackgrass	*Elymus repens*	Introduced
Queen Anne’s lace	*Daucus carota*	Introduced
Red pine	*Pinus resinosa*	Native
Smooth brome	*Bromus inermis*	Introduced
Sneezeweed	*Helenium autumnale*	Native
Sorrel	*Rumex acetosella*	Introduced
Spotted knapweed	*Centaurea stoebe*	Introduced
St. John’s wort	*Hypericum perforatum*	Introduced
Staghorn sumac	*Rhus typhina*	Native
Sweet clover	*Melilotus spp.*	Introduced
Sweet William	*Dianthus barbatus*	Introduced
Trembling aspen	*Populus tremuloides*	Native
White pine	*Pinus strobus*	Native

Table 22. Numbers of Native and Introduced Plant Species Found within Each Assessment Area in the Transmission Corridor

Area	Native Plant Species	Introduced Plant Species	Total Plant Species
A	4	6	10
B	9	10	19
C	4	5	9
D	6	7	13
E	6	7	13

Summary

Invasive or nuisance species identified within the project area include:

- Spotted knapweed
- Autumn olive (considered to be invasive but is sparse within the project area)

1.8.2 Non-Native Invasive Plant Species Control

1.8.2.1 Impoundment and Riparian Corridor

Assessment for the presence of non-native, invasive plant species within the impoundment and riparian corridor of the Boyne River found only one species of potential concern within the impoundment; narrow-leaved cattail (*Typha angustifolia*). While this species is present in low numbers (with less than 5 percent aerial coverage), it is unknown when this species initially established or how long it has been present in the impoundment. Regardless, this species is highly invasive and has the potential to form dense monocultures, replacing native plants.

Recommended Controls

Numerous techniques have proven effective in controlling narrow-leaved cattail, with cutting and water level manipulation being cited as one of the more effective methods. However, fluctuations in water elevation within the impoundment are not subject to significant changes (storage or draw down) and are strictly a result of the run-of-the-river. Therefore, chemical treatments are recommended.

Given the low coverage of narrow-leaved cattail, hand treatment with an herbicide wick should be used to reduce impact to desirable native species. Application of glyphosate (for aquatic use) can occur any time the plants are green, but is most effective in late summer/early fall (2020), when the plants begin to store energy in the rhizomes (roots) to overwinter. The plants absorb the herbicide through the leaves and translocate to through the rhizomes, ensuring a thorough kill with long lasting results. Annual inspections after treatments should be conducted to identify annual treatment needs and effectiveness of applications.

Boyne USA is adopting these recommendations and will be implementing an annual inspection program with follow-up treatment as necessary starting in the fall of 2020. Starting in 2020 and thereafter, when indicated, A systemic herbicide (Glyphosate) will be used for targeted treatment of narrowleaf cattail, using backpack sprayers and a boat. The estimated annual cost of inspection and treatment is provided in Exhibit A.

1.8.2.2 Transmission Corridor

Approximately 55 percent of the species identified within the transmission corridor were non-native. However, with the exception of spotted knapweed (*Centaurea stoebe*), these species were generally present in low densities, often with only a few individual plants present. The majority of non-native plants were present in the southern portion of the corridor (south of Co. RD. C-48) where a portion of the transmission line parallels the county road, and travels south through an old sand and gravel filled corridor. Routine maintenance occurs (primarily cutting) within these areas and throughout the entire transmission corridor.

Considering the non-native species present, their densities within the corridor, and propensity to invade natural plant communities, spotted knapweed is the only species of concern, being highly invasive and difficult to control. However, spotted knapweed is also present in high densities within the surrounding lands and control would not only be difficult but require an ongoing, indefinite chemical treatment program (in part) not only within the corridor but also outside the corridor and outside properties under the control or ownership of Boyne. Therefore, programs to control non-native species within the transmission corridor are not recommended at this time.

1.8.3 Nuisance Animal Species

The following invasive or nuisance species were identified within the project area as mentioned in previous sections. They are:

- Rusty crayfish (not documented in Impoundment or Upstream site)
- Zebra mussel (not documented at Upstream site)
- Asiatic clam (not documented in Impoundment or Upstream site)

1.8.4 Map of wetlands, riparian and littoral habitat

The National Wetlands Inventory Map for the project area is provided in Figure 34. It shows areas of Freshwater Pond, Freshwater Forested Shrub Wetland (temporarily flooded), Lacustrine Limnetic (reservoir), and Freshwater Forested Shrub Wetland (seasonally flooded) and Emergent Wetland.

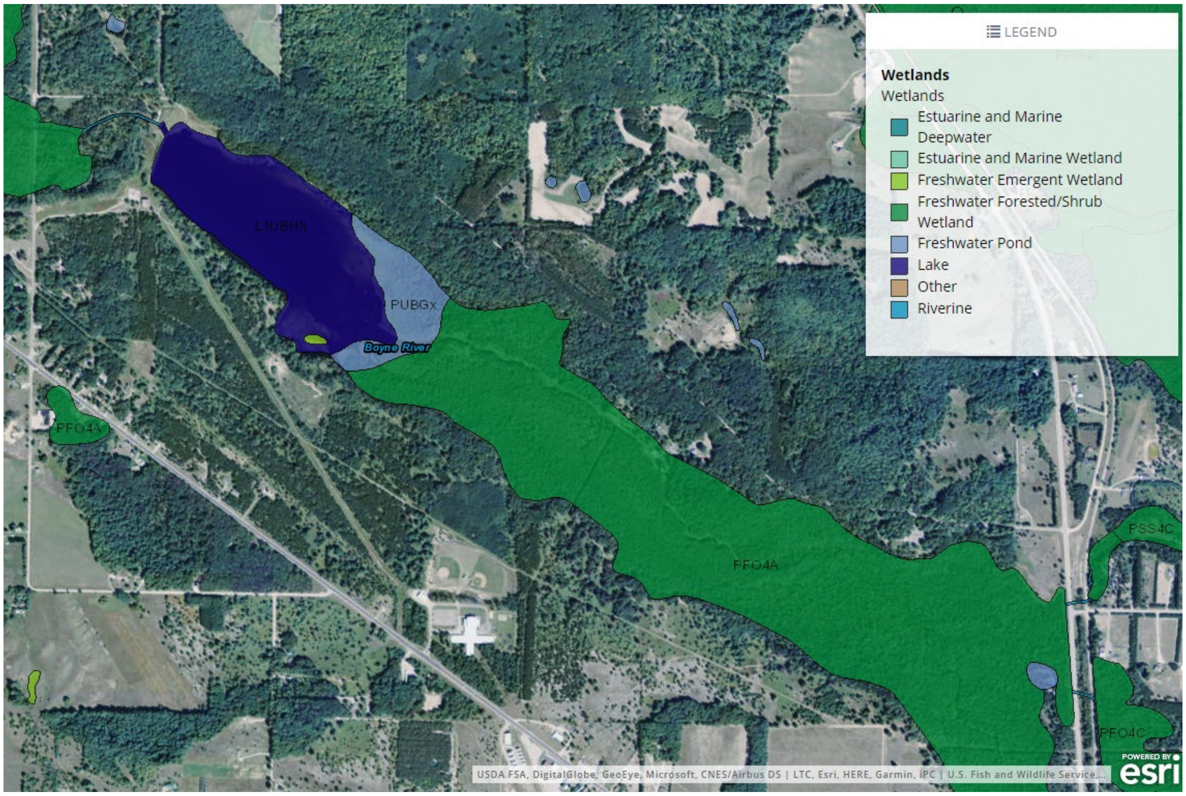


Figure 34. National Wetlands Inventory Map

1.8.5 Estimates of Acreage for Each Type of Wetland, Riparian, or Littoral Habitat

Wetland areas within the project boundary include a small island with Freshwater Emergent Wetland (approximately 0.4 acres), and irregular small fringes of areas classified as Freshwater Pond (National Wetlands Inventory Classification Code PUBGx indicating palustrine with unconsolidated bottom, intermittently exposed, excavated), (approximately 10.1 acres) and Freshwater Forested Shrub Wetland (Code PFO4A indicating palustrine, forested, needle-leaved evergreen, temporarily flooded), (approximately 1.3 acres) that is flooded for brief periods during the growing season. The impoundment itself has a classification of L1UBHh which is considered a lacustrine, limnetic, unconsolidated bottom, permanently flooded, impounded environment and covers an area of approximately 67.5 acres.

The area surrounding that portion of the Boyne River just upstream of Dam Road is classified as Freshwater Forested Shrub Wetland (Code PFO4C indicating palustrine, forested, needle-leaved evergreen, seasonally flooded), (approximately 1.2 acres). No specific surveys of riparian or littoral habitats have been identified.

With the run of the river operation of the Project continuing since the initial licensing of the project in 1982, and with minimal fluctuations of the impoundment level, no adverse impacts to any wetland, riparian or littoral habitats are anticipated for the continued operation or maintenance of the project.

1.9 Rare, Threatened, and Endangered Species

The Michigan Natural Features Inventory (MNFI), an extension office of Michigan State University, maintains the most comprehensive database on rare species and natural communities in Michigan. Table 23 provides a database listing of occurrences of threatened, endangered and special concern species in Charlevoix County. It should be noted that this is a list of occurrences that may have been recorded at any past time or at any location within the County. Charlevoix County has several miles of Lake Michigan shoreline that provides a unique habitat within the County. Many of the rare species listed in Table 23 are only found in this Lake Michigan dunes or shoreline habitat.

The following 50 plant and animal species are found in Charlevoix County. Each of these species is considered as one of the following: endangered, rare, or threatened.

***Table 23. Endangered, rare, and threatened species in Charlevoix County as identified in Rare Species Explorer*[19]**

(LE=Listed Endangered, LT=Listed Threatened, C=Candidate, PS=Partial Status, E=Endangered, T=Threatened, SC=Special Concern)

Scientific Name	Common Name	Taxonomic Group	State Status	Federal Status	Habitat / Community Type
Accipiter gentilis	Northern goshawk	Birds	SC	PS	Hardwood-conifer swamp Northern hardwood swamp Floodplain forest Boreal forest Mesic northern forest Dry-mesic northern forest Dry northern forest
Adlumia fungosa	Climbing fumitory	Flowering Plants	SC		Northern hardwood swamp Mesic southern forest Dry-mesic southern forest Mesic northern forest Northern bald Open dunes Sand and gravel beach Limestone cobble shore Granite bedrock glade Limestone bedrock glade Volcanic bedrock glade Limestone bedrock lakeshore Limestone lakeshore cliff Limestone cliff
Ammodramus savannarum	Grasshopper sparrow	Birds	SC	PS	Lakeplain wet prairie Lakeplain wet-mesic prairie Wet prairie Wet-mesic sand prairie Mesic sand prairie Mesic prairie Dry sand prairie
Appalachina sayanus	Spike-lip crater	Snails	SC		Rich conifer swamp Hardwood-conifer swamp Northern hardwood swamp Floodplain forest

[19] *Michigan Natural Features Inventory. Rare Species Explorer. "All Plants and Animals Located in Charlevoix County".* http://mnfi.anr.msu.edu/explorer/search.cfm

Scientific Name	Common Name	Taxonomic Group	State Status	Federal Status	Habitat / Community Type
					Mesic northern forest
Botaurus lentiginosus	American bittern	Birds	SC		Emergent marsh Great Lakes marsh Northern wet meadow Southern wet meadow Coastal plain marsh Lakeplain wet prairie Lakeplain wet-mesic prairie Wet prairie Wet-mesic sand prairie Northern fen Poor fen Coastal Fen
Bromus pumpellianus	Pumpelly's bromegrass	Flowering Plants	T		Open dunes Sand and gravel beach
Buteo lineatus	Red-shouldered hawk	Birds	T		Southern hardwood swamp Floodplain forest Mesic southern forest Dry-mesic southern forest Mesic northern forest Dry-mesic northern forest
Calypso bulbosa	Calypso or fairy-slipper	Flowering Plants	T		Rich conifer swamp Wooded dune and swale complex Boreal forest Dry-mesic northern forest Dry northern forest Great Lakes barrens Limestone bedrock glade Volcanic bedrock glade Volcanic bedrock lakeshore
Charadrius melodus	Piping plover	Birds	E	LE	Open dunes
Cincinnatia cincinnatiensis	Campeloma spire snail	Snails	SC		Headwater Stream (1st-2nd order), Riffle Headwater Stream (1st-2nd order), Pool Headwater Stream (1st-2nd order), Run Mainstem Stream (3rd-4th order), Riffle Mainstem Stream (3rd-4th order), Pool Mainstem Stream (3rd-4th order), Run Inland Lake, Littoral, Benthic Great Lake, Littoral, Benthic
Cirsium pitcheri	Pitcher's thistle	Flowering Plants	T	LT	Wooded dune and swale complex Great Lakes barrens Open dunes Sand and gravel beach
Coregonus artedi	Lake herring or Cisco	Fish	T		River (5th-6th order), Pool River (5th-6th order), Run Inland Lake, Pelagic, Midwater Great Lake, Pelagic, Midwater
Cottus ricei	Spoonhead sculpin	Fish	SC		Headwater Stream (1st-2nd order), Riffle Mainstem Stream (3rd-4th order), Riffle

Scientific Name	Common Name	Taxonomic Group	State Status	Federal Status	Habitat / Community Type
					Inland Lake, Littoral, Benthic Inland Lake, Pelagic, Benthic Great Lake, Pelagic, Benthic
Cypripedium arietinum	Ram's head lady's-slipper	Flowering Plants	SC		Poor fen Rich conifer swamp Rich tamarack swamp Hardwood-conifer swamp Wooded dune and swale complex Boreal forest Dry-mesic northern forest Dry northern forest Great Lakes barrens Granite bedrock glade Limestone bedrock glade Volcanic bedrock glade Volcanic bedrock lakeshore
Dalibarda repens	False violet	Flowering Plants	T		Mesic northern forest Dry-mesic northern forest
Drosera anglica	English sundew	Flowering Plants	SC		Interdunal wetland Prairie fen Northern fen Patterned fen Poor fen Bog Volcanic bedrock lakeshore Coastal Fen
Emydoidea blandingii	Blanding's turtle	Reptiles	SC		Submergent marsh Emergent marsh Great Lakes marsh Northern wet meadow Southern wet meadow Coastal plain marsh Wet prairie Wet-mesic sand prairie Prairie fen Northern fen Bog Rich conifer swamp Rich tamarack swamp Southern hardwood swamp Floodplain forest Inundated shrub swamp Mesic southern forest Mesic sand prairie Mesic prairie Dry-mesic prairie Coastal Fen
Euxoa aurulenta	Dune cutworm	Insects	SC		Wooded dune and swale complex Great Lakes barrens Open dunes Sand and gravel beach

Scientific Name	Common Name	Taxonomic Group	State Status	Federal Status	Habitat / Community Type
Falco columbarius	Merlin	Birds	T		Boreal forest Great Lakes barrens
Gallinula galeata	Common gallinule	Birds	T	PS	Emergent marsh Great Lakes marsh Coastal plain marsh
Gavia immer	Common loon	Birds	T		Emergent marsh Bog Inland Lake, Pelagic, Midwater Great Lake, Littoral, Benthic Great Lake, Littoral, Midwater Great Lake, Pelagic, Benthic
Gymnocarpium robertianum	Limestone oak fern	Ferns and Fern Allies	T		Rich conifer swamp Wooded dune and swale complex Boreal forest Mesic northern forest Limestone bedrock glade Limestone lakeshore cliff
Haliaeetus leucocephalus	Bald eagle	Birds	SC		Bog Poor conifer swamp Rich tamarack swamp Hardwood-conifer swamp Northern hardwood swamp Southern hardwood swamp Floodplain forest Mesic northern forest Dry-mesic northern forest Dry northern forest
Hydroprogne caspia	Caspian tern	Birds	T		Sand and gravel beach
Iris lacustris	Dwarf lake iris	Flowering Plants	T	LT	Interdunal wetland Northern fen Rich conifer swamp Wooded dune and swale complex Boreal forest Mesic northern forest Great Lakes barrens Open dunes Sand and gravel beach Limestone cobble shore Alvar Limestone bedrock glade Limestone bedrock lakeshore Coastal Fen
Littorella uniflora	American shore-grass	Flowering Plants	SC		Submergent marsh Emergent marsh Intermittent wetland Inland Lake, Littoral, Benthic
Microtus pinetorum	Woodland vole	Mammals	SC		Floodplain forest Mesic southern forest Dry-mesic southern forest Dry southern forest

Scientific Name	Common Name	Taxonomic Group	State Status	Federal Status	Habitat / Community Type
					Mesic northern forest Dry-mesic northern forest Bur oak plains Oak openings Oak barrens Oak-pine barrens
Mimulus michiganensis	Michigan monkey flower	Flowering Plants	E	LE	Emergent marsh Great Lakes marsh Northern wet meadow Rich conifer swamp Hardwood-conifer swamp Sand and gravel beach Headwater Stream (1st-2nd order), Pool Headwater Stream (1st-2nd order), Run
Myotis lucifugus	Little brown bat	Mammals	SC		
Myotis septentrionalis	Northern long-eared bat	Mammals	SC	LT	
Orobanche fasciculata	Broomrape	Flowering Plants	T		Wooded dune and swale complex Great Lakes barrens Open dunes
Pandion haliaetus	Osprey	Birds	SC		Hardwood-conifer swamp Northern hardwood swamp Southern hardwood swamp Floodplain forest Coastal Fen
Papaipema aweme	Aweme borer	Insects	SC		Interdunal wetland Open dunes Limestone cobble shore
Physella magnalacustris	Great Lakes physa	Snails	SC		Inland Lake, Littoral, Benthic Great Lake, Littoral, Benthic
Pinguicula vulgaris	Butterwort	Flowering Plants	SC		Interdunal wetland Northern fen Wooded dune and swale complex Sand and gravel beach Limestone cobble shore Alvar Limestone bedrock lakeshore Volcanic bedrock lakeshore Sandstone lakeshore cliff Volcanic lakeshore cliff Coastal Fen
Pisidium idahoense	Giant northern pea clam	Fingernail and Pea Clams	SC		Inland Lake, Littoral, Benthic Inland Lake, Pelagic, Benthic Great Lake, Littoral, Benthic Great Lake, Pelagic, Benthic
Planogyra asteriscus	Eastern flat-whorl	Snails	SC		Northern fen Rich conifer swamp Northern shrub thicket Coastal Fen

Scientific Name	Common Name	Taxonomic Group	State Status	Federal Status	Habitat / Community Type
					Limestone cliff
Potamogeton hillii	Hill's pondweed	Flowering Plants	T		Submergent marsh Emergent marsh Headwater Stream (1st-2nd order), Pool Headwater Stream (1st-2nd order), Run Mainstem Stream (3rd-4th order), Pool Mainstem Stream (3rd-4th order), Run Inland Lake, Littoral, Benthic
Pupilla muscorum	Widespread column	Snails	SC		Rich conifer swamp Mesic northern forest Limestone bedrock glade Limestone cliff
Pyganodon lacustris	Lake floater	Mussels	SC		Mainstem Stream (3rd-4th order), Riffle Mainstem Stream (3rd-4th order), Pool Mainstem Stream (3rd-4th order), Run Inland Lake, Littoral, Benthic Inland Lake, Pelagic, Benthic
Ranunculus cymbalaria	Seaside crowfoot	Flowering Plants	T		Intermittent wetland
Schoenoplectus torreyi	Torrey's bulrush	Flowering Plants	SC		Emergent marsh Intermittent wetland Coastal plain marsh Bog Inland Lake, Littoral, Benthic
Solidago houghtonii	Houghton's goldenrod	Flowering Plants	T	LT	Great Lakes marsh Interdunal wetland Northern fen Wooded dune and swale complex Open dunes Sand and gravel beach Limestone cobble shore Limestone bedrock lakeshore Coastal Fen
Somatochlora hineana	Hine's emerald dragonfly	Insects	E	LE	Emergent marsh Great Lakes marsh Northern fen Patterned fen Poor fen Bog Rich conifer swamp Headwater Stream (1st-2nd order), Pool Coastal Fen
Stagnicola contracta	Deepwater pondsnail	Snails	E		Submergent marsh Inland Lake, Littoral, Midwater Inland Lake, Littoral, Benthic
Stagnicola woodruffi	Coldwater pondsnail	Snails	SC		Inland Lake, Littoral, Benthic Great Lake, Littoral, Benthic
Stellaria longipes	Stitchwort	Flowering Plants	SC		Wooded dune and swale complex Great Lakes barrens Open dunes

Scientific Name	Common Name	Taxonomic Group	State Status	Federal Status	Habitat / Community Type
Sterna hirundo	Common tern	Birds	T		Sand and gravel beach
Tanacetum huronense	Lake Huron tansy	Flowering Plants	SC		Interdunal wetland Wooded dune and swale complex Great Lakes barrens Open dunes Sand and gravel beach Limestone cobble shore
Trimerotropis huroniana	Lake Huron locust	Insects	T		Great Lakes barrens Open dunes

Out of the list in Table 23, there are 11 species that are State and/or Federally listed as Threatened or Endangered, with recorded occurrences in Charlevoix County in the last ten years (after 2007). Of the 11 Threatened or Endangered species noted above, 8 require habitat that is only found in the Lake Michigan dunes or shoreline habitat. That leaves the following species that may be found elsewhere in the County:

Table 24. Potential Threatened or Endangered Species in Project Area

SCIENTIFIC NAME	COMMON NAME	STATE STATUS	FEDERAL STATUS
Gavia immer	Common loon	T	-
Somatochlora hineana	Hine's emerald dragonfly	E	LE
Myotis septentrionalis	Northern long-eared bat	SC	LT

Pertinent information about these species is provided below.

1.9.1 NORTHERN LONG-EARED BAT (*MYOTIS SEPTENTRIONALIS*)

The Northern long-eared bat is a species of bat native to North America and known to inhabit various parts of Charlevoix County. In April 2015, the USFWS declared the long-eared bat a threatened species after facing dramatic decrease in population due to fungal disease (white nose syndrome). This declaration had caused a delay in the construction of the first phase of the Boyne Valley Trail. Construction was delayed because of the potential disruption to the bats during pup-rearing season. The species is considered of special concern by the State and I Federally listed as threatened as of May 4, 2015. Because the Federal listing is rather recent it does not appear that a recover plan has been published yet.

The USFWS describes the summer habitat for the northern long-eared bat as follows:

"*During the summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities or in crevices of both live trees and snags (dead trees). Males and non-reproductive females may also roost in cooler places, like caves and mines. Northern long-eared bats seem to be flexible in selecting roosts, choosing roost trees based on suitability to retain bark or provide cavities or crevices. This bat has also been found rarely roosting in structures, like barns and sheds*" (USFWS).

On April 2, 2015, the USFWS proposed, in the Federal Register Vol. 80 No. 63, the Northern long-eared bat as "Threatened status with interim 4(d) rule for incidental take of Northern Long-eared Bats." Under the interim 4(d) rule, take incidental to certain activities conducted in accordance with the following habitat conservation measures, as applicable, will not be prohibited (*i.e.,* will be excepted from the prohibitions). For such take to be excepted, the activity must:

- Occur more than 0.25 mile from a known, occupied hibernacula
- Avoid cutting or destroying known, occupied roost trees during the pup season (June 1–July 31).
- Avoid clearcuts (and similar harvest methods, *e.g.,* seed tree, shelterwood, and coppice) within 0.25 mile of known, occupied roost trees during the pup season (June 1–July 31).
- Be less than one acre in size of contiguous habitat or one acre in total within a larger tract, whether that larger tract is entirely forested or a mixture of forested and non-forested cover types.

While there are no known occurrences of the bat within the project area, it is possible that suitable bat habitat does exist within the project area. Though there are no proposed activities (land clearing, tree cutting, etc.) that would alter bat habitat, if any tree cutting were to become necessary to clear power line corridors, or similar, the activity would take place outside of the active season of the northern long-eared bat (April 1 to October 31).

1.9.2 COMMON LOON (*GAVIA IMMER*)

The Common Loon is not federally listed, but it was designated as a threatened species by action of the Michigan legislature in 1987.

Common Loons are known to nest on sheltered islands on large, undeveloped inland lakes; however, they may nest in lakes as small as 11 acres (MNFI). Preferred nest sites are on small islands or bog mats, at the water's edge. Quiet, shallow, sheltered coves are important nursery areas for rearing chicks. Loons are sensitive to human disturbance during the breeding season and, during this time, it is recommended that activities within one-quarter of a mile from active nests are limited (MNFI).

Common Loons have been observed on the impoundment within the project area, but there have been no reported signs of nesting or juvenile birds. There are small, marshy islands located on the east end the impoundment, but they are more than one-half of a mile distant from any project-related activities. As such, no maintenance or construction activities would ever take place within one-half of a mile of any potential nesting sites.

1.9.3 HINE'S EMERALD DRAGONFLY (*SOMATOCHLORA HINEANA*)

The Hine's emerald dragonfly is listed as a federally and state endangered species and is considered "critically imperiled" in Michigan. Its rarity is due, in large part, to its very specific habitat needs.

According to MNFI, the Hine's emerald dragonfly requires "graminoid (e.g. grasses, sedges, rushes) dominated wetlands which contain seeps, or slow-moving rivulets; cool, shallow water slowly flowing through vegetation; and open areas in close proximity to forest edge. The shallow, flowing, cool water provides important larval habitat and the open areas with adjacent woodland edge provide adult hunting and roosting habitat. Michigan Hine's emerald dragonfly sites could be classified as calcareous wetlands or northern fens with an underlining layer of shallow dolomite". More specifically, a depositional pool is needed in a first or second order headwater stream.

The original recovery plan for the Hine's emerald dragonfly was prepared in 2001[20]. That plan listed the presence of the animal at ten sites within Mackinac, Presque Isle and Alpena Counties. Later, in May 2013, the USFWS listed additional sites where the animals were discovered in the intervening years since the original plan was prepared. This included one site in Charlevoix County, on Garden Island, where an adult male Hine's emerald dragonfly was found on August 5, 2011. This is presumed to also be the one occurrence listed in the MNFI database for Charlevoix County in 2013 (the year of the USFWS report).

The habitat described for the Hine's emerald dragonfly does, generally, exist within the project area. There is cool, flowing water with open and forest edge habitat associated with the Boyne River; however, there are no first or second order headwater streams, calcareous wetland, northern fens or underlying dolomite known to occur within the project area. This project will not impact the Hine's emerald dragonfly since suitable habitat does not exist within the project area.

State Species of Special Concern

Out of the list in Table 24, there are seven species with the State designation of "Special Concern", for which there were recorded occurrences in Charlevoix County in the last ten years (after 2007). These are as follows:

Table 25. Species of Special Concern by the State of Michigan

SCIENTIFIC NAME	COMMON NAME	STATE STATUS	FEDERAL STATUS
Drosera anglica	English sundew	SC	-
Haliaeetus leucocephalus	Bald Eagle	SC	-
Pinguicula vulgaris	Butterwort	SC	-
Pyganodon lacustris	Lake floater	SC	-
Stagnicola woodruffi	Coldwater pondsnail	SC	-
Tanacetum huronense	Lake Huron tansy	SC	-
Emydoidea blandingii	Blanding's turtle	SC	-

There is no corresponding Federal status for these species. Specific information about these species and their habitat can be obtained by accessing the Michigan Natural Features Inventory Online Rare Species Explorer[21] search tool then selecting only the State Status of "Special Concern" and selecting "Charlevoix County". A table of the Special Concern species will come up with links to information about each species in the table.

[20] *The U.S. Fish and Wildlife Service. " Hine's emerald dragonfly (Somatochlora hineana) Recovery Plan". https://www.fws.gov/midwest/endangered/insects/hed/pdf/hedplan.pdf*

[21] *Michigan Natural Features Inventory. Rare Species Explorer. "All Plants and Animals Located in Charlevoix County". http://mnfi.anr.msu.edu/explorer/search.cfm*

1.10 SUMMARY OF ENVIRONMENTAL STUDY FINDINGS

Table 26. Summary of Findings, Boyne River Hydroelectric Project, 2018

	Upstream	Impoundment	Downstream	Transmission Corridor
Water Temp Monitoring				
Mean July Temp. (F)	62.4		67.8	
Thermal Classification	Cold		Cool	
DO Monitoring				
Meeting Water Quality Standards (%)	92*		100	
Aquatic Survey				
Fish Community Meeting Coldwater Standard	Yes		Yes	
Fish Community	6 native species 2 non-native species 0 invasive species	13 native species 0 non-native species 0 invasive species	9 native species 4 non-native species 0 invasive species	
Macroinvertebrate Community	Acceptable (2)		Acceptable (0)	
Physical Habitat	Excellent (166/200)		Good (154/200)	
Freshwater Mussel Community	0 species	3 native species 1 invasive species	3 native species 2 invasive species	
Non-native/Invasive Species	Rainbow trout Brown trout	Zebra mussel** Narrowleaf cattail**	Rusty crayfish** Zebra mussel** Asiatic clam** Coho salmon Chinook salmon Rainbow trout Brown trout	Autumn olive Bentgrass Bouncing bet Bull thistle Common mullein Common sowthistle Hoary alyssum Quackgrass Queen Anne's lace Smooth brome Sorrel Spotted knapweed** St. John's wort Sweet William White sweet clover

**Most likely due to logger malfunction*
***Highly invasive*

1.11 RECREATION AND LAND USE

The Project boundary includes approximately 116 acres of which 68 acres are open water (the reservoir). The remaining uplands include the transmission line running from the Project powerhouse to the Boyne Mountain Resort complex, a narrow band of undeveloped shoreline bordering the reservoir, and the land bordering both sides of the river downstream of the powerhouse to Dam Road, utilized for public recreational access.

1.11.1 NATIONAL WILD AND SCENIC RIVER SYSTEM (NATIONWIDE RIVERS INVENTORY)

The Nationwide Rivers Inventory (NRI), that is maintained by the National Park Service, lists more than 3,400 free-flowing river segments in the United States that are believed to possess one or more "outstandingly remarkable" natural or cultural values judged to be at least regionally significant. Hence, these rivers are potential candidates for inclusion in the National Wild and Scenic River System[32].

In Michigan, river segments totaling 656 miles have been designated Wild, Scenic or Recreational under the National Wild & Scenic Rivers Act (PL 90-542 - 1968; 16 U.S.C. 1271 et seq.). The designated rivers in Michigan include segments of the following rivers:

- AuSable River
- Bear Creek
- Black River
- Carp River
- Indian River
- Manistee River
- Ontonagon River
- Paint River
- Pere Marquette River
- Pine River
- Presque Isle River
- Sturgeon River (Hiawatha National Forest)
- Sturgeon River (Ottawa National Forest)
- Tahquamenon River (East Branch)
- Whitefish River
- Yellow Dog River

The Boyne River is not listed in the NRI and is not considered eligible for listing under the Wild & Scenic Rivers Act.

1.11.2 State Protected River Segment

Michigan's Natural Rivers Program "was developed to preserve, protect and enhance our state's finest river systems for the use and enjoyment of current and future generations by allowing property owners their right to reasonable development, while protecting Michigan's unique river resources".[22]"Currently 2,091 miles of river and streams are designated as state Natural Rivers under authority of Part 305, Natural Rivers of PA 451 of 1994".[23] The Boyne River is not on the State's list of Natural Rivers and has not been proposed for designation.

1.11.3 Description of Project Lands Under Study for Inclusion in the National Trails System or as a Wilderness Area

The National Trails System Act of 1968, as amended, calls for establishing trails in both urban and rural settings for people of all ages, interests, skills, and physical abilities. The act promotes the enjoyment and appreciation of trails while encouraging greater public access. The North Country National Scenic Trail is the only designated National Trail in Michigan. The nearest location of the designated North Country Trail route is about five miles east of the Boyne Hydro Project. The Project has no effects related to the North Country Trail.

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[22] *Michigan Department of Natural Resources. "Michigan's Natural Rivers Program".*

http://www.michigan.gov/dnr/0,4570,7-153-10364_52259_31442-95823--,00.html

[23] *ibid*

Michigan contains 16 federally protected wilderness areas totaling 291,307 acres. The closest federally designated wilderness areas to the Boyne River Project are Sleeping Bear Dunes National Lakeshore, about 60 miles southwest of the Project, and Nordhouse Dunes, about 105 miles southwest of the Project, both areas border Lake Michigan. There are no additional areas currently under study for protection as federally designated wilderness in Michigan, including the Boyne River Project.

1.11.4 Regionally or nationally important recreation areas

There are no regionally or nationally important recreation areas within the Project boundaries. Boyne Mountain Resort, located adjacent to the Project is a regionally recognized skiing and golf resort. Several outdoor recreation sites that attract visitors regionally are located downstream of the Project on Lake Charlevoix, notably Young State Park, a 560-acre State Park with 240 campsites and a wide variety of outdoor recreation activities.

1.11.5 Non-recreational land use and management within the Project Boundary

This section is a description of land ownership and land use within the Project Boundary and supplements the Exhibit G map. The following descriptions are organized by land ownership (please refer to Figure 3 of this document, or Exhibit G, for a map of property ownership):

Boyne USA

Boyne USA owns most of the property within the Project Boundary. The property can be categorized as follows:

- Dam and Reservoir
  - The dam and reservoir are used for the operation and maintenance of the Project. This includes the embankments, the spillways, the penstocks and powerhouse. The reservoir provides the hydraulic head for means of power generation.
- River- Dam to Dam Road
  - The river from the discharge of the dam down to Dam Road is a natural area. As described in other sections, it provides for public recreation, mostly used by those wishing to fish the river.
- Power Transmission Corridor (approximately 2.5 miles long)
  - Boyne USA owns most of the transmission corridor, except that described elsewhere within this section. The corridor is used of course by the Project to convey power from the powerhouse to the Boyne Mountain Resort.
  - As described in other sections, the Licensee has also agreed to allow access to a section of the Project transmission line for the construction of a recreation trail.
  - A portion of the power transmission corridor is shared with other utilities.
  - A small section of the transmission corridor at the Boyne Mountain Resort is used for green space and driveway crossings.

Boyne Valley Schools

A small portion of the power transmission corridor is owned by the Boyne Valley Schools. This segment is about 500 feet in length. Boyne USA has an easement from Boyne Valley Schools for this portion of the Project along the southwesterly property line of the school property. The easement is within the property margin known as a setback area, within which no structures can be constructed. The easement is currently green space and is separated from the school campus by approximately 275 feet of forest.

Michigan Department of Transportation (MDOT)

The project power transmission line crosses, then follows within and parallel to, the southerly line of the MDOT M-75 State Trunkline Highway public road right-of-way for a distance of about 1,600 feet.

Consumers Energy

A very small parcel of land at the terminal end of the power transmission corridor is owned by the utility company, Consumers Energy. The parcel of land serves as a substation for utility power service to the Boyne Mountain Resort and is also the tie-in location of the power being transmitted from the Project. From this substation location, a combination of utility and Project power is distributed to the Boyne Mountain Resort.

1.11.6 Non-Recreational Land Use and Management Adjacent to the Project Boundary

The area surrounding the project is zoned as Agricultural/Forests (see Figure 2, above) with forest being the predominant land use with scattered residences. Forests are managed for timber, firewood and as natural areas. There are also areas of Rural Residential (minimum lot size 1 acre) and Single Family Residential (minimum lot size 20,000 square feet) zoning nearby. To the south of the project, Boyne Mountain Resort occupies a large area of land that is zoned as Resort Mixed Use. There is also scattered Commercial and Conservation Reserve zoning in the area.

1.11.7 Project Recreation Facilities

Under the current FERC license, the Licensee provides facilitated access to both the north and south side of the tailwater, from the hydro plant downstream to Dam Road, the nearest public road, a distance of approximately ¼ mile. These sites are located within the Project boundary, as shown on Exhibit G. These North and South Tailwater sites are primarily used for fishing, but also for walking / hiking / sightseeing activities.

Public access on both sides of the river is provided by developed pathways with stairways located periodically to facilitate user access to the river and help to prevent erosion. The North Tailwater Project recreation site includes six raised stairway locations along the ¼ mile pathway, while the South Tailwater Project recreation site has four raised stairway locations. Both sites have additional terraced in-ground erosion control – stairway structures to facilitate river access, as well as other erosion control measures (e.g. rip-rap) to address erosion that is primarily related to user activity. A trash barrel, along with signage that provides user information and resource protection messages are also maintained by the Licensee. Project recreational sites along the river, parking along Dam Road and the DNR property downstream of Dam Road are shown in Figure 35.

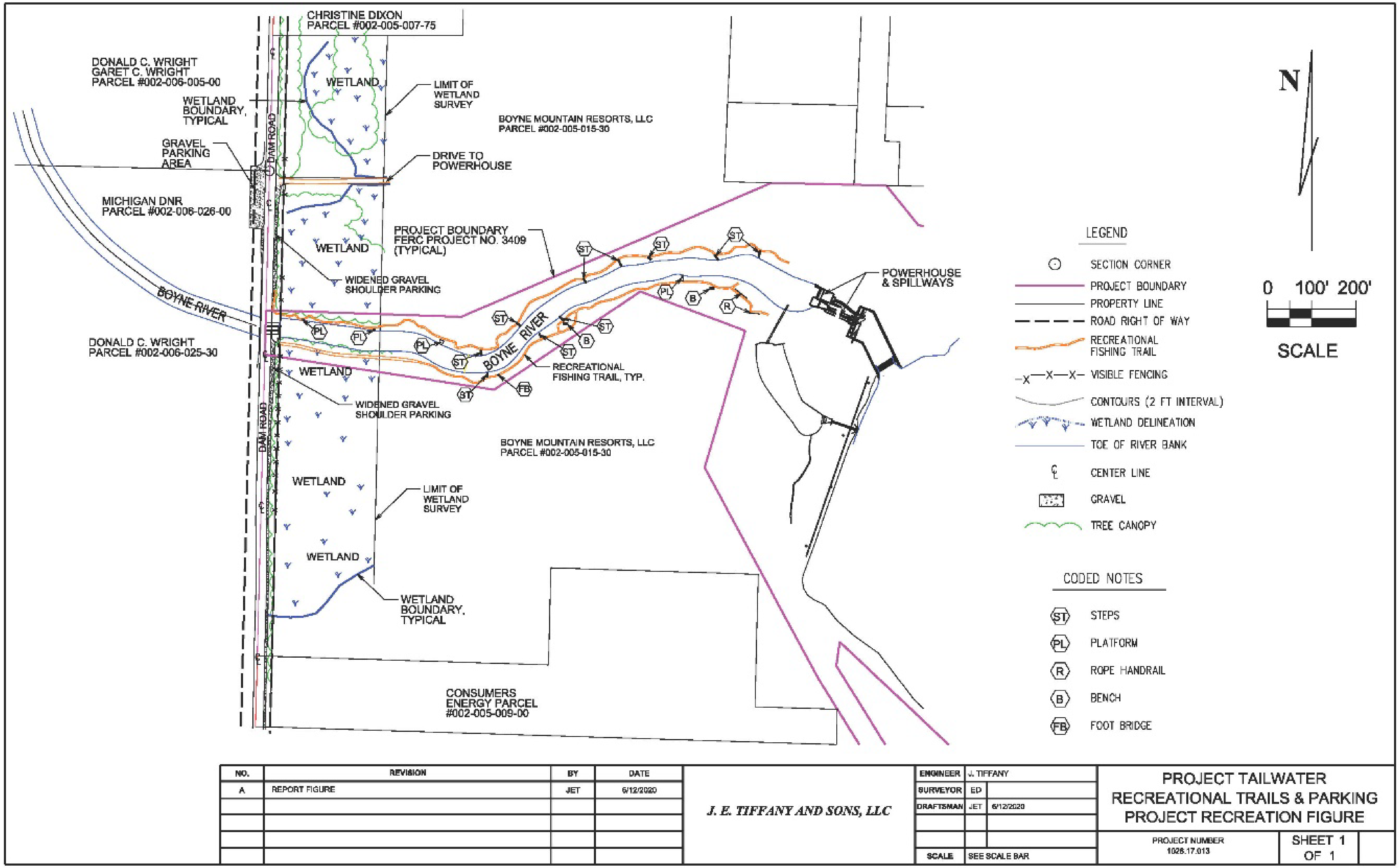

Figure 35. Project Tailwater Access Parking / Wetlands Delineation Sketch

1.11.8 Non-Project Recreation Facilities Within and Adjoining the Project

Immediately adjoining the Project tailwater access sites on the downstream (west) side of Dam Road is additional fishing access to the Boyne River on Michigan State Forest land managed by the Michigan Department of Natural Resources (MDNR). Anglers move back and forth between the Project tailwater access and the downstream State Forest access. The MDNR does not provide any amenities to facilitate public access at the State Forest land site, and there is no signage to indicate its availability for public use, but most anglers who utilize the Boyne River in this area are aware of the MDNR property. The MDNR property is discussed further in the Recreation Resources Study Report (RRSR) (Appendix B).

The State Forest land also includes the location for 15 parking spaces utilized by visitors to the Project tailwater sites and the downstream State Forest land. The parking is located within the Charlevoix County Dam Road right-of-way (R-O-W), was developed and is maintained by the Charlevoix County Road Commission. The county R-O-W for Dam Road is 66 feet wide, 33 feet from the centerline on each side, which is typical of county R-O-W in Michigan. The parking area extends approximately 20 feet deep beyond the paved Dam Road edge and runs for approximately 140 feet along Dam Road to the north boundary of the State Forest land. Figure 35 provides a sketch of the parking area.

The Licensee has also recently agreed to allow access to a section of the Project transmission line for the construction of a recreation trail, as shown on the annotated Exhibit G Map in the RRSR (appendix B). The trail project is being constructed as part of Boyne City's recreation development efforts. The trail project will create a 10-foot wide paved trail for non-motorized use. The 7.2 miles trail will connect Boyne City, located downstream of the Project, with Boyne Falls, located upstream of the Project. Construction of the $1.8 million trail, which is being funded through various grants and community sources, began in 2019 and completion is targeted for summer 2020. Approximately 0.38 miles (2,000 feet) will be located within the Project, along the existing transmission line corridor. The Licensee did not charge any fee for access to the transmission corridor land and will not have any management or maintenance responsibility for the trail.

1.11.9 Existing and Potential Project Recreation Use Estimate

The Licensee conducted a recreation use survey between July 1, 2018 and October 31, 2018

to develop an estimate of the amount of use occurring at Project recreation sites within the

Boyne Project boundary. Additional daily vehicle count observations from May 1 through October 31, 2017, and March 1 through April 30, 2018, made by the Licensee, were also incorporated into the use estimate. These latter observations were made by the Licensee for the purpose of completing the 2017 FERC Form 80 Recreation Use reporting requirement, for which Boyne had been granted an extension of time to August 31, 2018.

It should be noted that Licensee staff did not attempt to separate out those who had vehicles parked along Dam Road, but may have been fishing downstream of the road on the Non-Project MDNR State Forest parcel. Indeed, users typically move back and forth upstream and downstream of Dam Road while fishing this river stretch, often wading to work various portions of the stream. As a result, many of the anglers are utilizing both the Project Tailwater sites and the non-Project MDNR River access during the same visit. The survey methods are discussed further in the RRSR (Appendix B).

Table 27 summarizes recreation use observations recorded by the Licensee. The North and South Boyne Tailwater sites are used consistently outside the winter snow covered season from mid-April through the end of October. They are particularly popular with fisherman in the fall, and to a lesser extent spring, salmonid spawning migration periods; but they also attract anglers seeking brown trout and other stream resident species throughout the remainder of the spring, summer and fall.

Table 27. Recreation Use Observations (Number of Anglers Observed)

Month		North Tailwater	South Tailwater	Total
April 2018	Weekdays – 21	25	24	49
	Weekend/Holiday – 9	9	9	18
May 2017	Weekdays - 23	95	94	189
	Weekend/Holiday – 8	62	62	124
June 2017	Weekdays – 22	104	104	208
	Weekend/Holiday – 8	35	34	69
July 2018	Weekdays – 21	56	56	112
	Weekend/Holiday - 10	11	9	20
August 2018	Weekdays – 22	19	13	30
	Weekend/Holiday - 9	28	19	49
September 2018	Weekdays - 19	90	83	173
	Weekend/Holiday - 11	84	90	174
October 2018	Weekday - 23	108	86	194
	Weekend/Holiday – 8	20	20	40
TOTAL	214 Days	746	703	1449

The once daily point-in-time use observations, shown in Table 27, above, are estimated to have captured about one-third of the total visitors on any given day. This would include many users who may fish for one part of the day and then depart the site and return later in the same day. These would be counted as separate site use visits, following FERC Form 80 protocol. In its most recent Form 80 Recreation Use Report filed 8/26/2018, Boyne estimated total daytime use of 5,200 visits.

Based on the conclusion of Recreation Study personnel that the study period use observations captured about one-third of the daily site use, and recognizing that use also occurs outside the primary April to October period, 5,000 daytime visits is believed to be a sound estimate of Project use. Occasional nighttime fishing also occurs, but is limited at the site. Nighttime use is estimated to be about 10 percent of the daytime use, or 500 visits.

The peak use periods are associated with the spring and fall salmonid spawning migration, as indicated by the observations shown in Table 27, September's 347 users is the highest number of users observed for any month, equating to a total September visitor estimate of 1,041 users (3 x 347); followed by May's 313 users, equating to an estimated 939 visitors (3 x 313) during that month.

The Boyne River is located within the 1836 Ceded Territory pursuant to Native American treaty rights; and the Little Traverse Bay Bands of Odawa Indians (LTBB) retains the rights to hunt, fish and gather within that territory. Tribal members consider the Boyne Tailwater to be an important location for Fall salmon harvest activity (personal communication Lauren Dey, LTBB Water Quality Technician).

The potential capacity of the Project Tailwater Access sites is based on the recreation use measure, PAOT (People At One Time), historically used by the USDA – Forest Service as a measure of a site's capacity. The site's PAOT capacity has been developed based on the assumption that it could accommodate an angler every 50 feet without causing an unreasonable level of user conflict. The two, one-quarter mile trails (North and South Tailwater) added together total 2,640 feet, indicating the Project recreation sites could accommodate 52 people at one time, 26 on each side of the river (2,640' / 50'). Using this capacity measure and its use observations, the Licensee reported an average non-peak weekend use level of 42% on the 8/26/2018 Form 80 Recreation Report. This indicates adequate site capacity to accommodate additional use if demand warrants.

1.11.10 Proposed Project Recreation Measures

Boyne proposes to continue to make the North and South Tailwater Access sites available under a new FERC license as Project recreation facilities. Maintaining access to the existing Project Tailwater recreation sites by Boyne Hydro provides a significant recreational use benefit to the public.

1.11.11 Licensee Costs to Construct, Operate, and Maintain Recreation Use Facilities

Currently, the Licensee spends an estimated $5,000 annually to maintain the Tailwater access sites. These costs include access trail maintenance to remove deadfalls, etc., trash removal, fencing and signage maintenance for user safety and powerhouse protection, use monitoring and other incidental recreation access related activities.

These costs are not all routine, recurring expenses. More fence work, or work on the trails or stairway sites may be needed in any single year. The Licensee expense is an estimate of the average cost based on past experience. Removal of trash and maintenance of the trash barrels, sign maintenance, and recreation site monitoring are routine, recurring costs incurred by the Licensee. The Project Tailwater sites are open and used by the public from April through October, at a minimum, and in some years used in March and November also.

These costs are expected to be similar for providing the proposed Project recreation facilities and no additional major construction is proposed.

1.11.12 Agency Recommended Measures For Recreation

The MDNR (ltr 12/26/2019), USFWS (ltr 12/20/2019) (the Agencies) and MHRC (ltr 12/27/2019) recommend that the Licensee construct a parking lot for 30 vehicles that includes two spaces designed for disabled access and a toilet facility.

As discussed in section 1.9.9 above and in detail in the RRSR Section 4.3, parking for the Project Tailwater Access and the State Forest land downstream of the Project is provided for in an area that accommodates 15 vehicles within the Dam Road R-O-W, which is under the jurisdiction of the Charlevoix County Road Commission. The MDNR / MHRC requested that the Licensee include an analysis of the Tailwater Access parking in the RRSR, but did not propose specific parking construction measures at that time.

During the recreation resource study period, the existing parking capacity was insufficient to provide for all the vehicles present on 8 days of the 123-day study period (6% of the time). On these occasions, when the visitor use exceeds the available parking spots, users park along the upstream shoulder (east side) of Dam Road. The Road Commission has augmented the gravel shoulder along the east side of Dam Road so that users can safely park along that area. At the same time, the Road Commission has installed signage that prohibits parking along the downstream shoulder (west side) of Dam Road, with the exceptions of the widened 15-space parking area described above. These measures ensure there is adequate room for safe passage of traffic. The existing tailwater parking is provided in Figure 35 in Section 1.11.7.

The Agency / MHRC recommendations state that because the parking area is not within the Project Boundary, the Licensee must develop a separate parking area that is subject to FERC control. The

Licensee notes that FERC regulations at 18CFR §2.7 (d) *encourage governmental agencies and private interests, such as operators of user-fee facilities, to assist in carrying out plans for recreation, including operation and adequate maintenance of recreational areas and facilities*.

The construction of a new parking area on the upstream side of Dam Road, as now requested by the Agencies / MHRC in the comments on the DLA, would likely involve a loss of wetlands, as nearly all of the Licensee owned property on the upstream (Project) side of Dam Road has been delineated as forested wetlands in a recent survey performed for the Licensee. The forested wetlands habitat along Dam Road, both north and south of the Boyne River, is shown on Figure 35 in Section 1.11.7

The Agency / MHRC proposed 30-vehicle parking area would involve a construction area of approximately 11,500 square ft. This includes two 15-vehicle space rows 9.5' wide by 25' deep, positioned across from each other and a center ingress / egress aisle of similar 25' width, together with an entrance area off Dam Road. Cost for this Agency / MHRC measure, without consideration of any potential additional wetland mitigation expense is estimated at approximately $57,400, as shown in Table 28, below. Additional Licensee cost would be incurred for ongoing maintenance of the vault toilet building, including weekly cleaning and toilet paper stocking.

Table 28. Construction Costs for 30 Vehicle Parking Per Agency / MHRC Request

Item	Unit of Measure	Cost per Unit	# of Units	Cost
Clearing & Grubbing	Sq Ft	$ 0.50	11,500	$ 5,750
Deliver, place, spread 6" gravel	Sq Ft	$ 2.00	11,500	$ 23,000
Install 2 concrete ADA spaces	Sq Ft	$ 5.00	575	$ 2,875
Concrete Parking Bumpers	Ea	$ 60.00	30	$ 1,800
Construct ADA Vault Toilet Bldg	LS	$10,000.00	1	$ 10,000
ADA parking signs / space striping	LS	$ 500.00	1	$ 500
Permits	LS	$ 2,000.00	1	$ 2,000
SUBTOTAL				$ 45,925
Engineering, Design, Const Eng	LS		25%	$ 11,480
TOTAL				$ 57,405

The existing parking area has adequately served the Project Tailwater access during the term of the current license. The Project recreation sign (see RRSR – Appendix B, P.9) informs users that this is a FERC Project recreation site and that more information can be obtained at the Boyne Mountain Resort. Boyne Resort staff has not received any user requests for installation of additional, or replacement, parking; and MDNR provides no facilities of this nature to serve its downstream access area adjacent to the Project. It should also be noted that the Road Commission allows fishing to occur from the Dam Road – Boyne River bridge, and that this is the most suitable location for disabled access to the fishery. Installing a new parking area farther away from the bridge with ADA parking spaces would not enhance disabled access to the fishery.

There is no basis for concluding that the existing parking area will not continue to adequately serve the public access function associated with the Boyne Project; or to conclude that the Charlevoix County Road Commission will discontinue allowing this parking use in the county road R-O-W.

The Agencies / MHRC also recommend that access be provided to the impoundment. "*We have no objection to the facilities being small and rustic in nature. We suggest that at a minimum the impoundment access should include an ADA accessible shore fishing or fishing pier opportunity and at a minimum a canoe\kayak carry down launch site. Parking for at least 4 vehicles with 1 ADA compliant spot should be included."* (MDNR Ltr. 12/29/2019). "*MHRC feels that the cost of developing public access that is described in the RRSR represents intensive, high level development ("major public use infrastructure")."* (MHRC ltr 12/27/2019). The comments provided suggest that the Licensee cost estimate for developing access to the reservoir were unrealistically high.

In comments submitted for the RRSR. The MDNR / MHRC requested that "*the recreation study review the potential for expanding recreational access opportunities to include access to the impoundment for shore fishing, kayaking and a small boat launch*." (MDNR Ltr 8/31/2017). As is discussed in the RRSR – Section 6.3, there are no public roads that lead to the Project reservoir; and there has never been public access to this area. Staff access to the powerhouse area is by means of a gated, native (sand) surfaced two-track route. While this route is suitable for staff access use one or two times per day, it is not suitable for opening to the public. Upgrading this access route to accommodate the general public is the "major public use infrastructure' that the Licensee referred to in the RRSR as being necessary for developing public access to the reservoir. Necessary upgrade of the sand two-track route in order to make it safe and suitable for public use would have to be undertaken by the Licensee.

In developing the $250,000 cost estimate included in the RRSR for the proposed reservoir access, the Licensee assumed costs that included an 18 foot wide access road for two-way vehicle traffic, parking for 10 vehicles, including an ADA paved space, a concrete launch ramp for small boats with an accessible skid pier, a vault toilet building, fencing, ADA pathways, permits, engineering and design, and other miscellaneous costs. In their comments on the DLA, the Agencies / MHRC have suggested that a lower level of developed access is now recommended, but added recommendations for an accessible fishing pier and a canoe / kayak launch.

Accordingly, the Licensee has reduced the access road estimate to reflect a single lane road with 50-foot turnouts every 300 feet to allow vehicle passage, reduced the size of the parking area, and eliminated the vault toilet and the concrete launch ramp in favor of an accessible canoe / kayak launch. Substantial new fence installations would still be needed. The fencing is for protection of the powerhouse and powerhouse intake areas for public safety and critical energy infrastructure protection purposes, along with fence and gate installations to protect upstream private property from encroachment that would also be needed. The Agencies / MHRC also proposed an accessible fishing pier, which the Licensee recognizes must be built to withstand winter ice conditions. Table 29 summarizes costs the Licensee anticipates would be involved in providing the facilities requested by the Agencies / MHRC.

Table 29. Construction Costs for Agency/MHRC Requested Reservoir Access

Item	Unit of Measure	Cost per Unit	# of Units	Cost
Grade / Gravel 11' x 1600' Road	Sq Ft	$ 2.50	17,600	$ 44,000
Install 4 turnouts (50' x 8')	Sq Ft	$ 2.50	1,600	$ 4,000
Install new culverts	Ea	$1,500.00	2	$ 3,000
Install concrete ADA space	Sq Ft	$ 5.00	300	$ 1,500
Gravel surfaced parking spaces	Sq Ft	$ 2.50	950	$ 2,375
Concrete Parking Bumpers	Ea	$ 60.00	5	$ 300
ADA Canoe / Kayak Launch	LS	$40,000.00	1	$ 40,000
ADA Fishing Pier	LS	$50,000.00	1	$ 50,000
ADA Compacted Gravel Pathways	LF	$ 7.00	200	$ 1,400
ADA parking signs / space striping	LS	$ 400.00	1	$ 400
New Fence, powerhouse/pvt land	LF	$ 20.00	900	$ 18,000
Install Gates	EA	$ 2,500.00	2	$ 5,000
Permits	LS	$ 1,000.00	1	$ 1,000
SUBTOTAL				$ 170,975
Engineering, Design, Const Eng			**20%**	**$ 34,200**
TOTAL				**$ 205,175**

While the Licensee acknowledges that the revised Agency / MHRC reservoir access request is a somewhat lower scale than the access assumptions evaluated in the RRSR, notably in terms of parking capacity, a vault toilet building, and a vehicle back-down boat ramp; nevertheless, substantial expense of approximately $205,200 would still be involved in the requested installation. Additional ongoing maintenance costs, including periodic grading, trash removal and similar recurring expenses would also be incurred by the Licensee as a result of adding reservoir access.

The Agencies/MHRC state that they believe there will be interest in the reservoir fishery, but they do not refute the scientific study results that found the impoundment is shallow and dominated by small size class, warmwater species, particularly pumpkinseed sunfish (*Lepomis gibbosus*), yellow perch (*Perca flavescens*), and rock bass (*Ambloplites rupestris*) (see RRSR – Section 6.3). The Licensee continues to believe that there would be little public interest in this fishery, notes that reservoir access has not been requested by any members of the public and believes this expense would be well in excess of what is appropriate to give equal consideration to recreational resources.

In summary, the Licensee continues to believe that providing and maintaining the tailwater access for public use is a significant recreational investment by the Licensee, considering the small 250kW size of the Boyne River Hydro Project. The public clearly enjoys and benefits from the availability of these sites. The Licensee believes that the investment that would be required to provide the facilities requested by the Agencies / MHRC, both in terms of capital costs (estimated $262,600) and increased ongoing maintenance costs, is inconsistent with the objective of giving equal consideration to recreation objectives, is not justified, and is not in the public interest.

1.12 Aesthetic Resources

The Boyne Project is located in a landscape setting that consists of natural and planted second growth forests, wetlands, farmlands and streams. The 116-acre Project area consists of the 68-acre open water reservoirs, the transmission line, which is maintained in an open grasslands condition, and forested lands. The forested lands include some mixed hardwood – white pine forest types and forested wetlands that also include white cedar, balsam fir and black and white spruce. The character of the landscape is not rare or unique for northwest Michigan and can be commonly seen throughout the area.

The principal view of Project lands by the public is primarily by those that are fishing along the Project Tailwater access sites, downstream of the dam. The lands along the tailwater are primarily forested wetlands, as described above. As is discussed in the final RRSR Section 3.1 (see Appendix B), the Licensee does not provide developed public access to the Project reservoir, which is bordered by upland mixed hardwood – white pine forest land, and does not propose to develop the infrastructure that would be needed to provide public access to this area. There are no public access points upstream of the Project for launching watercraft, including canoes and kayaks. Accordingly, there is no public use by watercraft through the Project reservoir and no portage use at the dam.

The Boyne Project dam has been in place for over 100 years. Its red brick powerhouse is, functional, well maintained and aesthetically pleasing, but not unique or outstanding in its architectural character. The embankment of the dam is maintained with a groundcover of grasses that blends well with the surrounding undeveloped environment. The photographs below provide typical views of the project.

Figure 36. Reservoir

Figure 37. Embankment Slope, Powerhouse and River Downstream

1.13 Cultural Resources

1.13.1 Identification of Any Historic or Archaeological Site In the Proposed Project Vicinity

The Licensee has initiated consultation with the Michigan State Historic Preservation Officer (SHPO) pursuant to Section 106 of the National Historic Preservation Act. ,Since submitting the Final License Application on January 31, 2020, Boyne USA received a letter from the State Historic Preservation Office (SHPO) dated February 21, 2020 stating that "Based on the information provided for our review, it is the opinion of the State Historic Preservation Officer (SHPO) that **no historic properties are affected** within the area of potential effects of this undertaking." (emphasis within the original letter). A copy of that letter has been added to Appendix G of this Exhibit E.

The Licensee has identified the Boyne Hydro Project Boundary as the Area of Potential Effect (APE). The Licensee based its identification of the Project Boundary as the APE because it is not proposing any construction or change in the existing Project operation, and as a result anticipates no ancillary impacts or effects resulting from a new FERC license. No properties listed on the National Register of Historic Places, or believed to be eligible for listing, have been found in the APE.

The Licensee evaluated the one above ground structure that is more than 50 years old in conjunction with the Section 106 consultation submittal to SHPO, the Boyne Project powerhouse and spillway, which available records indicate was constructed in 1939. The only other above ground structures in the APE are the Project transmission line support poles.

In researching the history associated with the Boyne Project powerhouse structure, the Licensee consulted records of Consumers Power Co (now Consumers Energy), who acquired the plant in 1950 as part of the acquisition of the assets of the Michigan Public Service Co. Consumers Power records included a photo of the circa 1906 powerplant as it appeared 12-19-1923, from the records of Jackson, Mi engineer William Fargo. The records also stated that the powerhouse was rebuilt in 1939. The reason for the rebuild was not stated, but is assumed to be because the original power house was destroyed or demolished around the time the current powerhouse was built in 1939.

Figure 38. Photograph of the original circa 1906 Boyne River Hydro powerhouse as it appeared on 12-19-1923. This structure was destroyed or removed circa 1939 when the current powerhouse structure was constructed. Photo by William Fargo Engineering from Consumers Energy records.

No visible signs of the original structure have been observed. or are likely to exist, since the adjacent spillway structure was also rebuilt at that time. Based on comparison of the 1923 photograph with current photographs and field observations, the Licensee concluded that no evidence of the original powerhouse remains.

Consumers Power records also indicated that the Boyne River Hydro was retired 1-4-1963 and that the generating equipment was sold at that time. The site was sold to Boyne USA at that time. When Boyne (Licensee) obtained its current FERC license in 1982, new generating equipment was installed and we presume the powerhouse was also refurbished at that time since it had sat idle for about 20 years, but no records were found regarding what work may have been done or the source of the current generating equipment. Boyne believes the powerhouse is a functional brick building that is not rare or unique for its function. The powerhouse does not possess unique or distinctive architectural elements, is not associated with significant historic events or persons, and is not likely to yield any historical information that has not been well documented in similar structures of the period. Based on this information, the Licensee (Boyne USA) has concluded that the Boyne River Hydro Powerhouse is not eligible for listing on the National Register of Historic Places, subject to SHPO review and concurrence.

1.13.2 Existing Archeological Discovery Measures

No archeological subsurface testing work has been undertaken by the Licensee within or adjacent to the APE. No records of previous subsurface testing were found.

1.13.3 Identification of Indian Tribes that May Attach Religious and Cultural Significance to Historic Properties

Prior to the arrival of Europeans, all of Michigan was Native American territory. There are eleven Federally recognized tribes in the State of Michigan. Two tribes are located in Northwest Michigan. The Grand Traverse Band of Ottawa and Chippewa Indians is based in Suttons Bay in Leelanau County. The Little Traverse Bay Bands of Odawa Indians (LTBB) is based in Petoskey, Emmet County.

Neither tribe has Federally or State recognized reservation boundaries. However, the LTTB has sued the State of Michigan to have formal reservation boundaries established. The claim, based in 1836 and 1855 treaties, includes much of Emmet County and a Northern portion of Charlevoix County. The southern border of the claimed reservation land is approximately 6.5 miles North of the Boyne River Project. In August 2019, Judge Paul L. Maloney issued a summary judgement against the LTBB. LTBB Tribal chairwoman Regina Gasco-Bentley says the tribe is currently considering its legal options. [24]

There are no known traditional or religious properties in the vicinity of the Project. However, as discussed in the Recreation Resource Study Report (Appendix B), Section 5.1, LTTB tribal members consider the Boyne Tailwater to be an important location for Fall salmon harvest activity (personal communication Lauren Dey, LTBB Water Quality Technician).

1.14 Socio-Economic Resources

As discussed above, the Boyne River Dam is located close to the center of Charlevoix County in Northwest Michigan. Charlevoix County has a land area of 417 miles and is the 53rd largest county in Michigan by population with 10,794 households. The largest places within the county are the Cities of Boyne City, Charlevoix and East Jordan. Recent population estimates are 26,238 for the County[25]; Boyne City, 3,776[26]; Boyne Falls, 295[27]; and 1,195 for Boyne Valley Township[28].

The most common industries throughout Charlevoix County include manufacturing, healthcare and social assistance, and retail trade[29]. When looking at the total gross regional product for Northwest Michigan, 14.3% of it comes from manufacturing[30]. When compared to other counties in Michigan, Charlevoix has a considerably high number of jobs in the production, food service, cleaning and

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[24] *Michigan Radio npr. https://www.michiganradio.org/post/judge-says-1855-treaty-did-not-establish-reservation-little-traverse-bay-bands-odawa-indians*

[25] *Boyne Area Chamber of Commerce. http://www.boynechamber.com/demographics*

[26] *ibid*

[27] *Networks Northwest. "2015 Population Estimates, Village of Boyne Falls"*

http://www.benchmarksnorthwest.org/userfiles/uploads/PopEst2015-BoyneFalls-2609840.pdf

[28] *Networks Northwest. "2014 Population Estimates, Boyne Valley Township".*

http://www.benchmarksnorthwest.org/userfiles/uploads/PopEst2014-BoyneValleyTwp-2602909860.pdf

[29] *Data USA. "Charlevoix County, MI". https://datausa.io/profile/geo/charlevoix-county-mi/#economy*

[30] *Networks Northwest. 2015 "Comprehensive Economic Development Strategy – Appendix A Data Supplement ". http://www.networksnorthwest.org/userfiles/filemanager/4219/*

maintenance fields with Boyne USA being the largest employer in the County[31]. The per capita personal income is approximately $35,947 and the median household income is $46,554. The median property value is recorded at $153,000. According to Data USA, 80.5% of the housing units are occupied by their owner, which is 16.6% higher than the national average[32]. Figure 39, below, shows a map of income by location in Charlevoix County.

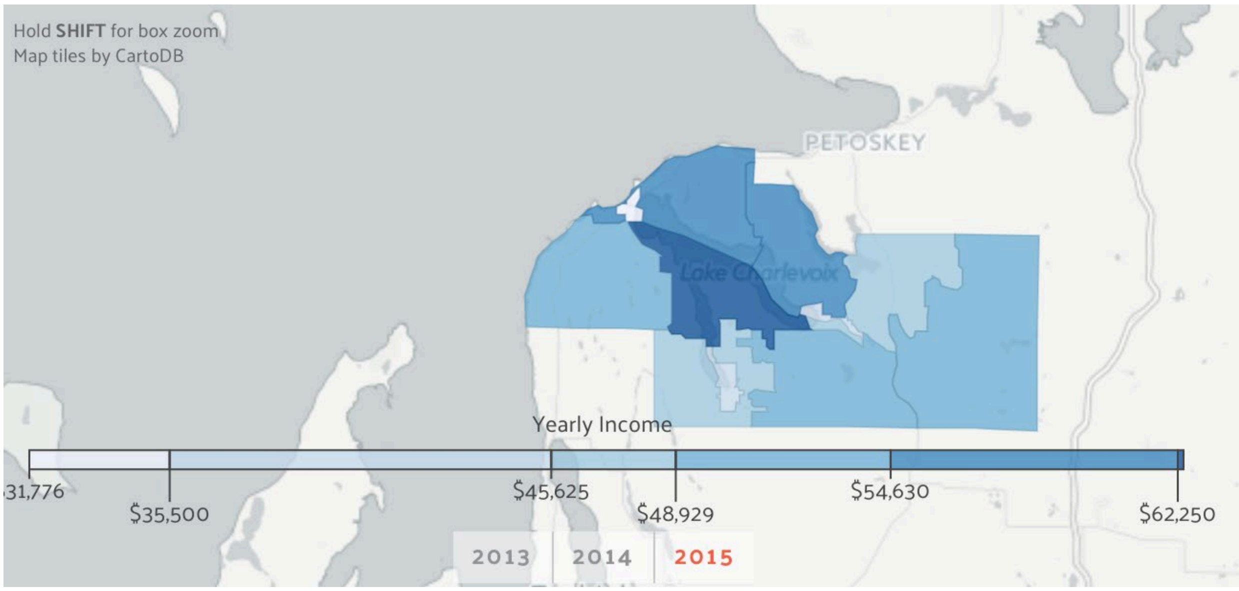

Figure 39. Median income by location in Charlevoix County (2015)[33]

1.15 Tribal Resources

1.15.1 Effect of Project Operations on Tribal Cultural or Economic Interests

There are no known impacts of Project operation to tribal cultural or economic interests.

1.16 River Basin Description

1.16.1 Area of River Basin and Sub-Basin and Length of Stream Reaches

The river at the dam has a total drainage area of 63.6 square miles but only 45.6 square miles of that area is considered to be contributing to the discharge from the dam (EGLE correspondence 7/11/2019). Parts of the watershed lie in Charlevoix, Antrim and Otsego Counties.. Approximately 1.3 miles upstream of the reservoir the main stem of the Boyne River splits into a North Branch and a South Branch. From the North Branch and the South Branch there are several tributaries, some named, but most unnamed, on the USGS Quadrangle Map. The drainage area is shown in Figure 7.

[31] *Northern Lakes Economic Alliance. Charlevoix County Information and Demographics. http://www.northernlakes.net/why-northern-michigan/regional-information-demographics/charlevoix-county/*

[32] *Data USA. "Charlevoix County, MI". https://datausa.io/profile/geo/charlevoix-county-mi/#economy*

[33] *Data USA. "Charlevoix County, MI". https://datausa.io/profile/geo/charlevoix-county-mi/#economy*

1.16.2 Major land and water use in project area

The area surrounding the project is zoned as Agricultural/Forests (see Figure 2) with forest being the predominant land use with scattered residences. There are also areas of Rural Residential (minimum lot size 1 acre) and Single Family Residential (minimum lot size 20,000 square feet) zoning nearby. To the south of the project, Boyne Mountain Resort occupies a large area of land that is zoned as Resort Mixed Use. There is also scattered Commercial and Conservation Reserve zoning in the area.

Domestic, agricultural and commercial water use in the project area is supplied by wells. Surface water resources in the project area predominately serve to provide aesthetic views, wildlife habitat and recreation.

1.16.3 All dams and diversion structures in the basin or sub-basin, regardless of function

The Boyne Falls Dam is located on the South Branch of the Boyne River at State Route M-75. It has a height of approximately 23 feet and impounds approximately 17 acres. The Weiss family dam was located upstream of the Boyne Falls Dam on the South branch of the Boyne river along US 131. That dam failed in March, 2019. It is not known if there are plans for reconstruction of the dam.

1.16.4 Tributary rivers and streams, the resources of which are or may be affected by project operations

The three longest tributaries of the main stem are the South Branch of the Boyne River, the North Branch of the Boyne River and Moyer Creek with approximate lengths of 9.2 miles, 6.6 miles and 3.6 miles respectively. There are several smaller tributaries as well (see Figure 7).

1.17 Relevant qualifying Federal and state or tribal comprehensive waterway plans

Section 10(a)(2)(A) of the Federal Power Act (FPA), 16 U.S.C. section 803 (a)(2)(A), requires the Federal Energy Regulatory Commission (FERC) to consider the extent to which a project is consistent with Federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project.

The FERC, issued an order on April 27, 1988, establishing that the Commission will accord FPA section 10(a)(2)(A) comprehensive plan status to any Federal or state plan that:

- is a comprehensive study of one or more of the beneficial uses of a waterway or waterways;
- specifies the standards, the data, and the methodology used; and
- is filed with the Secretary of the Commission.

The FERC maintains a list of documents, by state, that it has accepted as Comprehensive Waterway Plans that have been generated by State and Federal Agencies. The list, current as of December 2016, contains 67 reports for the State of Michigan. It was determined by a review of the list, that six of those reports may have general applicability to the Boyne River Hydroelectric Project. Those are:

- Michigan Department of Environmental Quality. 1996. "Non-indigenous aquatic nuisance species, State management plan: A strategy to confront their spread in Michigan". Lansing, Michigan.
- Michigan Department of Natural Resources. 1994. "Fisheries Division strategic plan". Lansing, Michigan. June 1994.
- Michigan Department of Natural Resources. "Statewide Comprehensive Outdoor Recreation Plan (SCORP): 2008-2012". Lansing, Michigan.

- National Park Service. "The Nationwide Rivers Inventory". Department of the Interior, Washington, D.C. 1993.
- U.S. Fish and Wildlife Service. Canadian Wildlife Service. 1986. "North American waterfowl management plan". Department of the Interior/ Environment Canada. May 1986.
- U.S. Fish and Wildlife Service. 1993. "Upper Mississippi River & Great Lakes Region joint venture implementation plan: A component of the North American waterfowl management plan". March 1993.

As mentioned above, these documents are general in nature covering the entire State of Michigan and in some cases beyond.

The 1994 Michigan Department of Natural Resources (MDNR) Fisheries Division Strategic Plan was not obtained in our document search. However, the successor document from 2002 contains the following statement:

> *"Dam removal restores the natural flowing character of a stream and restores essential ecological processes in the river. Large segments of previously inaccessible water may be open to use by a variety of fish species. In addition, dam removal and sediment management can restore buried fish spawning habitat and other critical stream habitat. Selective dam removal will be an integral component of successful watershed management initiatives since the response in the stream after dam removal is usually dramatic and lasting improvement. Fisheries Division is interested in fcilitating [sic] dam removal to improve fisheries potential in Michigan streams and rivers. Dam removal is among the most important techniques available to improve natural fish production in the State."*

Not surprisingly, the MDNR Fisheries Division generally favors dam removal as a means of improving fisheries within the State. The document goes on to state that-

> *"No [dam removal] project will be pursued without dam owner and local support."*

A review of the other documents listed above, leads to the conclusion that there are no conflicts between those comprehensive waterway plans and continued operation of the Boyne River Hydroelectric Project.

1.18 RELEVANT RESOURCE MANAGEMENT PLANS

Several relevant resource management plans can be cited on the level of State, County and Township agencies and even non-profit organizations. A listing of pertinent agencies follows:

> Michigan Department of Environmental Quality. November 2016, rev. January 2017. "Water Quality and Pollution Control in Michigan, 2016 Sections 303(d), 305(b), and 314 Integrated Report". Lansing, Michigan.
> Charlevoix County. February 2015." Charlevoix County Recreation Plan 2015-2019". Charlevoix, Michigan.
> Charlevoix County Planning Commission. 2009. "Charlevoix County Future Land Use Plan". Charlevoix, Michigan.

Boyne Valley Township/Village of Boyne Falls. 2015. "Boyne Valley Township 2015 Master Plan". Boyne Falls, Michigan.

Lake Charlevoix Watershed Advisory Committee. "Lake Charlevoix Watershed Management Plan". July, 2012.

A review of the documents listed above, leads to the conclusion that there are no conflicts between relevant resource management plans and continued operation of the Boyne River Hydroelectric Project.

2 DESCRIPTION OF EXPECTED ENVIRONMENTAL IMPACTS FROM PROPOSED CONSTRUCTION OR CHANGES IN OPERATION §4.61(d)(2)(ii)

No new construction is proposed for the Boyne River Project. In addition, there will be no significant operational changes in conjunction with this application. The dam was built more than a century ago to generate power and any environmental impacts resulting from that original construction have been noted elsewhere in this application. Boyne will continue to operate the project in an environmentally sensitive way.

The Michigan Department of Natural Resources (MDNR) has requested that Boyne reduce the operating range of the impoundment to 0.5 feet or less. This is addressed in the Hydrologic and Hydraulic Report provided in Exhibit F.

Boyne USA plans to address the erosion issue mentioned in Section 1.4.3.1 by placing riprap along the waterline of the left embankment. The cost of this measure is provided in Exhibit A.

3 CONSULTATION WITH FEDERAL, STATE AND LOCAL AGENCIES WITH EXPERTISE IN ENVIRONMENTAL MATTERS §4.61(d)(2)(iii)

3.1 INITIAL CONSULTATION

Prior to development of the Pre Application Document (PAD), Boyne requested available existing information and studies from public agencies, tribes and non-profits that may have important information. That letter and the list of stakeholders that the letter was mailed to are listed in Appendix D along with a response letter received from the Michigan Department of Natural Resources (MDNR).

3.2 STAGE 1 CONSULTATION REQUIREMENTS

Boyne has complied with the Stage 1 consultation requirements of 18 C.F.R. §16.8 (b). The supporting correspondence and documents are provided in Appendix E and are as follows:

- Transmittal of the Pre-Application Document to stakeholders on March 20, 2017.
- Letter to stakeholders notifying them of a Joint Agency/Public Meeting to be held on July 10, 2017.
- Public notice in the Boyne City Gazette on June 28, 2017 regarding the Joint Agency/Public Meeting.
- The public meeting was held on July 10, 2017. The attendance sign-in sheet is included in Appendix E.

Boyne provided 60 days from the time of the Joint Agency/Public Meeting for stakeholders to request studies. Three letters pertaining to study requests were received from the MDNR, the Michigan Hydro Relicensing Coalition (MHRC) and the Michigan Department of Environmental Quality (now Michigan Department of Environment, Great Lakes and Energy). Those study requests, and correspondence relative to Boyne's study methodologies are provided in Appendix F.

3.3 STAGE 2 CONSULTATION REQUIREMENTS

The Stage 2 consultation requirements have been fulfilled through the following efforts:

- Boyne undertook the requested studies starting in June, 2018 and completed them in 2019. The results of the studies are included in this application.
- Boyne provided the results of the studies, along with the draft application, to the stakeholders on October 4, 2018. A written request for review and comment was included in the cover letter.
- Stage 2 Consultation is documented in Appendix G.

3.4 COMPLIANCE WITH COMPREHENSIVE WATERWAY PLAN:

There is no comprehensive waterway plan for the Boyne River as defined by 18 CFR, Chapter I, §2.19.

Appendix A ENVIRONMENTAL STUDY REPORT

Boyne River Hydroelectric Project

Environmental Studies

01.29.20

PSC

Prepared by

Streamside Ecological Services, Inc.
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Table of Contents

Introduction

Boyne USA, Inc. (Boyne) is licensed by the Federal Energy Regulatory Commission (FERC) to operate and maintain the Boyne River Hydroelectric Project (FERC P-3409) on the Boyne River, in Boyne Valley Township, Charlevoix County, Michigan (Figure 1). The dam impounds an area of about 68 acres at normal power pool elevation and contains a volume of about 356 acre-feet of water. The Boyne River enters the east end of the impoundment and exits about 3,000 feet northwest, over the dam and through the turbines and/or spillway and continues to flow northwesterly for about 3.5 miles before discharging into Lake Charlevoix. The dam is considered to be the first upstream barrier, and a complete migration barrier, for fish migrating from the Great Lakes.

The existing FERC license for the dam was issued in 1982 and is set to expire on January 31, 2022. As part of the relicensing process, Boyne is required to prepare and submit, among other items, a preapplication document (PAD). On March 20, 2017, a PAD was prepared and submitted on behalf of Boyne to the FERC and to various stakeholders as listed in the application documents. As part of the first-stage consultation process, Boyne received study requests from the Michigan Hydro Relicensing Coalition (MHRC), the Michigan Department of Natural Resources (MDNR) and the Michigan Department of Environmental Quality (MDEQ). In May 2018, Boyne contracted Public Sector Consultants (PSC) to assist with environmental studies in response to the study requests. PSC, along with Streamside Ecological Services, Inc. (SES), began assessment work by submitting a document outlining the methodology to the above-mentioned entities for approval prior to completion of any fieldwork. A methods document was approved by the agencies after modifications were made to incorporate their input. Fieldwork began within the Project Area in June 2018. Specifically, the PSC team completed:

- Shoreline erosion inventory within and downstream of the impoundment
- Water temperature monitoring of the tailrace and the Boyne River, both upstream and downstream of the impoundment
- Seasonal dissolved oxygen (DO) monitoring in the tailrace and upstream of the impoundment
- Water temperature and DO vertical profiles in the impoundment
- Aquatic survey of the impoundment
    - Fish community
    - Macroinvertebrate community (including freshwater mussels)
    - Macrophyte community

Upstream segment

- Impingement/entrainment evaluation including measurement of water velocity at the dam intake
- Aquatic survey of the Boyne River, both upstream and downstream of the impoundment
    - Fish community
    - Macroinvertebrate community (including freshwater mussels)
    - Physical habitat and geomorphology
- Temperature modeling study within the impoundment
- Nuisance plant surveys in the impoundment and transmission corridor

Downstream segment

FIGURE 1. Location of the Boyne River Hydroelectric Project, Charlevoix County, Michigan

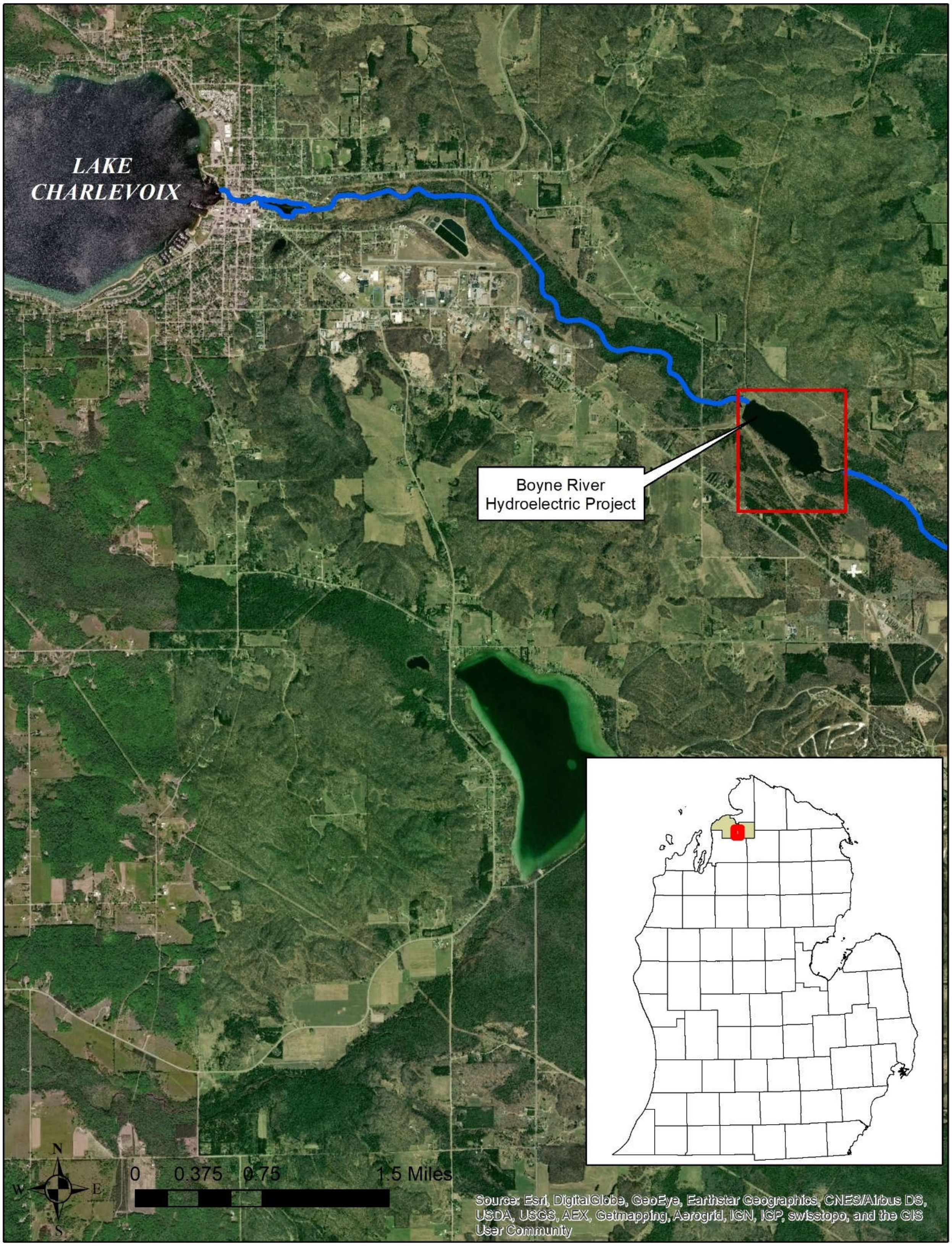
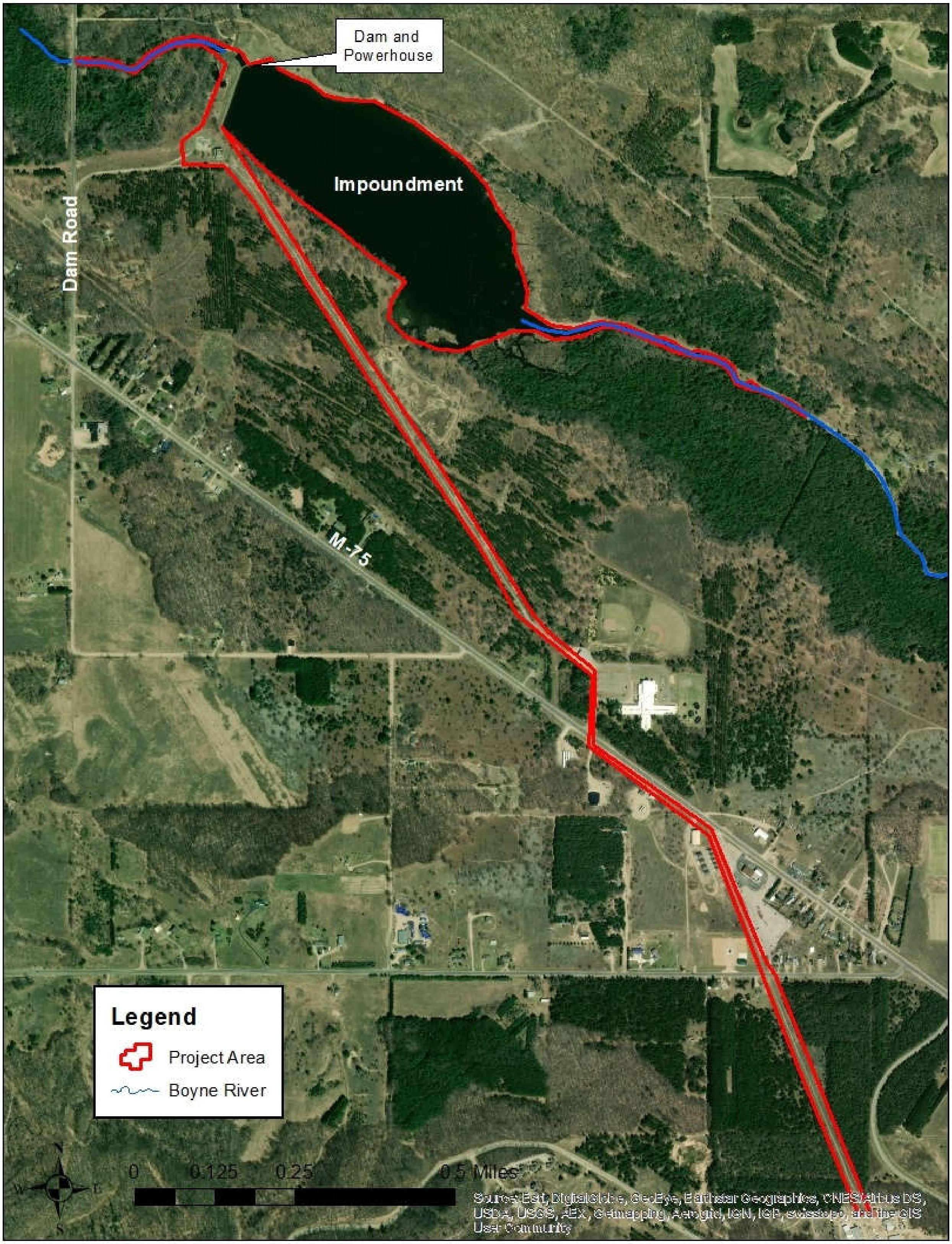


FIGURE 2. Project Area



Methods

Shoreline Erosion Inventory

An inventory of shoreline erosion was completed to document existing conditions within the Project Area. The inventory was completed using a boat to traverse the entire perimeter of the impoundment. The banks of the Boyne River, between the powerhouse and Dam Road, were assessed for erosion by walking the entire reach.

Water Temperature Monitoring

Water temperature was recorded on an hourly basis in three locations: in the tailrace, in the Boyne River upstream of the impoundment, and in the Boyne River downstream of the impoundment (Figure 3) from June 1, 2018, to May 31, 2019. Onset Hobo U22 temperature loggers were deployed at all sites. Data were used to thermally classify the stream reaches based upon criteria described in the MDNR's Fisheries Research Report 2091 (cold, cold-transitional, etc.) (Zorn, Seelbach, and Wiley 2009). Data were also compared to Michigan's Water Quality Standards for coldwater streams (Part 4. R 323.1075).

Dissolved Oxygen Monitoring

DO was monitored on a continual basis, from June 1 to September 30, 2018, at two locations—in the dam tailrace and in the river upstream of the impoundment (Figure 3). Onset Hobo U26 DO data loggers were installed and programmed to record data at ten-minute intervals. These loggers also record water temperature and provide redundancy. Loggers were downloaded once every two weeks and data were compared to Michigan's Water Quality Standards for coldwater streams (Part 4. R 323.1064).

Water Temperature and Dissolved Oxygen in the Impoundment

Two locations were identified within the impoundment for water temperature and DO profiles (Figure 3). A watercraft was launched to access the two sites on a biweekly basis between June 1 and September 30, 2018, for a total of nine samples over 17 weeks. A Yellow Springs Instrument Professional Plus multiparameter meter was used to collect the data at established intervals from the water surface to the bottom of the impoundment.

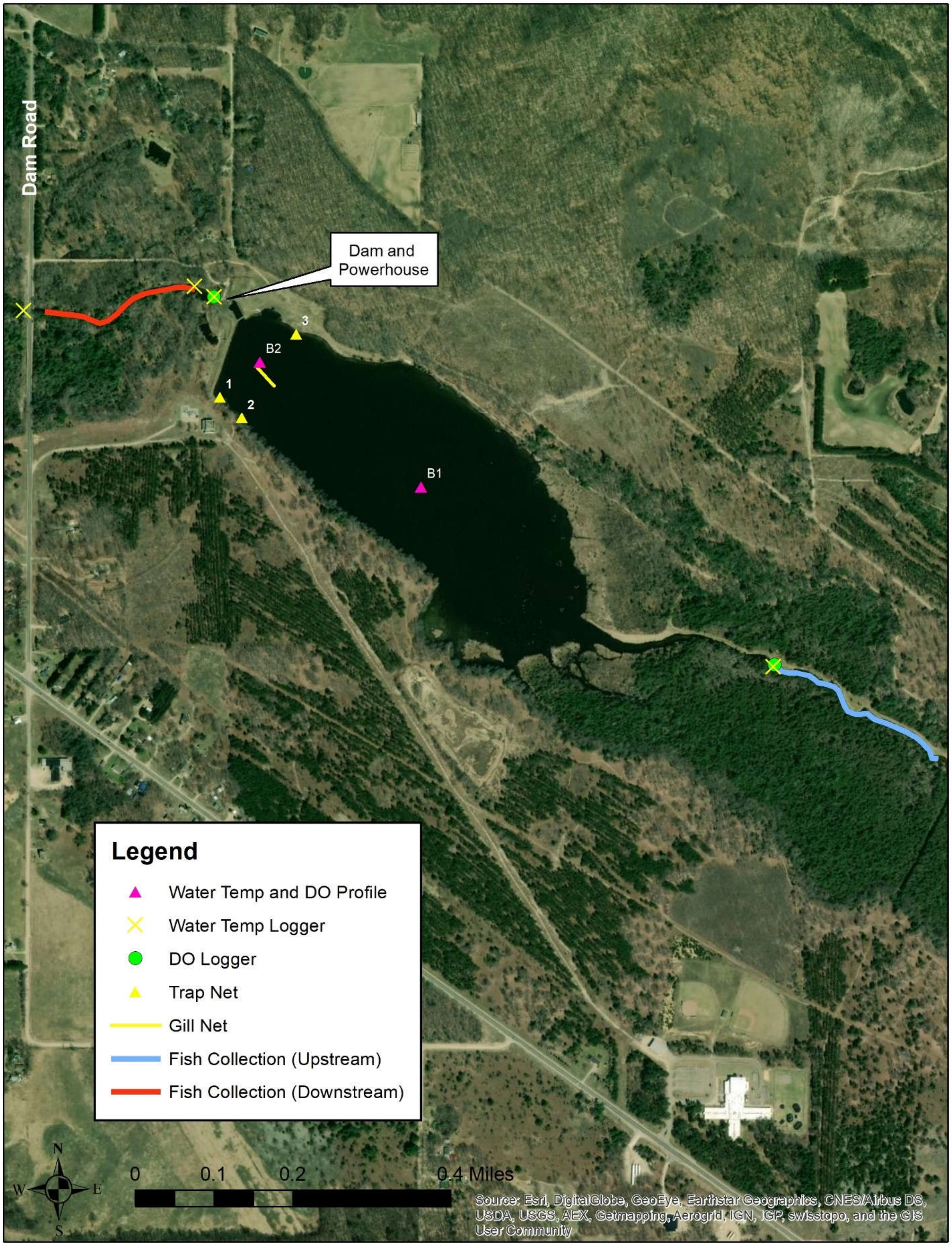
Aquatic Survey of the Impoundment

Fish Community

The fish community of the impoundment was surveyed using boat-mounted electrofishing gear to collect fish in shallow water and near-shore areas. Fyke nets were placed in four locations around the shoreline of the impoundment, and a gill net was placed in the deepest portion of the impoundment (Figure 3).

Pulsed direct current was used during the survey to minimize trauma to the fish. Electroshocking duration was automatically recorded as the total seconds of electricity that was discharged from the electrofisher for each transect. Electrofishing was conducted in the evening, which is more effective than shocking during daylight hours (Sanders 1992; Dumont and Dennis 1997).

FIGURE 3. Sampling Sites within Project Area



Fyke nets were fished overnight. The nets were placed along the shoreline in locations where drop-offs (i.e., access to deeper water) were typically located close to the shoreline. Two fyke nets were constructed of two-inch stretch mesh and the hoop diameter measured four feet with a 50-foot long center lead, and two six-foot by 25-foot wing leads. Two additional fyke nets were constructed of 0.125-inch ace-type nylon mesh coated with green latex net dip, where the lead was 15 feet long and two feet high. The frame and the cab were ten feet long when fully extended.

A multiple panel monofilament gill net of varying mesh size was fished in the deepest portion of the impoundment. The gill net consisted of five six-foot by 25-foot panels ranging from 1.5-inch to six-inch stretch mesh. The gill net was set overnight and was fished for approximately 12 hours.

Catch per unit effort (CPUE) is used as an index of fish abundance. Fish sampling efforts were standardized to units consistent with the MDNR sampling protocol (Schneider et al. 2000a). CPUE for electroshocking was estimated as follows:

CPUE = $\frac{N}{t}$

Where:

N = number of fish caught
t = duration of electricity discharge in minutes, or minutes of fyke net soak time

The species, length in millimeters (converted to inches), weight in grams (converted to ounces or pounds), and number of fish captured were recorded for all fish collected. Fish were returned alive to the system following collection and identification. Fish were identified to species using various taxonomic references, as necessary (Bailey et al. 2003; Becker 1983).

Weight-length regressions were evaluated for selected fish species and the data were compared to state average length and weight values to evaluate the condition of the fish. Condition (robustness) sometimes reflects food availability and growth within the weeks prior to sampling (Schneider et al. 2000b). The weight-length relationship was expressed on a logarithmic (base 10) scale as follows:

$\log W = \log a + b \log L$

Where:

W = total weight
L = total length
log a = intercept of regression equation
b = slope of regression equation

Macroinvertebrate Community

Grab samples were collected within the littoral margins of the impoundment by wading and using D-framed kick nets, generally, following the Great Lakes Environmental Assessment Section (GLEAS) Procedure 51 (P51) protocol established for nonwadable rivers (MDEQ 2013). In addition, a Petite Ponar Grab Sampler was used, from a boat, to collect sediment samples at five locations at different water depths. Collected specimens were stored in labeled, one-gallon zipper bags in a cooler of ice. After all samples were collected, insects were removed from each bag, identified using various taxonomic references, and enumerated (Merritt and Cummins 2008; Bright 2018).

Freshwater Mussel Community

A Reconnaissance Mussel Survey was completed within the impoundment by wading the littoral zone and collecting live and dead specimens (Hanshue et al. 2018). An attempt was made to sample each habitat type along the perimeter of the impoundment to ensure documentation of all species. Each species was identified, enumerated, and photographed before being returned, in its proper orientation, to its suitable habitat. In total, two hours and ten minutes were spent surveying 700 feet of shoreline. Most time was spent on the western end of the impoundment, where suitable habitat hosted the highest density of mussel species.

Macrophyte Community

Survey of the impoundment was completed using the MDEQ's procedures for aquatic vegetation surveys (MDEQ 2005). The macrophyte community was assessed in 19 similarly sized, individual aquatic vegetation assessment sites (AVAS) that averaged about 320 feet in width (Figure 4). In each unit, visual observations and rake tows were used to document all plant species and their densities. Densities were determined by using the following code:

- = found: One or two plants of a species found in an AVAS, equivalent to less than 2 percent of the total AVAS surface area
- = sparse: Scattered distribution of a species in an AVAS, equivalent to between 2 percent and 20 percent of the total AVAS surface area
- = common: Common distribution of a species, where the species is easily found in an AVAS, equivalent to between 21 percent and 60 percent of the total AVAS surface area
- = dense: Dense distribution of a species, where the species is present in considerable quantities throughout an AVAS, equivalent to greater than 60 percent of the total AVAS surface area

Aquatic Survey of the Boyne River

The fish community of the Boyne River was surveyed at two sites (Figure 3). The purpose of the Boyne River fish survey was to describe fish community composition and relative abundance as well as to estimate the population size of trout. Prior to sampling, existing data were gathered and reviewed. The Michigan Natural Features Inventory County Element List was reviewed to determine if any threatened, endangered, or special-concern aquatic species have been documented within or near the Project Area.

Fish Collection Site One (Downstream) was 1,100 feet in length and about 0.9 acres in surface area. The reach is located from a point about 75 feet upstream of the Dam Road crossing, upstream to a point approximately 100 feet below (downstream of) the dam. Fish Collection Site Two (Upstream) was 1,330 feet in length and also covered about 0.9 acres. The point of beginning for the site was a location outside the influence of the still water of the impoundment.

FIGURE 4. Individual Assessment Units for Macrophyte Survey within the Boyne River Impoundment

A barge-mounted electrofisher was used to collect fish throughout each study reach. Shocking was conducted in an upstream direction to minimize fish avoidance of gear.

For trout population estimates, a mark-recapture study was conducted over two days. All species were identified, enumerated, and measured for length and weight, and trout were marked with a tail clip prior to release (Chapman 1951). The electrofishing survey was conducted again on the second day to identify all the individuals that were marked during the previous day's survey. On the first day of the study, all fish species were collected, measured, and counted. On the second day, only trout and "new" species were collected and handled. All fish were returned alive following collection and identification. The following formula was used to estimate the number of trout in the population:

$$N = \frac{M\,(C+1)}{(R+1)}$$

Where:

M = The number of individuals initially marked and released (day one)
C = The total number of individuals captured in the second sample (day two)
R = The number of marked individuals (recaptures) found in C

With variance:

$$V(N) = \frac{M^2\,(C+1)\,(C-R)}{(R+1)^2\,(R+2)}$$

Upon completion of the fish sampling, macroinvertebrates were collected according to GLEAS P51 for wadable streams and rivers (MDEQ 2008). An attempt was made to collect at least 300 organisms from both the Upstream and Downstream sites using D-framed kick nets. Collected specimens were stored in labeled, one-gallon zipper bags in a cooler of ice. After all samples were collected, insects were removed from each bag, identified using various taxonomic references, and enumerated (Merritt and Cummins 2008; Bright 2018). The macroinvertebrate data were analyzed according to nine metrics identified in the P51 methodology. The sum of the macroinvertebrate scores can range from -9 to +9 and are graded as excellent, acceptable, or poor, according to the summation of the metric scores.

Riparian and in-stream habitats were qualitatively described for the Upstream and Downstream sites based on P51 scores interpreted from ten habitat metrics. A description of the physical habitat includes run/riffle/pool/shallow pool configurations, substrate, substrate embeddedness, in-stream cover, vegetation, flow stability, and bank stability. Habitat conditions, water quality, and stream dimensions were documented during the aquatic survey. In addition, a geomorphologic survey was completed on January 14, 2020, including survey of one cross section upstream of the impoundment and two cross sections downstream of the impoundment using methods described in Rosgen (2008).

A Reconnaissance Mussel Survey was completed at both the Upstream and Downstream sites, on July 12, using sampling techniques outlined by Hanshue et al. (2018). There were no known previous surveys of mussels or occurrences of listed mussel species in this area. At the Downstream site, each surveyor began at Dam Road, the downstream end of the stream reach, with one surveyor working upstream in a meandering path along each bank to the center of stream. Surveyors proceeded upstream until they reached the dam. At the Upstream site, the entire fish sampling site was inspected. Any time evidence of mussels was found, an intensive search for live mussels ensued. Each species was identified, enumerated, and photographed before being returned, in its proper orientation, to its suitable habitat.

Impingement/Entrainment Evaluation

Fish speed and endurance are important considerations in the development and design of fish screens, bar racks, etc. to exclude fish from harmful environments, such as dam intakes. Both factors vary among species, body morphology, fish length, and water temperature, among other variables. Swimming speeds are typically classified as burst, prolonged, or sustained. Burst is the highest speed that fish can attain over very short times (<20 sec), and are used to capture prey, avoid danger, or to negotiate high water velocities. Sustained (cruising) speeds can be maintained indefinitely without fatigue and are used for routine activities, such as foraging, holding, and schooling. The intermediate category of swimming speeds is known as prolonged, with fish endurance up to around 30 minutes and ending in fatigue.

Using flow data collected at the trash rack and swimming speed data for the fish community (species, size, abundance, etc.) of the impoundment, a brief analysis of the potential for fish to be impinged or entrained was completed. Water velocity was measured across the face of the trash rack on January 15, 2020, using a Marsh-McBirney (201D) portable water current meter. The trash rack was divided into a grid of cells measuring two feet by two feet, and water velocity was measured in the center of each cell. Measurements were conducted while the dam turbine was operating at minimum (40 kilowatts (kW)), average (77 kW) and maximum (300 kW) power generation settings.

Swim Performance Online Tools were used to calculate swimming speeds that each fish species can maintain for a period of five seconds (Katopodis and Gervais 2016). The calculation was made for both juvenile and adult fish. The shortest length allowable in the model was used for juvenile fish to approximate the size of young-of-year fish in the impoundment. Adult fish were considered those that are sexually mature, and the determination was made using the fish length at maturity component of the database.

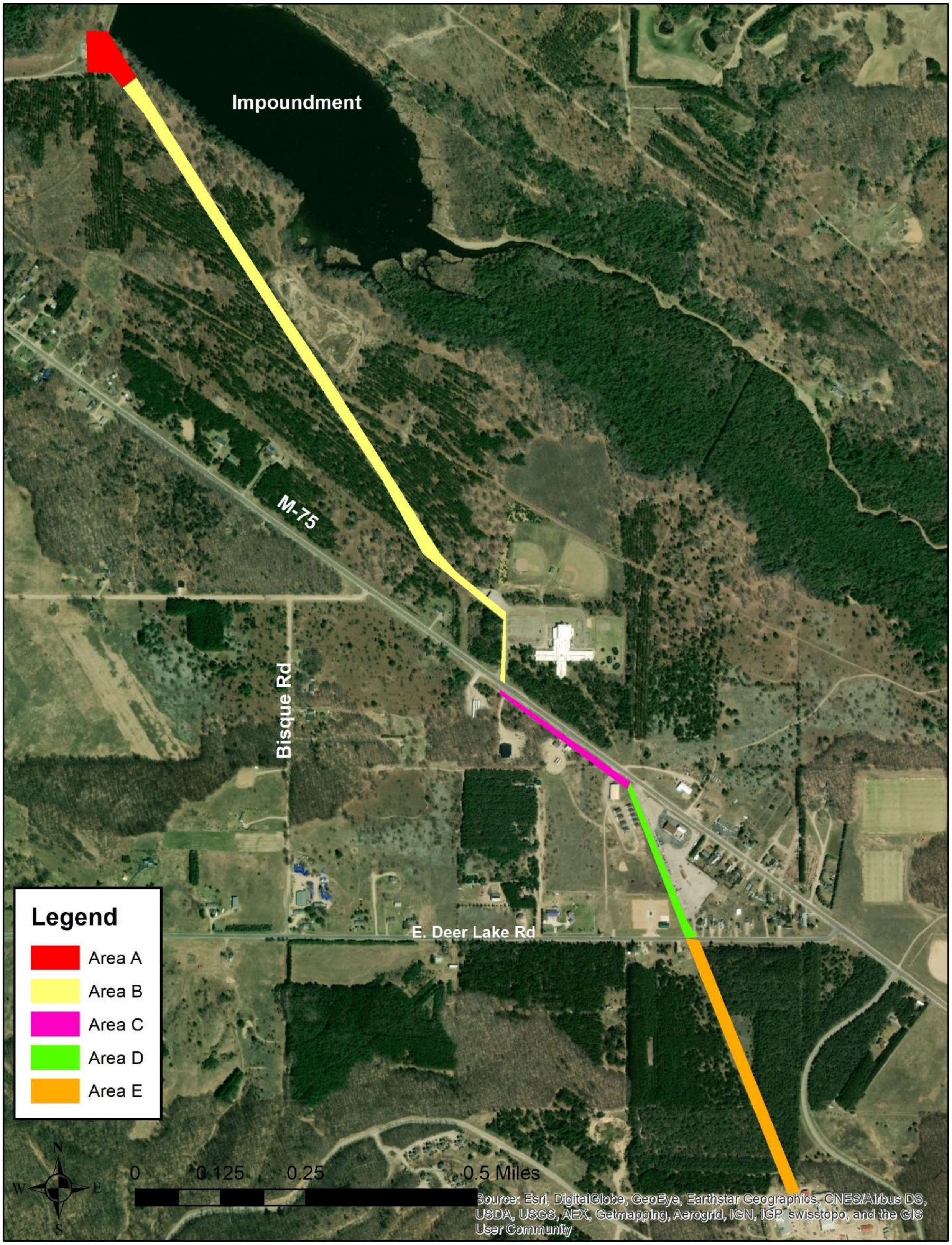
Water Temperature Modeling

Using a combination of bathymetric data provided by J.E. Tiffany and Sons, LLC and water temperature profiles collected from the impoundment, an estimate of the volume of colder water stored within the impoundment was made. This estimate was used to determine potential for using the deeper, colder water to cool the Tailrace and downstream receiving waters.

Nuisance Plant Surveys

Assessment for the presence of invasive and non-native plant species was completed on July 10 and 11, 2018, using meander searches, along approximately 2.5 miles of transmission corridor within the Project Area. The corridor was separated into five segments based on location, visible differences in plant communities, and adjacent land use (Figure 5). Meander searches were conducted on foot, and all plant species encountered were recorded, along with general notes on percentage covered by species (low, medium, or high). Photographs of each of the five corridor segments were also taken.

FIGURE 5. Transmission Corridor Areas Used for Vegetative Assessments



Results and Discussion

Shoreline Erosion Inventory

The entire shoreline of the impoundment was assessed by boat, with specific attention focused on the western end near the earthen dam and outlet. Only one notable area of bank erosion was observed just south of the spillway (Figure 6).

In the Boyne River below the dam, streambank erosion is common and widespread, but mostly not excessive. Similar to most rivers with dams, the Boyne is incised in this downstream section and higher-volume flows have little access to a floodplain. While most process-driven erosion appears to be historic and has been addressed in past years with fieldstone toe protection and other erosion control methods, the streambanks are heavily traversed by anglers and trampling of streambanks is evident, despite the existence of access stairs to the river. Natural erosion rates are very low, and no streambanks were identified as needing protection due to erosive flows.

FIGURE 6. Areas of Excessive Erosion

Water Temperature Monitoring

Coldwater fisheries are protected as a designated use under State of Michigan law. Specifically:

> "*R 323.1100 Designated uses: (7) All waters listed in the publication entitled "Designated Trout Streams for the State of Michigan," Director's Order No. DFI-101.97, by the director of the Department of Natural Resources under the authority of section 48701(m) of 1994 PA 451, MCL 324.48701(m) are designated and protected for coldwater fisheries. Under R 323.1043 Definitions; A to L. Rule 43. As used in this part: (r) "Coldwater fishery use" means the ability of a waterbody to support a balanced, integrated, adaptive community of fish species which thrive in relatively cold water, generally including any of the following: (i) trout . . .*"

The Boyne River, within and proximate to the Project Area, is considered a designated trout stream under the authority of Section 48701(o), as amended, being Sections 324.48701(o) of the Michigan Compiled Laws.

The MDNR's Fisheries Division classifies streams according to water temperature (Zorn et al. 2009). The following definitions were copied, with minor changes:

- Cold stream segments are defined (by the MDNR Fisheries Division) as typically having cold July mean water temperatures that do not exceed 63.5 degrees Fahrenheit (ºF). July water temperatures in a cold stream are diurnally (day-night) stable and constantly cold, even on a hot summer day, due to continuous groundwater inputs. Flow discharge and velocities are strong, even during the lowest-flow months. The typical summer fish assemblage of a Michigan cold stream includes only five to eight species adapted to cold or thermally transitional conditions: daces, juvenile salmon, trout, and sculpins. No warmwater fishes are found. Cold streams anchor the cold end of the summer water temperature range for Michigan river systems and support excellent populations of coldwater fishes; small changes in July water temperature will not result in a significant change to fish populations.
- Cold-transitional stream segments are defined as typically having fairly cold July mean water temperatures between 63.5ºF and 67.1ºF. July temperatures in cold-transitional streams fall at the warmer edge of the acceptable range for trout and juvenile salmon, and the slightly warmer (than in cold streams) temperatures often promote rapid growth in trout and salmon. The typical summer fish assemblage of a Michigan cold-transitional stream includes ten to 18 fish species: some cold-adapted (juvenile salmon, trout, and sculpins), and several that are well-adapted to grow and reproduce at cool temperatures (daces, chubs, suckers, mudminnows, and sculpins). It is also not unusual for limited numbers of warm-adapted species to be present. Cold-transitional stream fish populations are sensitive to small changes in July water temperature.
- Cool stream segments are defined as having cool July mean water temperatures between 67.1ºF and 69.8ºF, diurnally variable temperatures, and smaller waters. The typical summer fish assemblage of a Michigan cool stream includes 15–20 fish species, most adapted to transitional and somewhat variable temperatures (minnows, daces, chubs, suckers, bullheads, mudminnows, and darters), and a few warm-adapted (shiners, chubs, pike, and sunfishes). July diurnal temperature fluctuations are modest, allowing several warm-adapted fishes to be supported (chubs, shiners, minnows, pike, sunfishes, and darters).

- Warm stream segments are defined as typically having warm July mean water temperatures greater than 69.8ºF. Warm streams are home to a limited number of fish species that tolerate extreme diurnal temperature fluctuations (often 50ºF), associated swings in DO concentrations, and smaller waters. The typical summer fish assemblage of a Michigan warm stream includes 15–18 tolerant fish species, including several adapted to transitional temperatures (chubs, minnows, daces, bullheads, mudminnows, and darters), and a few warm-adapted species (shiners, pikes, pirate perch, and sunfishes).

At the Upstream site, average July water temperature was 62.4 degrees Fahrenheit, classifying the stream as cold (Table 1). From June 30 to July 6, the water temperature occasionally exceeded 70°F (Figure 7). The daily high air temperature averaged 96.9°F during this period (National Weather Service) (Table 2), and this is the only period of monitoring in which the water temperature rose above 70°F.

Within the Tailrace (Downstream) site, average July water temperature was 67.8°F, classifying the stream as cool (Table 1). The site was consistently warmer than the Upstream site during warm weather months, and averaged 5.4°F warmer in July. The site was cooler than the Upstream site during cold weather months. This observation illustrates the impact of groundwater input to the Upstream site, and the influence of the impoundment on the Tailrace site. A comparison of water temperatures (Upstream, Impoundment, and Tailrace) recorded on the nine dates of impoundment data collection is provided in Table 2.

Further, the MDNR's Fisheries Division considers dams to be a point source discharge and regulated pursuant to the State of Michigan's Part 4 Rules, Water Quality Standards (of Part 31, Water Resources Protection, of Act 451 of 1994). These rules specify water quality standards which shall be met in all waters of the state. Specifically, regarding water temperature, R 323.1075 "Temperatures of rivers, streams and impoundments" states:

> *"Rule 75. (1) Rivers, streams, and impoundments naturally capable of supporting coldwater fish shall not receive a heat load which would do either of the following: (a) Increase the temperature of the receiving waters at the edge of the mixing zone more than 2 degrees Fahrenheit above the existing natural water temperature. (b) Increase the temperature of the receiving waters at the edge of the mixing zone to temperatures greater than the following monthly maximum temperatures: …"*

Specific to the Boyne River and regulation of the dam, Rule 75 means that the water at the Downstream site cannot exceed 68°F, unless the water entering the impoundment is warmer than 68°F. In this case, the Downstream site cannot be more than two degrees warmer than the water at the Upstream site.

The Upstream water temperature exceeded 68°F for a total of about 77 hours (3.5%) during June, July and August (warm weather months). The longest continual duration of time in excess of 68°F was 13 hours and there was a period from June 29 to July 5 where the water temperature exceeded 68°F for 63 out of 148 hours.

The Tailrace water temperature exceeded 68°F, the water quality standard, for a total of about 388 hours (17.6%) during the warm weather months. The longest continual duration of time in excess of 68°F was 186 hours, from 16:41 on June 29 to 09:41 on July 7; the average water temperature during this period was 71.8°F. This occurred during the same hot weather period that peaked water temperatures at the Upstream sampling station.

Of the 388 hours, water temperatures at the Upstream site were below 68°F for 320 of those hours, meaning that the Tailrace was out of compliance with water quality standards, for exceeding 68°F, for 320 hours. In addition, the Tailrace and the Upstream site were above 68°F, concurrently, for 68 hours; for 44 of those 68 hours, the Tailrace was at least 2.0°F warmer than the Upstream site, meaning that the Tailrace was out of compliance for an additional 44 hours. In total, the Tailrace exceeded the water quality standard for water temperature for about 364 hours (15.2 days) from June 1 to August 31.

July air temperature in Boyne Falls, Michigan was higher than normal, with daily highs averaging 87.8°F. The normal average high in July is 82.9°F–4.9°F degrees cooler than the daily highs of 2018. Figure 8 illustrates that the water temperature at the Upstream and Tailrace sites only exceeded 70°F if the air temperature rose above 90°F. With rare exception, the Tailrace only exceeded 68°F when the air temperature rose above 80°F. The unusually hot weather undoubtedly raised stream temperatures above their long-term average for July.

TABLE 1. Water Temperature Summary for the Upstream and Tailrace Sites, 2018–2019

	Upstream Site			Tailrace Site			Difference		
	Mean Temp. (°F)	**Minimum Temp. (°F)**	**Maximum Temp. (°F)**	**Mean Temp. (°F)**	**Minimum Temp. (°F)**	**Maximum Temp. (°F)**	**Mean Temp. (°F)**	**Minimum Temp. (°F)**	**Maximum Temp. (°F)**
Jan. 2019	33.1	31.8	37.9	33.8	32.3	36.7	0.7	0.5	-1.2
Feb. 2019	33.3	31.8	37.6	33.3	32.4	34.5	0.0	0.6	-3.1
Mar. 2019	35.3	31.8	42.5	35.5	32.3	40.0	0.2	0.5	-2.5
Apr. 2019	42.3	33.3	55.3	43.2	35.3	52.7	0.9	2.0	-2.6
May 2019	50.6	41.5	63.3	52.5	43.0	61.8	1.9	1.5	-1.5
June 2018	59.3	50.2	72.8	63.6	56.6	72.9	4.3	6.4	0.1
July 2018	62.4	55.2	72.7	67.8	61.3	76.6	5.4	6.1	3.9
Aug. 2018	61.1	54.9	68.8	65.3	60.7	69.9	4.2	5.8	1.1
Sept. 2018	57.2	48.1	67.5	60.8	50.5	67.6	3.6	2.4	0.1
Oct. 2018	47.6	40.5	60.0	47.8	42.4	60.3	0.2	1.9	0.3
Nov. 2018	38.3	31.8	45.6	38.5	34.0	45.7	0.2	2.2	0.1
Dec. 2018	36.5	33.0	40.3	36.6	34.3	38.8	0.1	1.3	-1.5

FIGURE 7. Water Temperatures (°F) at the Upstream and Tailrace Sites, June 1 to September 30, 2018

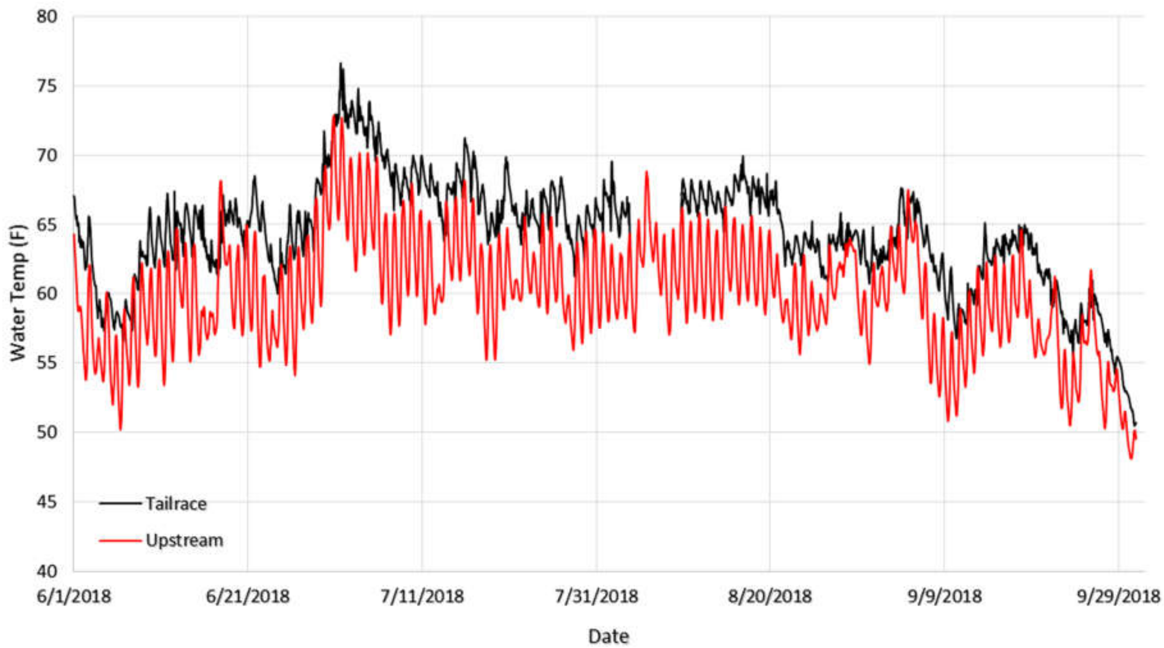
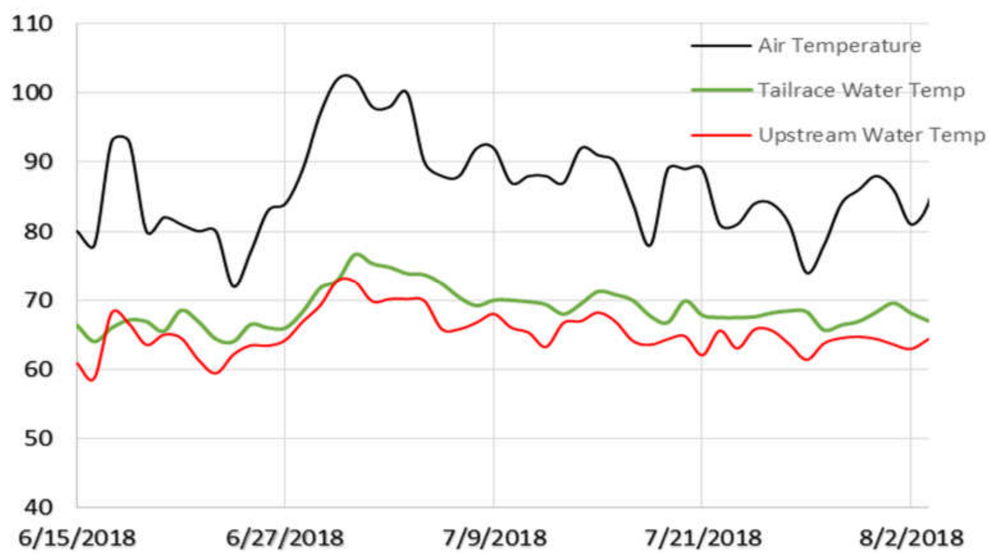


TABLE 2. Water Temperature Summary for the Impoundment (Site B2), Upstream and Tailrace Sites, 2018

Date	Maximum Daily Air Temp (°F)	Upstream Water Temp (°F)	Impoundment Surface Water Temp (°F)	Tailrace Water Temp (°F)	Tailrace—Upstream (°F)
June 12	88	56.4	67.5	62.7	6.3
June 24	72	61.4	69.4	61.4	0
July 10	87	59.9	71.8	68.7	8.8
July 24	84	61.3	69.3	63.9	2.6
Aug. 9	87	59.7	69.6	65.7	6
Aug. 20	88	61.4	72.0	67.9	6.5
Sept. 3	84	61.8	70.3	63.9	2.1
Sept. 17	86	59.3	69.4	63.1	3.8
Sept. 30	52	49.4	52.0	51.1	1.7

FIGURE 8. Example of Effect of Maximum Daily Air Temperatures (°F) on Maximum Daily Water Temperatures (°F) at the Upstream and Tailrace Sites, June 1 to August 3, 2018



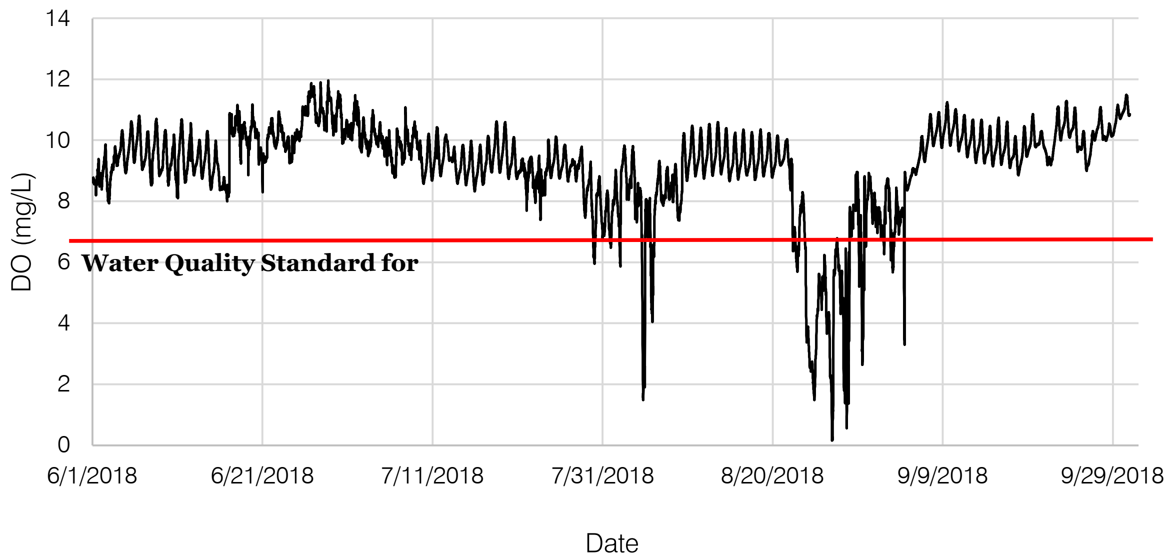
Dissolved Oxygen Monitoring

The State of Michigan's Part 4 Rules specify water quality standards which shall be met in all waters of the state. Specifically, regarding DO, R 323.1064 "Dissolved Oxygen in Great Lakes, Connecting Waters, and Inland Streams," states:

> *"Rule 64. (1) A minimum of 7 milligrams per liter of dissolved oxygen in all Great Lakes and connecting waterways shall be maintained, and, except for inland lakes as prescribed in R 323.1065, a minimum of 7 milligrams per liter of dissolved oxygen shall be maintained at all times in all inland waters designated by these rules to be protected for coldwater fish. In all other waters, except for inland lakes as prescribed by R 323.1065, a minimum of 5 milligrams per liter of dissolved oxygen shall be maintained."*

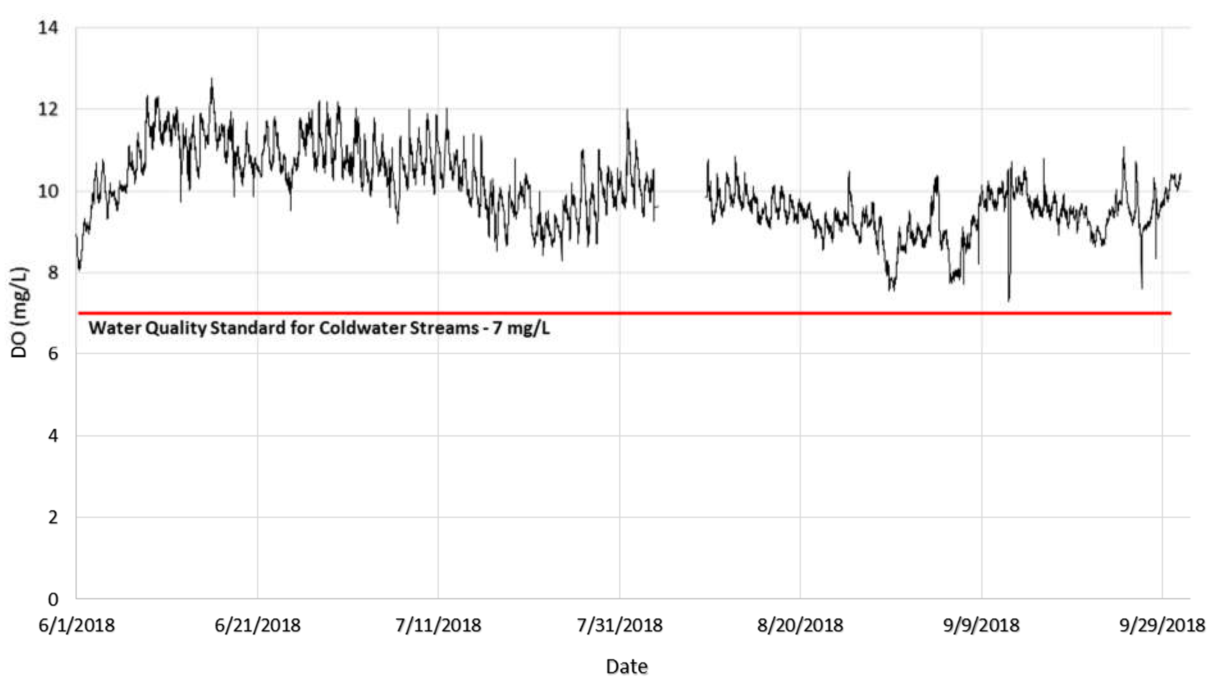
At the Upstream site, data show that the DO concentration dropped below seven milligrams per liter (mg/L) on several occasions (Figure 9). However, it is believed that the data may have been affected by improper function of the logger, rather than actual environmental conditions. During several of the data download events, significant accumulation of sediment and organic materials were noted to be covering the sensor of the data logger. Following the drop in DO levels on August 4, the sensor was replaced and the logger recalibrated. From August 22 to August 30, the data indicate that the DO was consistently below 7 mg/L, often falling to 0–2 mg/L. If these data were correct, it is likely that a mass die-off or migration of trout would have occurred. Boyne Outfitters, a local fly-fishing outfitter, led fishing trips on this section of river during the anomalous event, and reported that fish were present and active (E. Winchester, pers. comm.). Other than during these two periods, the DO concentration continuously exceeded the water quality standards at this site.

FIGURE 9. DO Concentrations (mg/L) for the Upstream Site, June 1 to September 30, 2018



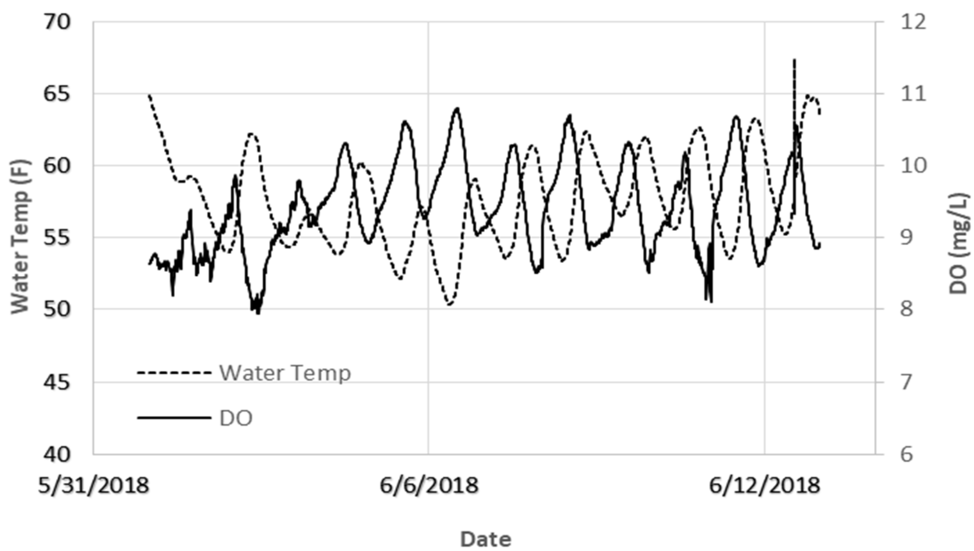
In the Tailrace, DO concentration was recorded from 12:01 AM on June 1 until about 9:00 PM on August 3, when the data logger was stolen from the site. A new logger was installed at 5:40 PM on August 9, which recorded continually until its removal on September 30. The nearly six-day data gap is apparent in Figure 10. At no time during the monitoring period, even during the hottest of weather, did the DO concentration fall below the water quality standard of 7 mg/L. As such, there is no reason to believe that the DO may have fallen below the standard during the time that data were not being recorded. Based upon the 2018 data, this site met the water quality standards for DO 100 percent of the time.

FIGURE 10. DO Concentrations (mg/L) for the Tailrace Site, June 1 to September 30, 2018



Diel fluctuations in DO concentration appeared to be directly related to water temperature, the two parameters being inversely proportional. Most of the time, the highest DO concentration occurred early in the morning, corresponding to the lowest water temperature (Figure 11). This is a typical relationship for flowing waters with little aquatic vegetation or organic decay to drive photosynthetic or biochemical oxygen-demand-related DO sags.

FIGURE 11. Typical Inverse Relationship between DO Concentrations (mg/L) and Water Temperature (°F), Upstream Site



Water Temperature and Dissolved Oxygen in the Impoundment

Based upon the bathymetry of the impoundment, it was determined that only two monitoring sites would be required to characterize the water temperature and DO profiles. Site B1 was located in about nine feet of water near the center of the impoundment (Figure 3). All of the water to the east of Site B1 is less than or equal to nine feet in depth. Site B2 was located in the deepest hole within the impoundment, near the outlet. Water depth was measured to be about 18 feet at this site. North and east of Site B2, the impoundment quickly shallows. In the direction of Site B1, the water gradually shallows from 18 feet to nine feet.

Data were collected approximately every two weeks on nine dates during June, July, August, and September. Data collection occurred at various times of the day, but always between the hours of 9:30 AM and 5:00 PM.

The highest water temperature recorded (71.6°F) at Site B1 occurred at 9:30 AM on July 10 (Figure 12), following 11 days of exceptionally hot weather, during which daily high air temperature averaged over 95°F. Also, at 9:30 AM, the water temperature in the Tailrace hit its daily maximum of 68.7°F; this temperature corresponded to the temperature four feet under the surface in the impoundment. The water temperature at the Upstream site was 59.9°F at this time. The maximum air temperature on July 10 was 87°F.

The deepest four-foot section of water (from five to nine feet in depth) at Site B1 only once (July 10) exceeded the upper thermal limit (67.1°F) for the cold-transitional classification. While the classification is not necessarily intended for lakes, it is used here for comparison purposes. Otherwise, this deeper water stayed below 67.1°F. The upper four feet of the water column regularly exceeded this water temperature over the duration of the monitoring period. DO concentration never fell below 8 mg/L during monitoring of Site B1, well above the water quality standard of 7 mg/L for coldwater fisheries (Figure 13).

At Site B2, the water temperature reached 72°F on July 10 and August 20. The upper five feet of the water column regularly exceeded the upper thermal limit for the cold-transitional classification. The deepest 12-foot section of water (from six to 18 feet in depth) never exceeded 66.4°F and most often fell into the cold classification (Figure 14). The upper 11 feet (from zero to 11 feet in depth) always had DO concentrations above 7 mg/L (Figure 15). Thus, a layer of water between the depths of six and 11 feet always met the criteria for cold-transitional and the water quality standards for DO concentration.

Based upon the data collected, it appears that depths of the impoundment that exceed five feet are almost always colder than 67°F and have an adequate oxygen supply for coldwater organisms.

FIGURE 12. Water Temperature Profiles for Site B1, June–September 2018

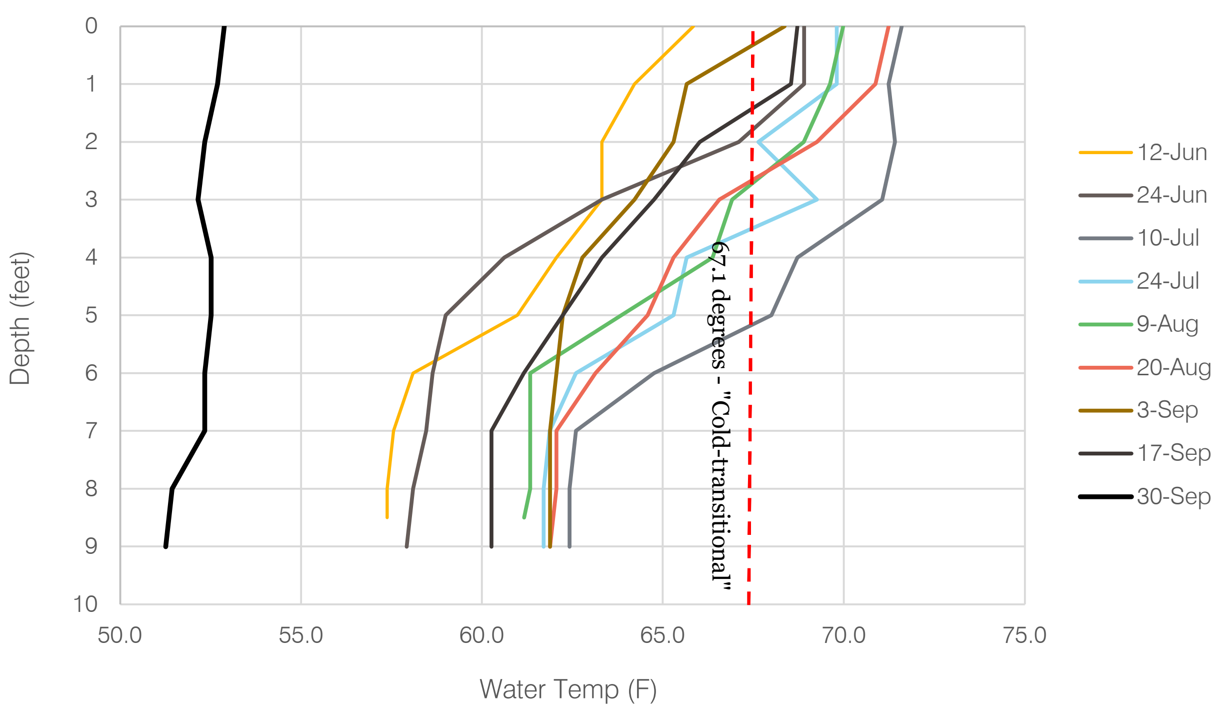


FIGURE 13. Dissolved Oxygen Profiles for Site B1, June–September 2018

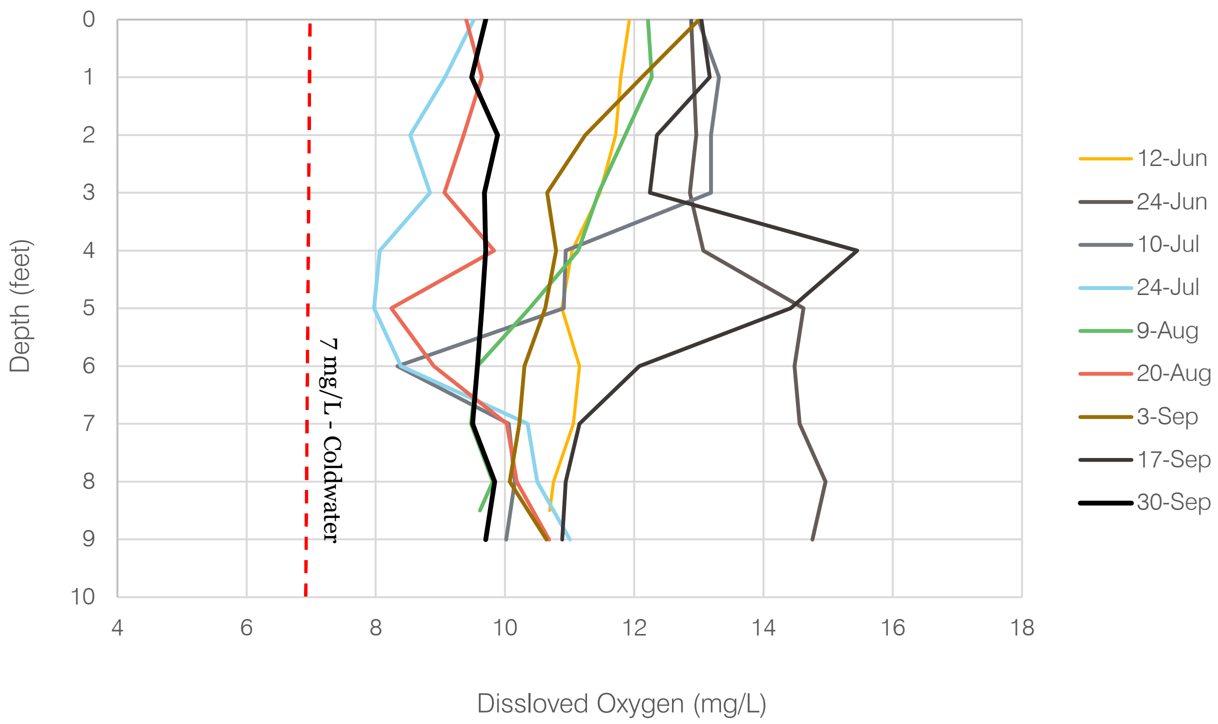


FIGURE 14. Water Temperature Profiles for Site B2, June–September 2018

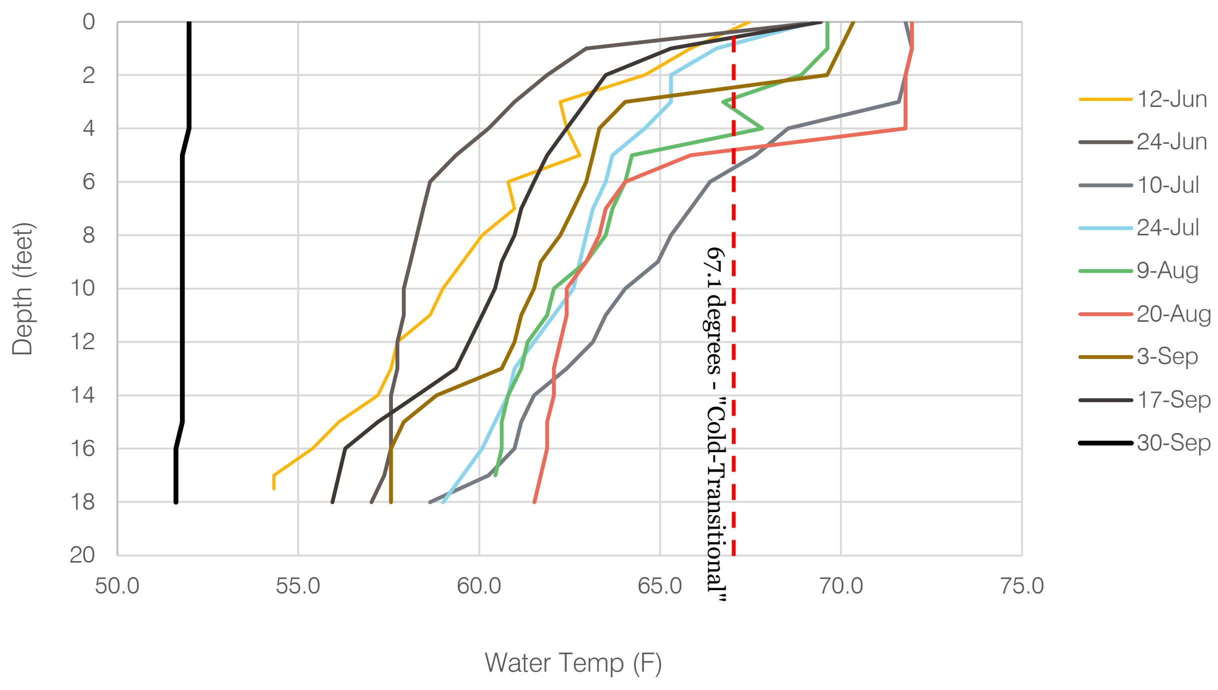
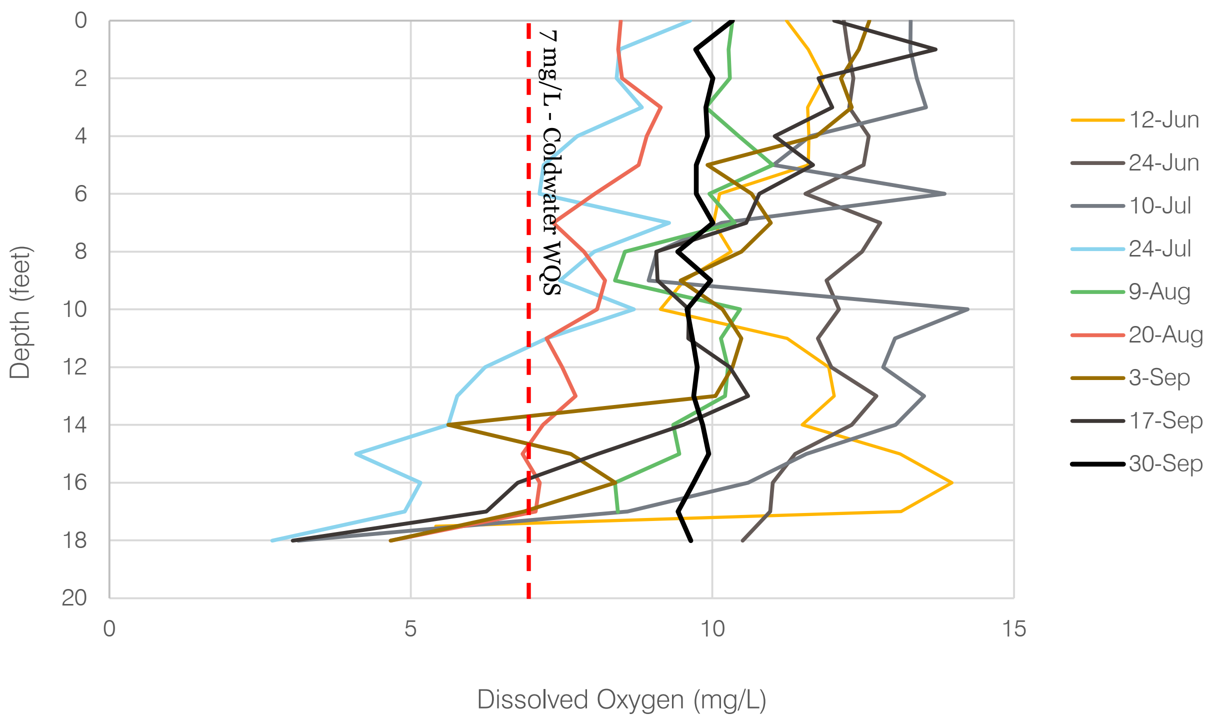


FIGURE 15. Dissolved Oxygen Profiles for Site B2, June–September 2018



Aquatic Survey of the Impoundment

Fish Community

Electrofishing of the impoundment was conducted during the evening (after sunset) of July 10, along the shoreline and throughout shallow water areas (approximately less than six feet in depth). The total shocking time was 3,087 seconds of electricity discharge into the water. Four fyke nets were deployed, for a total of four net nights, from July 10 through July 12, and one gill net was deployed for a total of one net night from July 10 through July 11.

A total of 450 fish, comprising 13 species, were caught among all sample gear within the impoundment, where pumpkinseed sunfish (*Lepomis gibbosus*), yellow perch (*Perca flavescens*), and rock bass (*Ambloplites rupestris*) were the most frequently observed species (Table 3). Most of the fish collected during the survey were captured using electrofishing gear. The catch rate using electrofishing gear for all species was 5.9 fish per minute of electrofishing. The catch rate using fyke nets was approximately 35 fish per net night.

TABLE 3. Fish Captured in the Impoundment, by Each Sampling Method, July 2018

Common Name	Electrofishing	Fyke Net	Gill Net	Grand Total
American brook lamprey	3			3
Bluntnose minnow	6	1		7
Central mudminnow	1			1
Common shiner	1			1
Golden shiner	1			1
Largemouth bass	2			2
Mottled sculpin	1			1
Northern pike	8	4	4	16
Pumpkinseed	124	109		233
Rock bass	34	20		54
Smallmouth bass	5	5		10
White sucker	13			13
Yellow perch	105		3	108
Grand Total	**304**	**139**	**7**	**450**

Pumpkinseed sunfish ranged in length from 1.8 to 5.6 inches, with an average length of 3.3 inches (sample size n = 233; standard deviation s = 0.6 inches), and ranged in weight from 0.03 to 4.2 ounces, with an average weight of 0.5 ounces (s = 0.4 ounces). Approximately 65 percent of the pumpkinseed sunfishes were four inches in length (Figure 16), and their size within the impoundment was consistent with state average-sized pumpkinseed sunfishes (Figure 17).

Yellow perch ranged in length from 1.6 to 8.6 inches, with an average length of 5.2 inches (n = 108; s = 1.4 inches), and ranged in weight from 0.1 to 4.1 ounces, with an average weight of 1.1 ounces (s = 0.9 ounces). Approximately 77 percent of the yellow perch were between five and seven inches in length (Figure 18), and their size within the impoundment was consistent with state average–sized yellow perch (Figure 19).

Rock bass ranged in length from 2.1 to 8.3 inches, with an average length of 4.3 inches (n = 54; s = 1.7 inches), and ranged in weight from 0.1 to 8.1 ounces, with an average weight of 1.5 ounces (s = 1.9 ounces). Approximately 86 percent of the rock bass were between three and six inches in length (Figure 20), and their size within the impoundment was consistent with state average–sized rock bass (Figure 21).

The fish community described here is typical for an impounded coldwater river. Though, it is unusual for bluegill (*Lepomis macrochirus*) to be missing from any lentic environment in lower Michigan; the reason for this is unknown. Most of the fish collected in the impoundment were less than eight inches in length. The lack of larger panfish in the population is likely related to habitat suitability; the preference of deeper water in maturing panfish forces them into a relatively small basin that is already occupied by large predators, while the small panfish find refuge in the abundant vegetation of the littoral zone. Several northern pike (*Esox lucius*) were captured, with a maximum observed length of 32 inches, and a few smallmouth bass (*Micropterus dolomieu*) were captured as well, which ranged to 18 inches.

FIGURE 16. Length Frequency Distribution of Pumpkinseed Sunfish within Boyne River Impoundment, July 2018

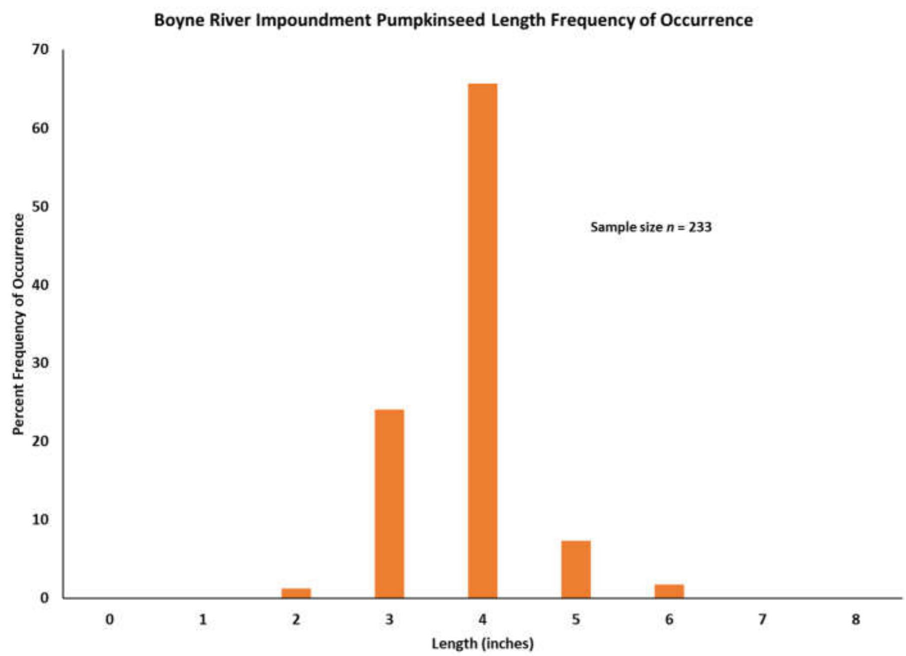
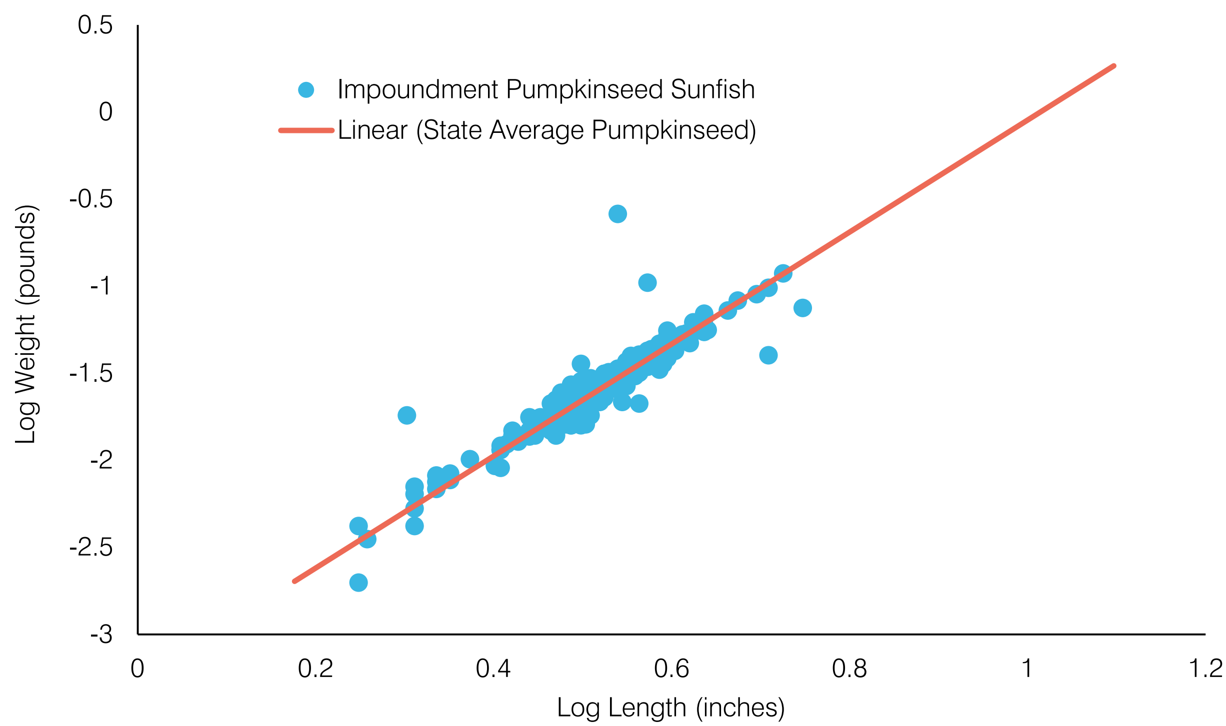


FIGURE 17. Pumpkinseed Sunfish Length-weight Regression for Boyne River Impoundment, July 2018, and State Average Length-weight Relationship for Michigan



Source: Schneider et al. 2000b

FIGURE 18. Length Frequency Distribution of Yellow Perch within Boyne River Impoundment, July 2018

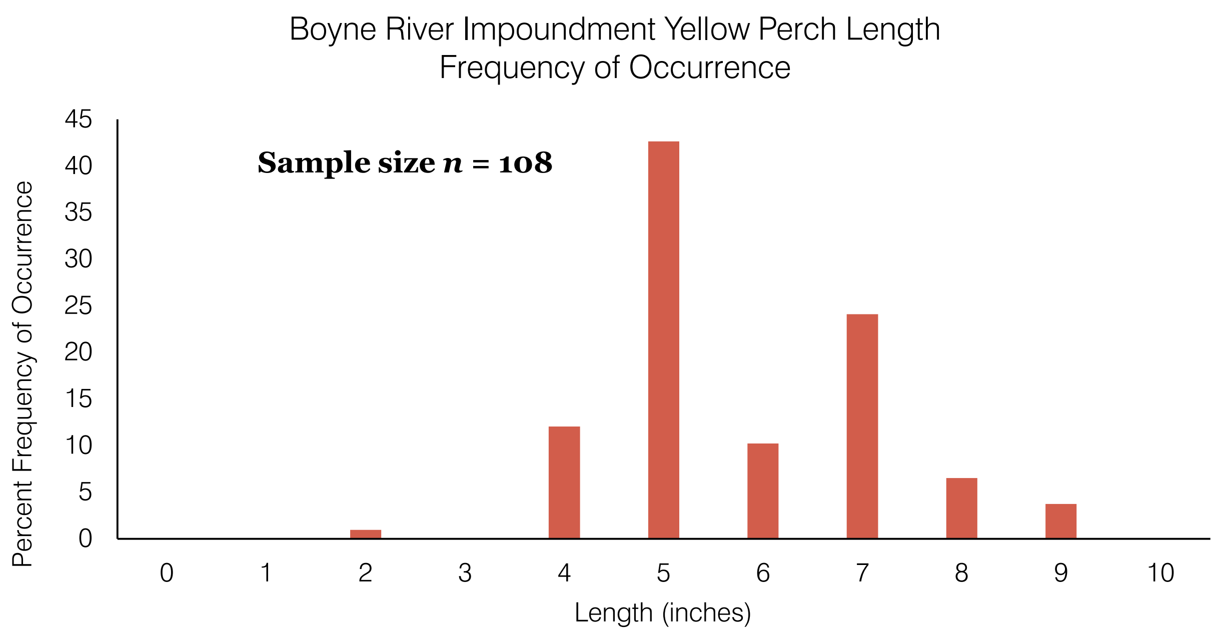
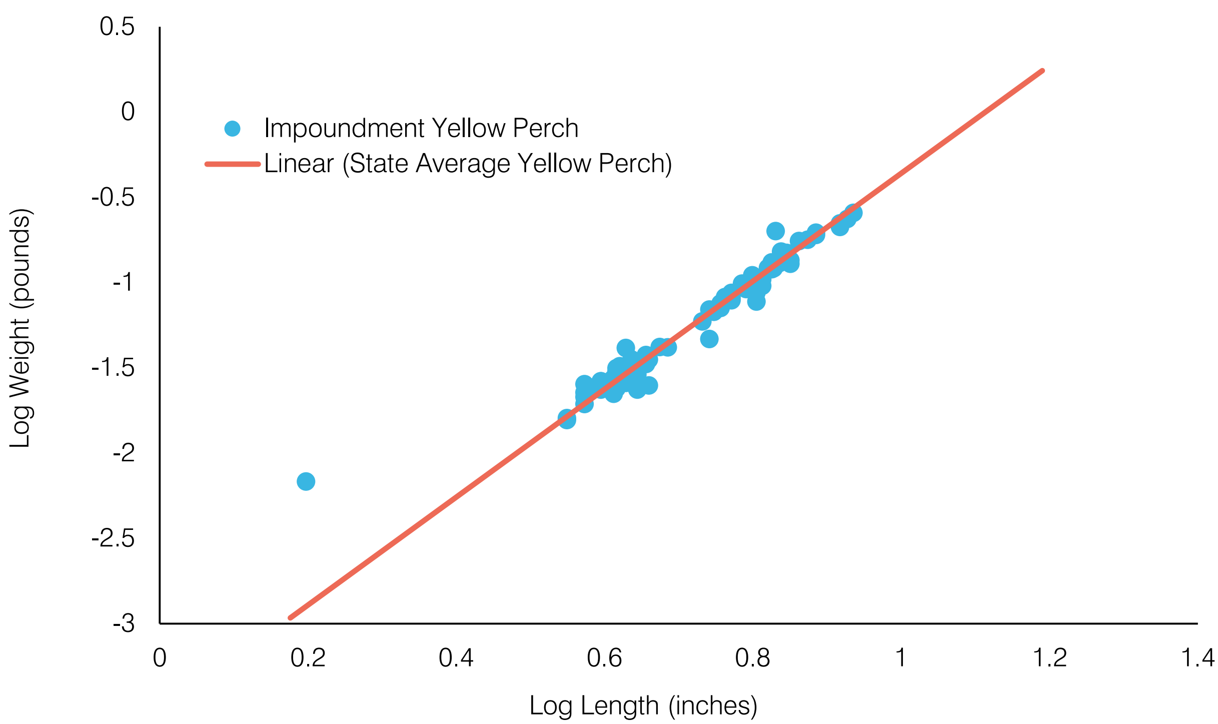


FIGURE 19. Yellow Perch Length-weight Regression for Boyne River Impoundment, July 2018, and State Average Length-weight Relationship for Michigan



Source: Schneider et al. 2000b

FIGURE 20. Length Frequency Distribution of Rock Bass within Boyne River Impoundment, July 2018

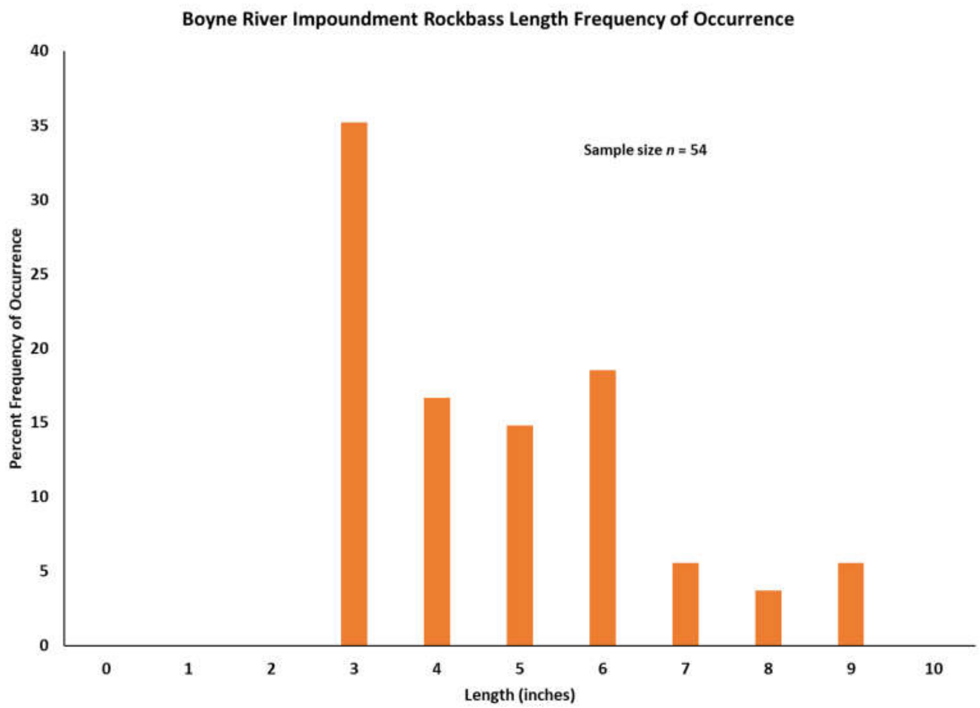
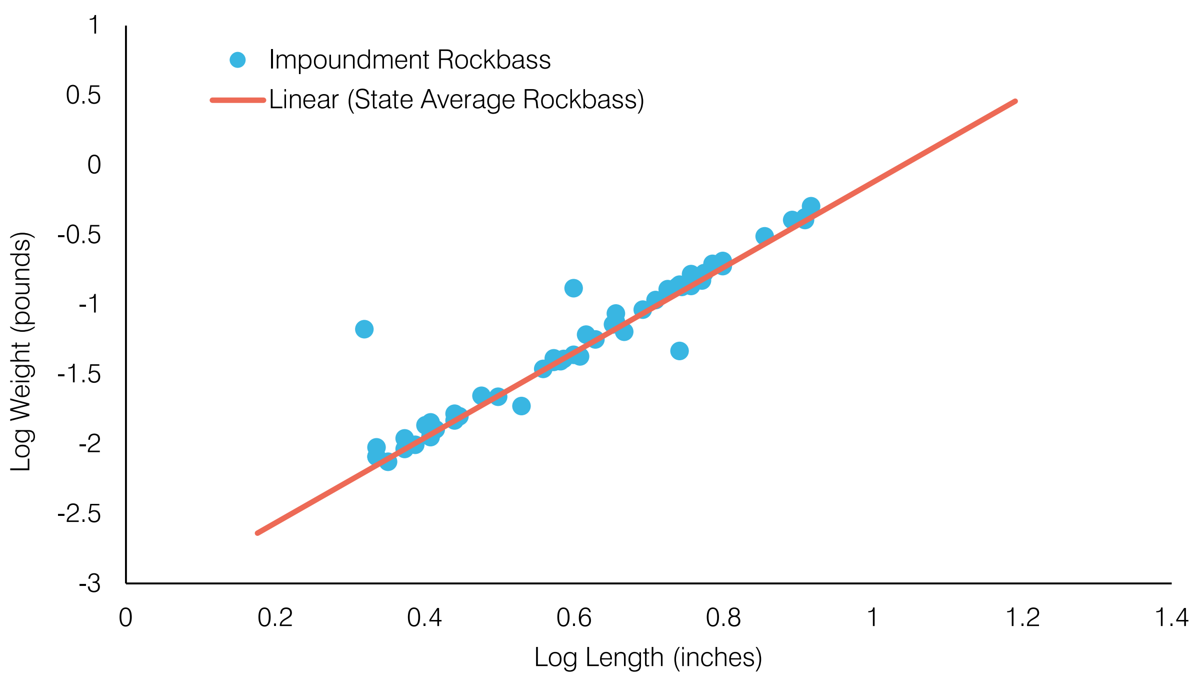


FIGURE 21. Rock Bass Length-weight Regression for Boyne River Impoundment, July 2018, and State Average Length-weight Relationship for Michigan



Source: Schneider et al. 2000b

Macroinvertebrate Community

Macroinvertebrate sampling was completed on July 12. Dip-netting was conducted for 30 minutes and five sediment samples were collected from a boat. A total of 475 organisms, representing 21 taxa, were collected (Table 4). The shallow water samples were dominated by water boatman (*Corixidae*), spread-winged damselflies (*Lestidae*), and water mites (*Hydracarina*). Deep water samples were dominated by nonbiting midges (*Chironomidae*) and water mites (Hydrachnidae). Two families of mayfly, *Baetidae* and *Ephemeridae* (e.g., *Hexagania*), and two families of caddisfly, *Limnephilidae* and *Phryganeidae*, were also found. During nighttime fish sampling, large hatches of both *Emphemeridae* and *Baetidae* were observed. Overall, the macroinvertebrate community is quite typical of a pond, lake, or impoundment; is relatively diverse; and would be expected to provide high-quality biomass for fish.

TABLE 4. Macroinvertebrate Collections from the Impoundment on the Boyne River, 2018

Taxa	Impoundment
Annelida (segmented worms)	
Hirudinea (leeches)	8
Arthropoda	
Crustacea	
Amphipoda (scuds)	16
Decapoda (crayfish)	10
Arachnoidea	5
Hydracarina	76
Insecta	
Ephemeroptera (mayflies)	
Baetidae	42
Ephemeridae	5
Odonata	
Anisoptera (dragonflies)	
Libellulidae	2
Zygoptera (damselflies)	
Lestidae	44
Hemiptera (true bugs)	
Belostomatidae	2
Corixidae	163
Notonectidae	1
Veliidae	3
Megaloptera	
Sialidae (alder flies)	9
Trichoptera (caddisflies)	
Limnephilidae	3
Phryganeidae	1
Coleoptera (beetles)	
Dytiscidae (total)	4
Diptera (flies)	
Athericidae	1
Ceratopogonidae	12

Taxa	Impoundment
Chironomidae	65
Mollusca	
Physidae	3
Total Individuals	**475**

Freshwater Mussel Community

A reconnaissance mussel survey was completed on July 12. There were no known previous surveys of mussels or occurrences of listed mussel species in this area. Two surveyors spent a total of two hours and ten minutes surveying approximately 700 feet of the shallow littoral zone, searching for evidence of mussels. Most of the time was spent on the western end of the impoundment, where typically suitable habitat was found and safe wading could occur. The water was extremely clear until the sediments were disturbed, making the water very turbid and the sighting of mussels impossible. Thus, the shallowest water was used for trekking and mussels were spotted along the drop-off, where they could be collected before disturbing the sediments. The collection included 25 live cylindrical papershell (*Anodontoides ferussacianus*), 12 live giant floater (*Pyganodon grandis*), and eight live fatmuckets (*Lampsilis siliquoidea*), along with many shells from dead mussels of these same species (Photographs are included in Appendix A). Many live zebra mussels (*Dreissena polymorpha*) and empty shells were observed.

An August 28, 2018, memo was submitted to Kyle Kruger, an MDNR fisheries biologist, describing results of the survey. Response was received in the form of a January 10, 2019, email from another biologist, Scott Hanshue, indicating that no further mussel investigation is necessary. Both of these correspondence documents are included in Appendix A.

Macrophyte Community

The impoundment was broken into 19 similarly sized cells for assessment (Figure 4). A total of 13 different plant species were documented (Table 5). Muskgrass (*Chara spp*.), which is a macroscopic algae, is the only species that was found in each cell and is very abundant throughout the impoundment. Nearly the entire littoral zone of the northern and eastern shores contains dense mats of *Chara* on the bottom and in floating mats. *Chara* makes good juvenile fish and macroinvertebrate habitat and is useful for stabilizing the soft substrate. American elodea (*Elodea canadensis*) and clasping-leaf pondweed (*Potamogeton richardsonii*) were also found in most cells.

Narrowleaf cattail (*Typha angustifolia*) is the only non-native species that was documented and is considered to be invasive. Eurasian watermilfoil (*Myriophyllum spicatum*) or curly-leaf pondweed (*Potamogeton crispus*), two of the most widespread and highly invasive aquatic plants in Michigan, were not found in the impoundment. Starry stonewort *(Nitellopsis obtusa*), a more recent invasive species to cause significant problems in Michigan lakes, is also absent at this time.

TABLE 5. Plant Species Found within Each Survey Cell of the Boyne River Impoundment, July 2018

		Assessment Cell Number																		
Common Name	**Scientific Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
Coontail	*Ceratophyllum demersum*							B	A	A	A	A	A	A	A	A	D	A		A
Muskgrass	*Chara spp.*	D	D	D	D	D	D	D	D	D	D	D	D	D	A	D	D	B	D	D
American elodea	*Elodea canadensis*	A	A	A	A	B	A	D	C	A	A	A	A	A	A	A	A	A		
Iris spp.	*Iris spp.*	A			A				A									A	A	
Common naiad	*Najas flexilis*																	D	D	
Leafy pondweed	*Potamogeton foliosus*							A	A	A	A	A	A	A						B
Clasping-leaf pondweed	*Potamogeton richardsonii*		A					D	A	D	D	D	D	D	A	A	D	D	D	D
Hardstem bulrush	*Schoenoplectus acutus*	A																		
Softstem bulrush	*Schoenoplectus tabernaemontani*	B	C	A	A															C
Bur-reed	*Sparganium*	A																		
Narrowleaf cattail	*Typha angustifolia*	A	B	A						B	B	B	B						A	B
Broadleaf cattail	*Typha latifolia*	A																	A	
Wild celery	*Vallisneria Americana*	A		A																A

A = found
B = sparse
C = common
D = dense

Aquatic Survey of the Boyne River

Fish Community

Electrofishing surveys of the Upstream and Downstream fish collection sites (Figure 3) were conducted on July 9 and 10. Water temperatures at the Upstream site ranged from 57-60°F during sampling, with pH of 8.7 and conductivity of 357 (Siemens (S) per meter (m)). At the Downstream site, water temperatures ranged from 67-69°F during sampling, with pH of 8.5 and conductivity of 390 S/m.

The Upstream sampling site is located above the dam, so migratory fish such as Pacific salmon and steelhead (*Oncorhynchus mykiss*), or invasive fish like the round goby (*Neogobius melanostomus*), cannot naturally access the site. The site is unique in that it is a privately managed fishery. *Boyne Outfitters* has sole access to the private property and adheres to a strict stocking and management program. Thus, numbers and sizes of trout are atypical, and results of this study cannot be directly compared to other sites along the Boyne River or in northwestern Michigan. For more relevant comparison, results of recent fish community surveys completed by MDNR were also obtained and are discussed below.

A total of eight species of fish was collected at the Upstream site (Table 6). Brook trout (*Salvelinus fontinalis*), mottled sculpin (*Cottus bairdii*), and brown trout (*Salmo trutta*) dominated the catch. Yellow perch were a somewhat surprising find, but are plentiful in the impoundment and, probably, in upstream ponds.

TABLE 6. Fish Species Collected at the Upstream Sampling Site of the Boyne River, July 9 and 10, 2018

Common Name	Scientific Name
American brook lamprey	*Lethenteron appendix*
Brook trout	*Salvelinus fontinalis*
Brown trout	*Salmo trutta*
Mottled sculpin	*Cottus bairdii*
Rainbow trout	*Oncorhynchus mykiss*
Rock bass	*Ambloplites rupestris*
White sucker	*Catostomus commersonii*
Yellow perch	*Perca flavescens*

On the first day of sampling, 22 brook trout, 18 brown trout, and eight rainbow trout were tail clipped (Appendix B). Of these 48 trout, 16 were recaptured on the second day of sampling. Thirteen unmarked trout were collected on day two. The recapture rate (33 percent) was high, considering that the stream is flowing very fast and there is an abundance of woody debris and other instream structure that made sampling difficult. Approximately 50 percent of brook trout were recaptured, while the recapture rates for browns and rainbows were 28 percent and 0 percent, respectively. Only one rainbow trout was captured on day two; it is unknown if they were better at avoiding capture on the second day, or if the process of electrofishing and handling was mortal. No dead fish were observed on day two.

If the population estimate is run using the number of all three trout species, there are an estimated 79 trout (variance (v) = 16) within the survey reach, which equates to 315 trout per mile, or 88 trout per acre in the Upstream site. If only brook trout are considered, the estimate is 30 brook trout (v = 2) within the survey reach, and 120 brook trout per mile, or 33 per acre.

Of the 61 total trout collected in the Upstream site, there were 28 brook trout, 24 brown trout, and nine rainbow trout. Brook trout ranged from 5.2 to 14.2 inches (mean = 11.1 inches) in length and all but one met the legal size limit of eight inches. Brown trout ranged from 5.7 to 22.4 inches (mean = 9.8 inches) in length, and 38 percent were of legal size. Rainbow trout ranged from 9.2 to 12.4 inches (mean = 11 inches) in length. Most of the fish in this sampling site are acquired from an approved private hatchery and stocked at a larger size than typical MDNR hatchery fish (E. Winchester, personal communication).

MDNR conducted fish surveys on Thumb Road (MDNR 2007) and Springbrook Road (MDNR 2015) on the North Branch of the Boyne River. Neither of the sites are stocked with trout and rely on natural reproduction to sustain the populations. In 2007, 19 brook trout (range = 2.2-7.4 inches), 58 brown trout (range = 1.9-12.4 inches) and 40 mottled sculpin were collected. None of the brook trout were of legal size, while 14% of brown trout exceeded the 8-inch minimum legal length requirement. Aging of the fish showed that 11 of the brook trout were Age 0, six were Age I and two were Age II. Fourteen brown trout were Age 0, 17 were Age I, 16 were Age II, four were Age III and one was Age IV. Both brook and brown trout were found to be growing slower than the state average. In 2015, the catch consisted of 12 brook trout (average = 6.5 inches), 57 brown trout (average = 5 inches) and 57 mottled sculpin. Two (17%) of the brook trout and 14% of the brown trout were of legal size for harvest. The numbers of trout collected were said to be higher than in any previous surveys conducted at the location.

At the Downstream site, ten species of fish were collected on the first day of sampling, and coho salmon (*Oncorhynchus kisutch*), longnose dace (*Rhinichthys cataractae*) and smallmouth bass were added to the list on the second day, for a total of 13 species (Table 7). The samples were dominated by brown trout, mottled sculpin, rainbow trout, and rock bass, in descending order. One mature female chinook salmon (*Oncorhynchus tshawytscha*) was captured. Overall, this is a typical fish community in a cool/cold-transitional stream connected to Lake Michigan and is nearly identical to the community last reported by the MDNR (MDNR 2018). The fish community meets the coldwater standard established under Procedure 51, since the number of salmonids exceeds 1% of the total population. The higher number of species compared to the Upstream site is largely due to the inclusion of potamodromous fishes, slightly warmer water, and, perhaps, a lower density of larger, predatory fish. Compared to the sites on the North Branch, the Downstream site is far more diverse.

TABLE 7. Fish Species Collected at the Downstream Sampling Site of the Boyne River, July 9 and 10, 2018

Common Name	Scientific Name
American brook lamprey	*Lethenteron appendix*
Brook trout	*Salvelinus fontinalis*
Brown trout	*Salmo trutta*
Chinook salmon	*Oncorhynchus tshawytscha*
Coho salmon	*Oncorhynchus kisutch*
Common shiner	*Luxilus cornutus*
Creek chub	*Semotilus atromaculatus*
Longnose dace	*Rhinichthys cataractae*
Mottled sculpin	*Cottus bairdii*
Rainbow trout	*Oncorhynchus mykiss*
Rock bass	*Ambloplites rupestris*
Smallmouth bass	*Micropterus dolomieu*

White sucker	*Catostomus commersonii*

The trout population survey resulted in marking of 47 trout (three brook, 29 brown, and 15 rainbow), ranging in size from one to 19 inches (Appendix B). On the second day, 38 trout, eight of which were recaptures, were collected. The recapture rate (17 percent) was about half the rate of the Upstream site. The population estimate for the Downstream site is 155 trout ($v = 65$), equaling 745 trout per mile, or 142 trout per acre.

Of 54 individual brown trout that were captured, 38 fish (70 percent) were between five and nine inches in length, 12 fish were between nine and 11 inches in length, and four fish were more than 11 inches in length. Four (7 percent) of the brown trout were of legal size, being ten inches or larger (Type 4 trout stream). This population structure is indicative of a stocked brown trout fishery, with no naturally produced fish that are smaller than stocking size. In 2018, the Boyne River was stocked downstream of the dam, with 4,000 brown trout averaging about 7.4 inches in length (MDNR 2019). Similar to the North Branch site, the proportion of larger fish in the population declines rapidly. Mortality could be due to high water temperatures, harvest, predation, or unsuitable habitat during any portion of the year. This stretch of the river is publicly accessible, and fishing activity was commonly observed during survey work.

The Boyne River was also stocked with 8,700 rainbow trout downstream of the dam in 2018, averaging 7.9 inches in length. Results of this fish survey found 20 individual rainbow trout. Ten of those were between 6.9 and 9.6 inches and were presumably stocked. The remaining ten were between 1.9 and 3.6 inches and are likely the result of successful spring spawning by adult steelhead (i.e., rainbows).

Three brook trout, all between 8.7 and 9.8 inches, were captured. All three would be legal for harvest.

During site visits in September, a relatively large number of mature chinook salmon were observed in the river below the dam. These fish were on their spawning migration.

Macroinvertebrate Community

At the Upstream site, 27 taxa were collected, including four families of mayfly, five families of caddisfly, and three families of stonefly (Table 8). These organisms are generally considered to be the most sensitive to pollution and their presence is noteworthy. Mayflies and caddisflies made up nearly 56 percent of the sample, by individual. The caddisfly, *Brachycentridae*, made up 36 percent of the sample. According to P51, the site scores a two with a community rating of acceptable.

Downstream, 21 taxa were collected, with three families of mayfly, two families of caddisfly, and one family of stonefly. Only one individual stonefly was found. About 71 percent of the sample consisted of types of mayfly and caddisfly. The most-collected organism was the mayfly, *Isonychiidae*, which made up about 35 percent of the sample. This site received a P51 score of zero, which is considered to be in the middle of the acceptable range.

While the Upstream site contains more families and individuals of pollution-sensitive organisms, the differences between the two samples could be a factor of physical habitat, a function of water quality, or their locations relative to the dam and impoundment. *Isonychiidae*, for example, was not found at the Upstream site. Its prevalence at the Downstream site is likely due to its feeding habits and location below the dam; its diet relies heavily on algae and diatoms, which would be produced in large volume in the impoundment. The abundance of stoneflies at the Upstream site may be a function of the very fast-flowing current, with an abundance of coarse wood and rocks.

TABLE 8. Macroinvertebrate Collections from the Upstream and Downstream Sites on the Boyne River, 2018

Taxa	Upstream	Downstream
Annelida (segmented worms)		
Hirudinea (leeches)	14	4
Arthropoda		
Crustacea		
Amphipoda (scuds)	35	1
Decapoda (crayfish)	2	9
Isopoda (sowbugs)		27
Arachnoidea	32	
Insecta		
Ephemeroptera (mayflies)		
Baetidae	3	2
Ephemerellidae	18	
Heptageniidae	23	56
Isonychiidae		144
Leptophlebiidae	2	
Odonata		
Anisoptera (dragonflies)		
Aeshnidae		3
Gomphidae	1	2
Zygoptera (damselflies)		
Calopterygidae	2	1
Coenagrionidae	1	
Plecoptera (stoneflies)		
Leuctridae	6	
Perlidae	8	1
Pteronarcyidae	19	
Hemiptera (true bugs)		
Gerridae	1	4
Megaloptera	9	1
Trichoptera (caddisflies)		
Brachycentridae	142	
Glossosomatidae	10	
Helicopsychidae	1	
Hydropsychidae	21	90
Limnephilidae	1	3
Coleoptera (beetles)		
Dytiscidae (total)	4	7
Dryopidae	1	
Elmidae	24	3
Diptera (flies)		
Athericidae	13	13
Chironomidae	4	42

Taxa	Upstream		Downstream	
Tabanidae			1	
Mollusca				
Gastropoda (snails)				
Physidae	2		1	
Total Individuals	**399**		**415**	

	Upstream		Downstream	
Metric	**Value**	**Score**	**Value**	**Score**
Total number of taxa	27	0	21	0
Number of mayfly taxa	4	0	3	0
Number of caddisfly taxa	5	0	2	-1
Number of stonefly taxa	3	1	1	0
Percentage mayfly composition	11.53	0	48.67	1
Percentage caddisfly composition	43.86	1	22.41	0
Percentage dominant taxon	35.59	-1	34.7	-1
Percentage isopod, snail, leech	4.01	0	7.71	0
Percentage surface airbreathers	1.25	1	2.65	1
Total Score		**2**		**0**
Macroinvertebrate community rating		Acceptable		Acceptable

Freshwater Mussel Community

At the Downstream site, several dead shells were found in the substrate and in middens (piles of shells discarded by predators, such as muskrat) directly upstream of the Dam Road crossing. Detailed inspection, including hand grubbing, uncovered hundreds of shells in various degrees of decay, along with 12 live mussels. All mussels, live and dead, were determined to be cylindrical papershell. A few hundred feet upstream, a live fatmucket was found; this was the one specimen representing this species in the entire reach. Scattered dead cylindrical papershells were found within the remainder of the reach. Three live cylindrical papershells were found immediately below the dam. The only other mussels observed within the downstream reach were thousands of live and dead zebra mussels. A total time of four hours and 40 minutes was spent searching for evidence of mussels in the downstream reach.

At the Upstream site, despite an intensive search of approximately two hours, no evidence of native mussels was found. Additionally, no zebra mussels were found within this reach.

A January 10, 2019, email from Scott Hanshue, MDNR fisheries biologist, indicates that no further investigation is necessary at either of the Boyne River sampling sites.

Physical Habitat Survey

Physical habitat at the Upstream site scored 166/200 (excellent—nonimpaired) using the P51 metrics (Table 9). The instream habitat is ideal, with an abundance of epifaunal substrate in the form of logs, branches, cobble, boulders, undercut banks, and exposed roots. There are a number of deep pools and runs (greater than six feet in depth) along with fast and slow water. The channel is stable and the floodplain is accessible and broad. The south bank contains a cedar swamp and is heavily wooded; the canopy shades the stream for much of the day. However, the riparian area on the northern bank is highly altered. It was historically filled to create a walking/driving path, and the entire streambank is lined with a cedar post breakwall for stabilization.

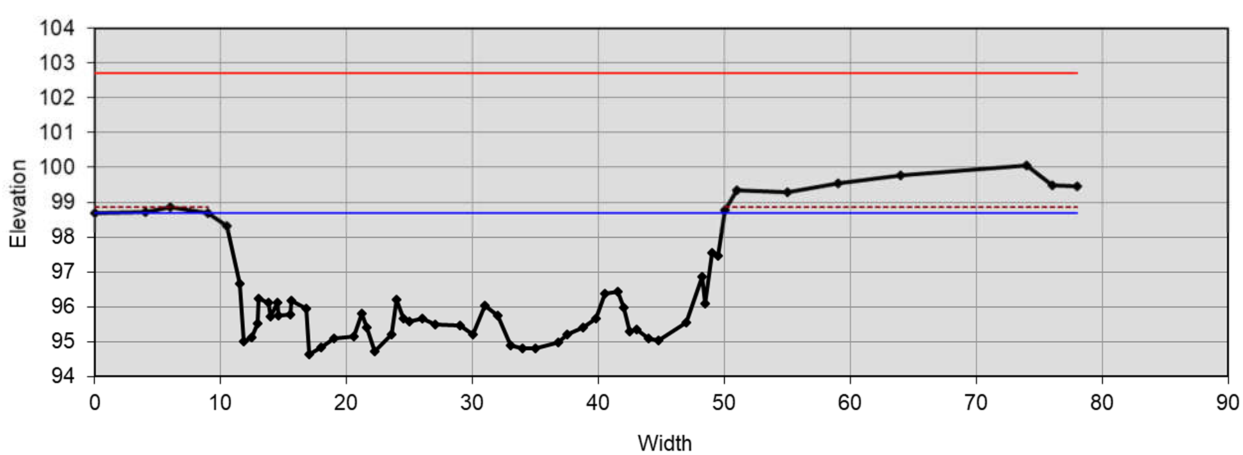
From a geomorphology perspective, the riffle selected for survey (Cross Section 1) is representative of the flowing river channel upstream of the impoundment. The riffle is located far enough upstream to be entirely outside the influence of the hydrodynamic impacts of the impoundment. The riffle is also naturally formed under the existing hydrology of the watershed, unlike some nearby reaches that have been altered with habitat improvement, stabilization of streambanks, etc. Human impacts at this site do include the mowing and past tree removal on the north bank.

In this area, the stream channel flows between vast expanses of wetlands and floodplains dominated by coniferous forest. The channel is mostly stable and controlled vertically and laterally by components of the forest, including the trees and roots growing adjacent, and a large volume of fallen large woody debris. The woody debris, rather than gravel and cobble, provides the foundation for riffle development and long-term stability.

A cross-sectional survey of the riffle indicates that the bankfull channel is 41 feet wide and averages three feet in depth, with a width-to-depth ratio of 13.7 (Figure 22; Table 10). Channel slope was measured to be 0.43%. The low bank and bankfull elevations are similar and the river has the ability to utilize a vast floodplain. The river would be classified as a “C” type channel according to the Rosgen classification system.

Pebble count data is somewhat unusual due to the fact that the large woody debris plays such an important role in channel stability. The soils in this area contain a lot of clay, which can be seen moving as bedload in gravel-sized chunks. Sand is also a notable component of the bedload. The natural riffles are held together by interlocking pieces of woody debris. Accordingly, this material was counted as cobble and boulders for purposes of data entry and particle size analysis.

Figure 22. Cross Section 1 Data Associated with the Boyne River, Upstream of the Impoundment. Bankfull (blue line), Low Bank (dashed line), Floodprone Width (red line)



The Downstream site scored 154/200 (good—slightly impaired) and was only one point shy of excellent. Compared to the Upstream site, the channel is wider (averaging about 43 feet), shallower and the instream cover sparse; however, there is still a large quantity of woody material and coarse substrates. While there are many riffles and runs, deep holes are lacking. The riparian area is in great condition, with the exception of some bank erosion caused by human foot traffic. It is obvious that this is a popular area for wading anglers, as the footpaths, access stairs, and benches are well used.

TABLE 9. Procedure 51 Physical Habitat Ratings for the Upstream and Downstream Sites on the Boyne River, 2018

Habitat Metric	Upstream	Downstream
Substrate and Instream Cover		
Epifaunal substrate/available cover (20)	20	12
Embeddedness (20)*	18	15
Velocity/depth regime (20)*	18	15
Channel Morphology		
Sediment deposition (20)	19	15
Flow status—maintained flow volume (10)	10	9
Flow status—flashiness (10)	10	7
Channel alteration (20)	13	17
Frequency of riffles/bends (20)*	16	15
Riparian and Bank Structure		
Bank stability (left) (10)	7	7
Bank stability (right) (10)	10	8
Vegetative protection (left) (10)	2	7
Vegetative protection (right) (10)	10	7
Riparian vegetation zone width (left) (10)	3	10
Riparian vegetation zone width (right) (10)	10	10
Total Score (200)	**166**	**154**
Habitat Rating	Excellent (nonimpaired)	Good (slightly impaired)

Table 10. Geomorphic Variables for the Upstream and Downstream Sites on the Boyne River, 2018

	Upstream (Cross Section 1)	Upstream (Cross Section 2)	Upstream (Cross Section 3)
Bankfull Width	41.0	41.9	44.5
Mean Depth (ft)	3.0	2.5	2.3
Max. Depth (ft)	4.0	3.2	3.5
Cross Sectional Area (sq. ft.)	122.8	104.1	104.2
Width to Depth Ratio	13.7	16.9	19
Flood Prone Area Width	800+	45.6	56.6
Entrenchment Ratio	19.5	1.1	1.3
Low Bank Height	4.2	8.2	8.8
Bank Height Ratio	1.0	2.6	2.5

Channel Slope	0.43	0.11	0.05**
Bed Material			
D50 (mm)	4*	15	7.2
D84 (mm)	190*	50	42
Threshold Grain Size (mm)	31*	7	3

*large woody debris counted as bed material

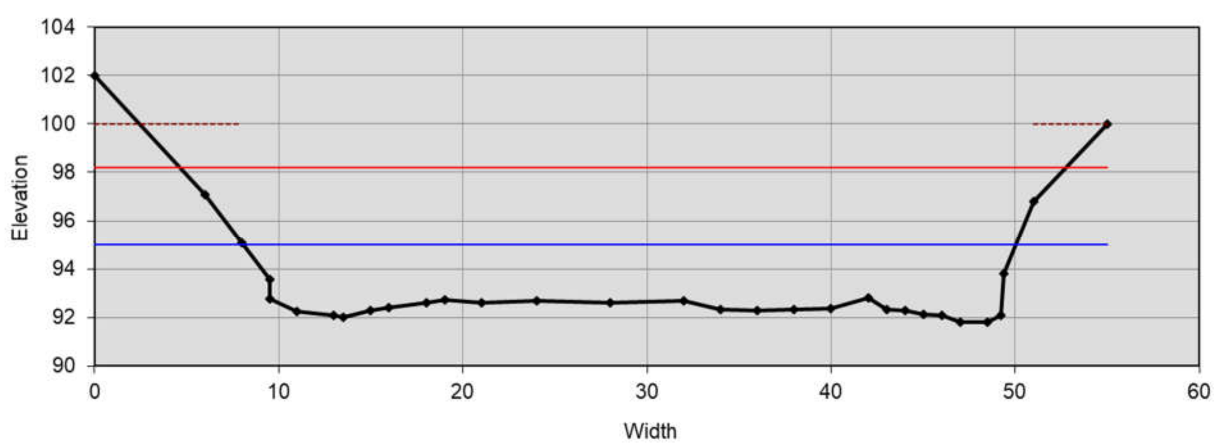
**controlled by downstream culverts

The geomorphic survey of the downstream river section included two cross sections, the first located about 400 feet downstream of the dam (Cross Section 2), and the second located about 1,300 feet downstream of the dam (Cross Section 3).

Just below the dam, at Cross Section 2, the river is deeply entrenched and laterally contained, with little to no floodplain access. The bankfull channel width is 41.9 feet, just slightly wider than the river upstream of the impoundment (Figure 23, Table 10). The river is shallower at this location, averaging 2.5 feet, with a width-to-depth ratio of 16.9. Cross sectional area is 104.1 square feet. Due to the severe entrenchment (1.1), the floodprone width is only slightly higher than the actual bankfull channel width; the river cannot flood out of its channel at this location. The river is classified as an "F" type of channel.

The streambed is comprised of 84% gravel and cobble, with a D_{50} of 15 mm and a D_{84} of 50 mm. The bed is relatively clear of finer sediments and evidence of fall-spawning salmon was evident. Because the cross section is located just below the dam and the channel is entrenched, the clean, coarse sediment should be expected. Despite the entrenchment and presumed lack of sediment delivery from upstream, the channel bed and banks are quite stable. Historic bank erosion was observed but is mostly healed.

Figure 23. Cross Section 2 Data Associated with the Boyne River, 400 feet Downstream of the Dam. Bankfull (blue line), Low Bank (dashed line), Floodprone Width (red line)



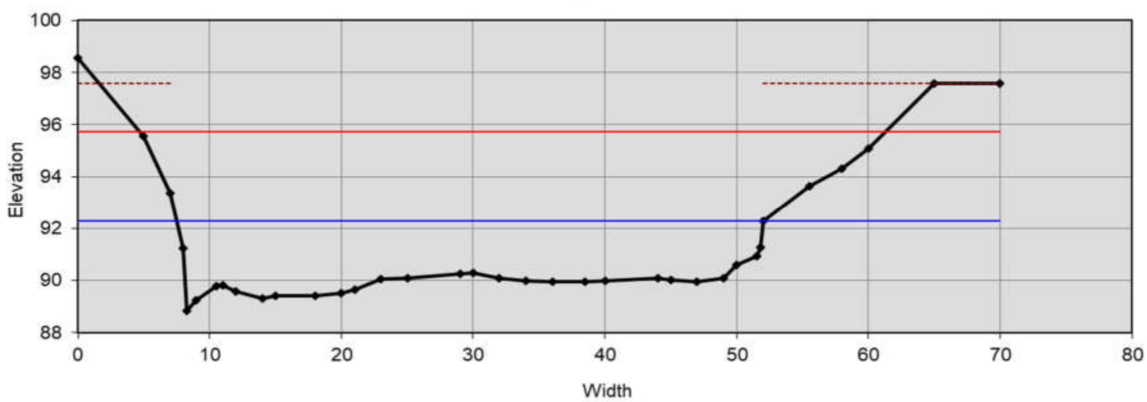
A third cross section, Cross Section 3, was surveyed to determine if the morphology changes as the distance from the dam increases (Figure 24). However, the crossing of Dam Road is located about 580 feet downstream of Cross Section 3 and influences the shape and function of the stream channel at this location. The stream slope was measured at 0.05%, the lowest of the three survey locations.

The bankfull channel is 44.5 wide, but the cross-sectional area (104.2 sq. feet) is nearly identical to Cross Section 2, due to a shallower channel. Width-to-depth ratio is 19. The channel banks are slightly lower here, but the channel is still entrenched (1.3) and the floodplain is effectively disconnected from the river channel. The channel remains to be an "F" type stream.

The pebble count indicates that substrate is finer at this location compared to Cross Section 2, likely due to the decreased channel slope. The D_{50} is 7.2 mm and the D_{84} is 42 mm. The substrate consists of 70% gravel and cobble and 30% finer sediments.

Similar to upstream reaches, the channel banks and bed appear to be stable. The only notable signs of bank erosion are associated with angler access and foot traffic, but many of these sites are fixed, with signage indicating recent attempts at repair.

Figure 24. Cross Section Data Associated with the Boyne River 1,350 feet Downstream of the Dam. Bankfull (blue line), Low Bank (dashed line), Floodprone Width (red line)



The survey data show a considerable difference in channel morphology between the sites located upstream and downstream of the dam. Upstream, the channel is stable and winds through a wide, accessible floodplain. Downstream, the channel is confined within its channel banks, there is no functional floodplain and there is a notable decrease in stream slope. Stream slope is controlled between the dam and the culverts beneath the Dam Road crossing. Substrate downstream of the dam is coarse and indicative of the interruption in sediment transport caused by the dam and impoundment. Evidence of historic erosion suggests past instability, but the stream channel has stabilized over time. The streambanks are steep and high, but well-vegetated. Currently, the greatest threat to streambank stability appears to be impacts caused by human foot traffic.

Impingement/Entrainment Evaluation

Water velocity leading up to and through the trash/debris rack was measured at three settings of the turbine, based upon operational data collected from January 7, 2016 to January 26, 2019: minimum power generation of 40 kW, average power generation of 77 kW and maximum power generation of 300 kW (Figures 25, 26, 27; Table 11). Water velocities range from -0.14 to 1.75 feet per second. Comparing these velocities to five-second swimming speeds of the adult fish found in the impoundment, it does not appear that any of the fish species, if healthy, would have difficulty escaping the water intake structure (Table 12). Mottled sculpin, the species with the lowest mean sustained swimming speed, is a substrate-oriented species and could navigate the velocities associated with the bottom half of the trash rack, even at the highest operational setting of the turbine.

Juvenile fish of several species, including the American brook lamprey, largemouth bass, northern pike, pumpkinseed, rockbass and smallmouth bass, could have difficulty navigating portions of the immediate trash rack area during maximum power generation. However, much of the surface area of the trash rack has lower velocities allowing easy escape, the burst rate for these species is greater than the five-second swimming speed and the dam infrequently operates at maximum output. Therefore, it is unlikely that the operation of the dam causes impingement or entrainment of any fishes of the impoundment.

Figure 25. Water Velocity Profile, in feet per second, looking west toward the Trash Rack, during minimum (40 kilowatt) power generation.

Figure 26. Water Velocity Profile, in feet per second, looking west toward the Trash Rack, during average (77 kilowatt) power generation.

Figure 27. Water Velocity Profile, in feet per second, looking west toward the Trash Rack, during maximum (300 kilowatt) power generation.

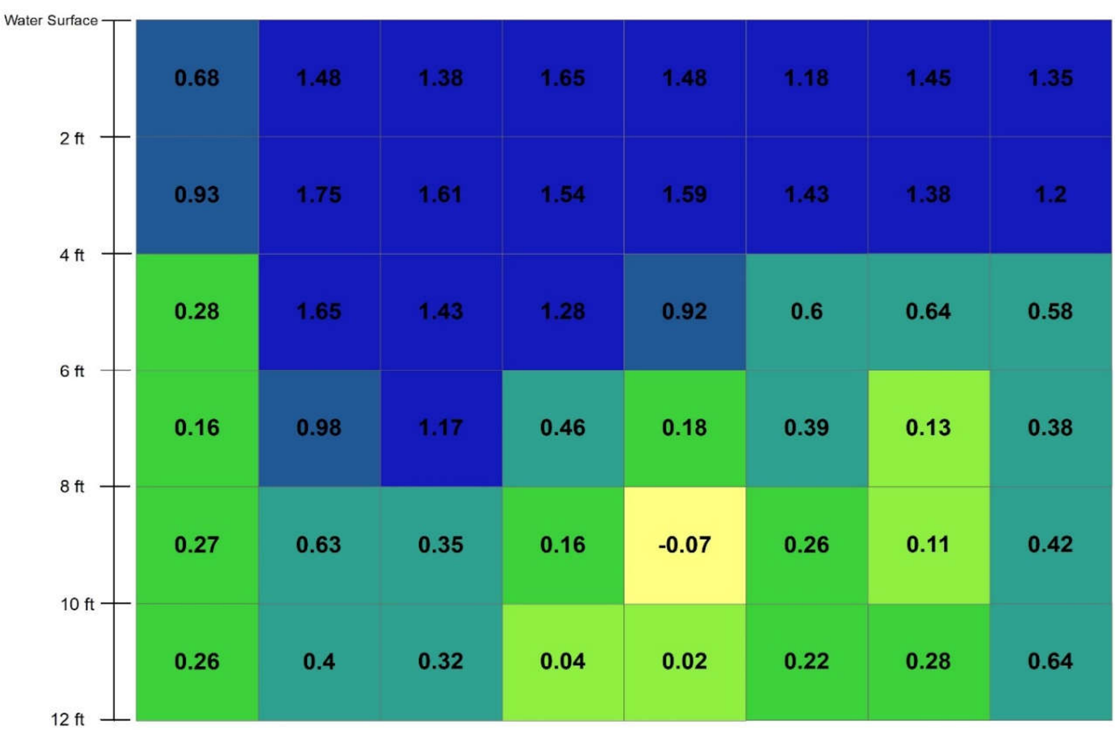


TABLE 11. Calculation of Water Velocities at the Trash Rack Opening during Various Flows Through the Boyne River Dam (Nominal Rated Capacity 250 Kilowatts [kW])

kW	Velocity Range at Trash Rack (ft./s.)
40	-0.14 to 0.8
77	-0.12 to 1.01
300	-0.07 to 1.75

TABLE 12. Critical Swimming Speeds of Fish Species Found within the Boyne River Impoundment

Species	Estimated Mean Sustained (Five Second) Swimming Speed of Juvenile (ft./s.)	Estimated Mean Sustained (Five Second) Swimming Speed of Adult (ft./s.)
American brook lamprey*	1.3	5.2
Bluntnose minnow**	1.9	3.9
Central mudminnow**	1.9	3.9
Common shiner**	1.9	3.9
Golden shiner**	1.9	3.9
Largemouth bass	1.5	6.2
Mottled sculpin	N/A	1.0
Northern pike	1.5	8.2
Pumpkinseed***	1.5	3.1
Rock bass***	1.5	3.1
Smallmouth bass	1.5	5.2
White sucker	2.3	6.2
Yellow perch	1.9	3.8

*Sea lamprey data
**Creek chub data
***Bluegill data

Water Temperature Modeling

Using water temperature data collected for this project, along with bathymetric mapping and average daily flows through the spillway, an effort was made to determine the potential for using the deep, cold water within the impoundment to cool downstream receiving waters. As previously discussed, the average July water temperature at the Tailrace site was 5.4°F warmer than the measurement at the Upstream site. It can be assumed that this is due, in large part, to warming of the impoundment itself.

Bathymetric data indicates that the average depth of the impoundment is 5.2 feet, and the maximum depth is 18.5 feet. Total residence time of water in the impoundment (355.6 acre-feet) is three days.

Water temperature profiles from the impoundment show that any water deeper than about five feet is almost always below 67.1°F, the upper thermal limit for a cold-transitional stream. About 60 percent (40.5 acres) of the impoundment is less than five feet deep, and an estimated 101 acre-feet (4.42 million cubic feet) of cold water is stored below the five-foot depth contour (Table 13). This 101 acre-feet is equivalent to the volume of flow through the impoundment over a 24-hour period at the median July flow of 50 cfs.

TABLE 13. Volume of Water Stored in Each One-foot Strata, below the Five-foot Depth Contour in the Boyne River Impoundment

Depth Range (ft.)	Acre-feet	Cubic Feet	Avg. Water Temp. (06/24/18 and 07/10/18)
5–6	25.2	1,096,162	67
6–7	19.8	860,895	66.1
7–8	15.6	678,345	65.6
8–9	12.0	521,258	65.1
9–10	8.6	376,622	64.5
10–11	6.1	266,822	63.8
11–12	4.5	194,109	63.3
12–13	3.4	148,624	62.8
13–14	2.7	117,547	62.0
14–15	1.7	74,985	61.3
15–16	1.0	41,723	61.1
16–17	0.6	25,871	60.6
17–18.5	0.4	15,243	59.5
	101.6	**4,418,179**	

Downstream Temperature Mitigation

Two potential mitigation schemes come to mind. One would be to develop a way to draw colder water from lower levels of the impoundment into the headrace channel upstream of the powerhouse intake and spillways (Bottom Draw alternative). The other would involve construction of a channel that by-passes the impoundment (Bypass Channel alternative). These are both considered briefly.

Bottom Draw

The headrace channel has an overall depth of about 12 feet. Bottom Draw alternative could be as simple as a curtain occluding the upper portion of the headrace channel near its upstream end. Warmer water from the surface of the impoundment would be prevented from entering the headrace channel. This alternative could conceivably be implemented at a modest cost. Although the limited volume of water in the impoundment (particularly at lower levels) has been mentioned previously as a limiting factor, this alternative has potential for mitigating downstream temperatures to some extent. However, in many similar situations, it should be noted that a bottom-draw scheme has only proven effective when there is a very large volume of deep, cold water relative to the flow in the stream. And, the potential for destratification within the impoundment exists, which can create other challenges for aquatic life there during warm months.

Bypass Channel

A bypass channel could be constructed that intercepts most of the flow from the river upstream of the impoundment and by-passes the flow around the reservoir to the headrace channel. This alternative would be cost-prohibitive. In addition, this scheme would have serious implications for the ecology of the impoundment that would not be receiving the cooling waters of the upper Boyne River.

Nuisance Plant Surveys

A total of 27 species of plant were identified within the transmission corridor (Table 14). Each of the five areas sampled (Figure 5) contain more introduced plant species than native (Table 15). Many of the introduced species are considered to be invasive. These invasive plants are pervasive in Charlevoix County, and throughout lower Michigan, and their existence is not unique to the Project Area. Appendix C provides additional detail on plant species found in each sampling area.

TABLE 14. Plant Species Found within the Transmission Corridor

Common Name	Scientific Name	Native/Introduced
Autumn olive	*Elaeagnus umbellate*	Introduced
Black cherry	*Prunus serotine*	Native
Bouncing bet	*Saponaria officinalis*	Introduced
Bracken fern	*Pteridium aquilinum*	Native
Bull thistle	*Cirsium vulgare*	Introduced
Common milkweed	*Asclepias syriaca*	Native
Common mullein	*Verbascum Thapsus*	Introduced
Common sowthistle	*Sonchus oleraceus*	Introduced
Creeping bentgrass	*Agrostis stolonifera*	Introduced
Daisy fleabane	*Erigeron annuus*	Native
Hoary alyssum	*Berteroa incana*	Introduced
Horseweed	*Erigeron canadensis*	Native
Indian hemp	*Apocynum cannabinum*	Native
Little bluestem	*Schizachyrium scoparium*	Native
Quackgrass	*Elymus repens*	Introduced
Queen Anne's lace	*Daucus carota*	Introduced
Red pine	*Pinus resinosa*	Native
Smooth brome	*Bromus inermis*	Introduced
Sneezeweed	*Helenium autumnale*	Native
Sorrel	*Rumex acetosella*	Introduced
Spotted knapweed	*Centaurea stoebe*	Introduced
St. John's wort	*Hypericum perforatum*	Introduced
Staghorn sumac	*Rhus typhina*	Naïve
Sweet clover	*Melilotus spp.*	Introduced
Sweet William	*Dianthus barbatus*	Introduced
Trembling aspen	*Populus tremuloides*	Native
White pine	*Pinus strobus*	Native

TABLE 15. Numbers of Native and Introduced Plant Species Found within Each Assessment Area in the Transmission Corridor

Area	Native Plant Species	Introduced Plant Species	Total Plant Species
A	4	6	10
B	9	10	19
C	4	5	9
D	6	7	13

Summary

Water Temperature

- The impoundment is having an impact on the water temperatures downstream of the dam. At the Upstream site, average July water temperature was 62.4°F, classifying the stream as cold. Within the Tailrace site, average July water temperature was 67.8°F, classifying the stream as cool. While the 5.4°F increase in water temperature is significant, the Downstream site does harbor a coldwater fish community, including trout. However, the Downstream site is stocked on an annual basis.
- The Upstream water temperature exceeded the water quality standard of 68°F for a total of about 77 hours (3.5%) during June, July and August. The longest continual duration of time in excess of 68°F was 13 hours and there was a period from June 29 to July 5 where the water temperature exceeded 68°F for 63 out of 148 hours.
- In total, the Tailrace exceeded the water quality standard for water temperature for about 364 hours (15.2 days) from June 1 to August 31. The longest continual duration of time in excess of 68°F was 186 hours, from 16:41 on June 29 to 09:41 on July 7
- The unusually warm air temperatures undoubtedly raised stream temperature beyond the long-term average, and most likely increased the average July water temperature of the Tailrace site enough to change the classification from cold-transitional to cool. The site exceeded the cold-transitional classification (67.1°F) by 0.7°F. The average daily high temperatures for July 2018 were 4.9°F warmer than the long-term average.

Dissolved Oxygen

- During the monitoring period, DO concentrations in the Tailrace site met water quality standards for coldwater streams 100 percent of the time. Based upon the data collected, the impoundment consistently has an adequate oxygen supply for coldwater organisms.
- DO concentrations in the impoundment were always in excess of 7 mg/L at Site B1 during data collection. The DO concentration in the deeper waters (11–18 feet) of Site B2 dropped below 7 mg/L on five sampling dates.
- At the Upstream site, data show that the DO concentration dropped below 7 mg/L on several occasions. However, it is believed that the data may have been affected by improper function of the logger, rather than actual environmental conditions.

Aquatic Community

- Physical habitat at the Upstream site scored 166/200 (excellent—nonimpaired) using the P51 metrics. The Downstream site scored 154/200 (good—slightly impaired) and was only one point shy of excellent.
- The survey data show a considerable difference in channel morphology between the sites located upstream and downstream of the dam. Upstream, the "C" type channel is stable and winds through a wide, accessible floodplain. Downstream, the "F" type channel is still stable, but confined within its channel banks, there is no functional floodplain and there is a notable decrease in stream slope.

- A total of 450 fish, comprising 13 species, were caught within the impoundment. Pumpkinseed and yellow perch were, by far, the dominant species. The fish community of the impoundment is dominated by species that prefer cool water.
- A total of eight species of fish were collected at the Upstream site. Brook trout, mottled sculpin, and brown trout dominated the catch. Brook and brown trout are heavily stocked. The fish community is dominated by species that prefer cold water.
- At the Downstream site, a total of 13 species were collected. The samples were dominated by brown trout, mottled sculpin, rainbow trout, and rock bass, in descending order. Brown and rainbow trout are stocked by the MDNR on an annual basis. Most species are cold water dependent, but coolwater species were intermixed in the fish community. Similar to sites on the North Branch, survival of trout to older age classes appears to be severely limited; the cause for this is uncertain.
- Freshwater mussels of the impoundment included 25 live cylindrical papershell, 12 live giant floater, and eight live fatmuckets, along with many shells from dead mussels of these same species. Zebra mussels were also found in the impoundment.
- At the Downstream site, 15 live cylindrical papershell and one fatmucket were found. The only other mussels observed within the downstream reach were thousands of live and dead zebra mussels
- At the Upstream site, despite an intensive search of approximately two hours, no evidence of native mussels was found. Freshwater mussels are less common in colder waters. No zebra mussels, live or dead, were found within this reach.
- A total of 475 macroinvertebrates, representing 21 taxa, were collected during sampling in the impoundment. Overall, the macroinvertebrate community is quite typical of a pond, lake, or impoundment; is relatively diverse; and would be expected to provide high-quality biomass for fish. No rusty crayfish were captured or observed.
- At the Upstream site, 27 macroinvertebrate taxa were collected, including four families of mayfly, five families of caddisfly, and three families of stonefly. No rusty crayfish were documented.
- At the Downstream site, 21 taxa were collected, with three families of mayfly, two families of caddisfly, and one family of stonefly. Differences in the macroinvertebrate communities between the two sample sites are likely a function of differences in physical habitat, water quality, and influence of the dam and impoundment. Rusty crayfish are prolific.
- In the impoundment, narrowleaf cattail is the only non-native aquatic plant species that was documented; the species is considered to be quite invasive.

Impingement/Entrainment Evaluation

- Water velocities range from -0.14 to 1.75 feet per second, depending on location on the trash rack and operational setting of the turbine. Comparing these velocities to five-second swimming speeds of the adult fish found in the impoundment, it does not appear that any of the fish species, if healthy, would have difficulty escaping the water intake structure.
- Juvenile fish of several species, including the American brook lamprey, largemouth bass, northern pike, pumpkinseed, rockbass and smallmouth bass, could have difficulty navigating portions of the immediate trash rack area during maximum power generation. However, much of the surface area of the trash rack has lower velocities allowing easy escape, the burst rate for these species is greater than the five-second swimming speed and the dam infrequently operates at maximum output. Therefore, it is unlikely that the operation of the dam causes impingement or entrainment of any fishes of the impoundment.

Water Temperature Modeling

- The dam is currently configured to draw water from impoundment depths ranging from zero feet (water surface) to 11.5 to 12 feet. However, flow data from measurements at the trash rack indicate that most of the water entering the turbine is being drawn from the upper, warmer, half of the water column.
- The volume of cold water in the impoundment appears to be limited for mitigating downstream temperatures. Installing a curtain within the headrace channel, forcing deeper water to be discharged from the dam, may mitigate warmer water temperatures to some extent. Withdrawing the full volume of "cold" impoundment water would likely de-stratify the impoundment. As a result of de-stratification, negative ecological impacts within the impoundment would be possible.

Nuisance Plants and Animals

- Invasive or nuisance species identified within the project area include:

  Animals

  - Rusty crayfish (not documented in Impoundment or Upstream site)
  - Zebra mussel (not documented at Upstream site)
  - Asiatic clam (not documented in Impoundment or Upstream site)

  Terrestrial plants

  - Spotted knapweed
  - Autumn olive (considered to be invasive but is sparse within the project area)

TABLE 19. Summary of Findings, Boyne River Hydroelectric Project, 2018

	Upstream	Impoundment	Downstream	Transmission Corridor
Water Temp Monitoring				
Mean July Temp. (F)	62.4		67.8	
Thermal Classification	Cold		Cool	
DO Monitoring				
Meeting Water Quality Standards (%)	92*		100	
Aquatic Survey				
Fish Community Meeting Coldwater Standard	Yes		Yes	
Fish Community	6 native species 2 non-native species 0 invasive species	13 native species 0 non-native species 0 invasive species	9 native species 4 non-native species 0 invasive species	
Macroinvertebrate Community	Acceptable (2)		Acceptable (0)	
Physical Habitat	Excellent (166/200)		Good (154/200)	
Freshwater Mussel Community	0 species	3 native species 1 invasive species	3 native species 2 invasive species	
Non-native/Invasive Species	Rainbow trout Brown trout	Zebra mussel** Narrowleaf cattail**	Rusty crayfish** Zebra mussel** Asiatic clam** Coho salmon Chinook salmon Rainbow trout Brown trout	Autumn olive Bentgrass Bouncing bet Bull thistle Common mullein Common sowthistle Hoary alyssum Quackgrass Queen Anne's lace Smooth brome Sorrel Spotted knapweed** St. John's wort Sweet William White sweet clover

*Most likely due to logger malfunction
**Highly invasive

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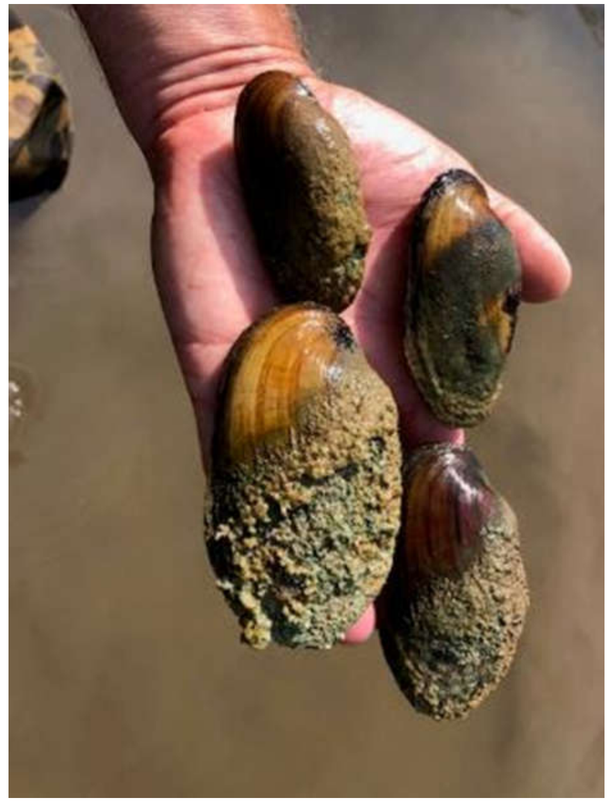
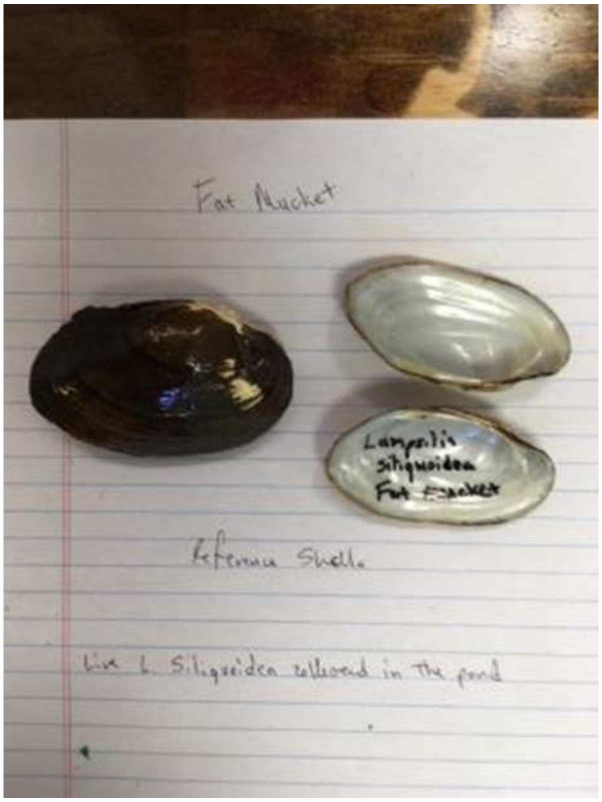
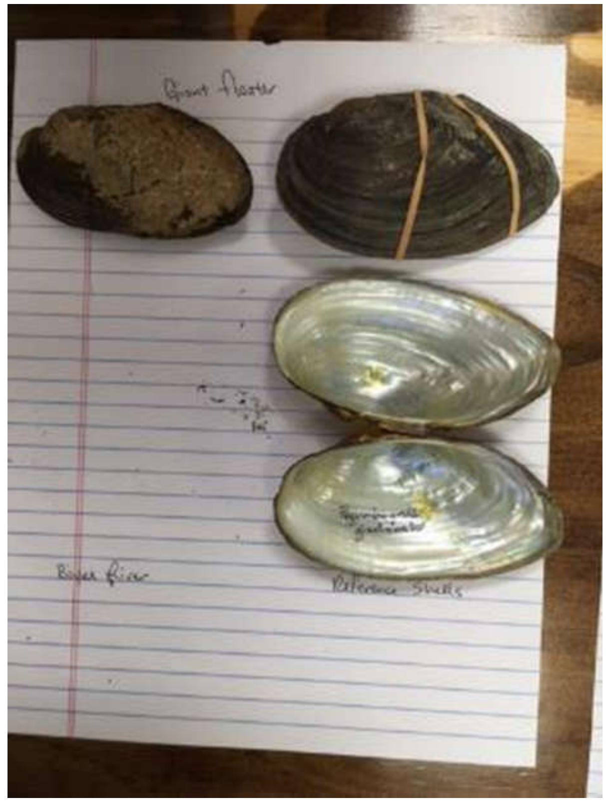
Appendix A: Freshwater Mussels Photos and Correspondence with Scott Hanshue, MDNR

FIGURE 1A. Impoundment Mussels




Fat Mucket
Lampsilis
siliquoidea
Fat Mucket
Reference Shells
Live L. Siliquoidea collected in the pond


Giant floater
Boyne River
Reference Shells


Cylindrical Papershell
Boyne River
Reference Shells

FIGURE 2A. Boyne River Mussels, Downstream Site

FIGURE 3A. Scott Hanshue Email, January 10, 2019

From: "Hanshue, Scott (DNR)" <HanshueS1@michigan.gov>
Date: January 10, 2019 at 1:53:53 PM EST
To: "Kruger, Kyle (DNR)" <KRUGERK@michigan.gov>, Mark Coscarelli <mcoscarelli@publicsectorconsultants.com>
Subject: RE: Boyne Mussel Inventory

Mark,

My apologies for not getting back with you sooner.

I reviewed the *2018 Reconnaissance Mussel Survey of the Boyne River*. I also reviewed information in the Michigan Natural Features Database and models used to develop the Michigan Freshwater Mussel Survey Protocols and Relocation Procedures. Based on this review I agree that further mussel surveys are not warranted at this location.

Let me know if you need further information.

Scott Hanshue
Fisheries Management Biologist
Southern Lake Michigan Management Unit
MDNR Plainwell Operations Service Center
621 North 10th Street, Plainwell Michigan 49080

Appendix B: Trout Population Estimates

Downstream Site

Population Estimate

Form by: DNR

Water: Boyne River
County: Charlevoix   Site TRS:
Site: Downstream   Date: 3,131 sec Mark 7/9/2018   2,892 sec Recap. 7/10/2018
Gear: Barge, 2 probes   Formula: Chapman-Petersen   Acres: 0.90   Length (ft.): 1,100.00   No/mile= 744.8
Min. legal/acceptable size: 8.0
Species: Brown, rainbow, brook trout   Estimated: no./acre: 172   Lb./acre: 37.98   %L-A:by no.: 69.71   by lb.: 88.12

Inch	No.	Recapture run		Estimates				No.	Estimates by age group**							
group*	marked	recaps	unmarked	No.	95% limits	Variance	Lb.	aged	0+	1+	2+	3+	4+	5+	6+	7+
0				0	0	0.00	0.00		0	0	0	0	0	0	0	0
1	2			2	0	0.00	0.00		0	0	0	0	0	0	0	0
2	3			3	0	0.00	0.02		0	0	0	0	0	0	0	0
3	2		4	14	15	59.00	0.21		0	0	0	0	0	0	0	0
4				0	0	0.00	0.00		0	0	0	0	0	0	0	0
5			2	2	0	0.00	0.12		0	0	0	0	0	0	0	0
6	3			3	0	0.00	0.29		0	0	0	0	0	0	0	0
7	7	2	6	23	15	59.00	3.42		0	0	0	0	0	0	0	0
8	16	2	10	73	59	858.44	15.77		0	0	0	0	0	0	0	0
9	12	3	6	32	19	86.75	9.55		0	0	0	0	0	0	0	0
10				0	0	0.00	0.00		0	0	0	0	0	0	0	0
11			2	2	0	0.00	1.08		0	0	0	0	0	0	0	0
12				0	0	0.00	0.00		0	0	0	0	0	0	0	0
13				0	0	0.00	0.00		0	0	0	0	0	0	0	0
14	1			1	0	0.00	1.08		0	0	0	0	0	0	0	0
15				0	0	0.00	0.00		0	0	0	0	0	0	0	0
16				0	0	0.00	0.00		0	0	0	0	0	0	0	0
17				0	0	0.00	0.00		0	0	0	0	0	0	0	0
18				0	0	0.00	0.00		0	0	0	0	0	0	0	0
19	1	1		1	0	0.00	2.64		0	0	0	0	0	0	0	0
20				0	0	0.00	0.00		0	0	0	0	0	0	0	0
21				0	0	0.00	0.00		0	0	0	0	0	0	0	0
22				0	0	0.00	0.00		0	0	0	0	0	0	0	0
23				0	0	0.00	0.00		0	0	0	0	0	0	0	0
24				0	0	0.00	0.00		0	0	0	0	0	0	0	0
25				0	0	0.00	0.00		0	0	0	0	0	0	0	0
Total	47	8	30	155	65	1063	34.18									

Brook Trout

Population Estimate

Form by: DNR

Water: Boyne River
County: Charlevoix | Site TRS:
Site: Upstream | Date: Mark 2,876 sec 7/9/2018 | Recap. 2,749 sec 7/10/2018
Gear: Barge, 2 probes | Formula: Chapman-Petersen | Acres: 0.90 | Length (ft.): 1,330.00 | No/mile= 119.1
Min. legal/acceptable size: 8.0
Species: brook trout | Estimated: no./acre: 33 | Lb./acre: 17.11 | %L-A:by no.: 96.67 | by lb.: 99.61

Inch	No.	Recapture run		Estimates				No.	Estimates by age group**							
group*	marked	recaps	unmarked	No.	95% limits	Variance	Lb.	aged	0+	1+	2+	3+	4+	5+	6+	7+
0				0	0	0.00	0.00		0	0	0	0	0	0	0	0
1				0	0	0.00	0.00		0	0	0	0	0	0	0	0
2				0	0	0.00	0.00		0	0	0	0	0	0	0	0
3				0	0	0.00	0.00		0	0	0	0	0	0	0	0
4				0	0	0.00	0.00		0	0	0	0	0	0	0	0
5			1	1	0	0.00	0.06		0	0	0	0	0	0	0	0
6				0	0	0.00	0.00		0	0	0	0	0	0	0	0
7				0	0	0.00	0.00		0	0	0	0	0	0	0	0
8	1			1	0	0.00	0.22		0	0	0	0	0	0	0	0
9	5	3	2	8	2	0.80	2.43		0	0	0	0	0	0	0	0
10	3	2	2	6	1	0.11	2.32		0	0	0	0	0	0	0	0
11	3	2	1	4	0	0.00	2.34		0	0	0	0	0	0	0	0
12	5	1		5	0	0.00	3.46		0	0	0	0	0	0	0	0
13	4	2		4	0	0.00	3.49		0	0	0	0	0	0	0	0
14	1	1		1	0	0.00	1.08		0	0	0	0	0	0	0	0
15				0	0	0.00	0.00		0	0	0	0	0	0	0	0
16				0	0	0.00	0.00		0	0	0	0	0	0	0	0
17				0	0	0.00	0.00		0	0	0	0	0	0	0	0
18				0	0	0.00	0.00		0	0	0	0	0	0	0	0
19				0	0	0.00	0.00		0	0	0	0	0	0	0	0
20				0	0	0.00	0.00		0	0	0	0	0	0	0	0
21				0	0	0.00	0.00		0	0	0	0	0	0	0	0
22				0	0	0.00	0.00		0	0	0	0	0	0	0	0
23				0	0	0.00	0.00		0	0	0	0	0	0	0	0
24				0	0	0.00	0.00		0	0	0	0	0	0	0	0
25				0	0	0.00	0.00		0	0	0	0	0	0	0	0
Total	22	11	6	30	2	1	15.40									

Upstream Site

Population Estimate

Form by: DNR

Water: Boyne River
County: Charlevoix | Site TRS:
Site: Upstream | Date: Mark 7/9/2018 (2,876 sec) | Recap. 7/10/2018 (2,749 sec)
Gear: Barge, 2 probes | Formula: Chapman-Petersen | Acres: 0.90 | Length (ft.): 1,330.00 | No/mile= 315.2
Min. legal/acceptable size: 8.0
Species: Brown, rainbow, brook trout | Estimated: no./acre: 88 | Lb./acre: 40.98 | %L-A:by no.: 76.91 | by lb.: 94.31

Inch	No.	Recapture run		Estimates				No.	Estimates by age group**							
group*	marked	recaps	unmarked	No.	95% limits	Variance	Lb.	aged	0+	1+	2+	3+	4+	5+	6+	7+
0				0	0	0.00	0.00		0	0	0	0	0	0	0	0
1				0	0	0.00	0.00		0	0	0	0	0	0	0	0
2				0	0	0.00	0.00		0	0	0	0	0	0	0	0
3				0	0	0.00	0.00		0	0	0	0	0	0	0	0
4				0	0	0.00	0.00		0	0	0	0	0	0	0	0
5	1		1	3	2	1.00	0.18		0	0	0	0	0	0	0	0
6	3		1	7	7	11.00	0.68		0	0	0	0	0	0	0	0
7	6	2	1	8	3	2.11	1.24		0	0	0	0	0	0	0	0
8	1		1	3	2	1.00	0.65		0	0	0	0	0	0	0	0
9	7	4	4	13	4	4.76	4.06		0	0	0	0	0	0	0	0
10	9	2	3	19	12	34.00	7.79		0	0	0	0	0	0	0	0
11	6	2	2	11	5	6.78	5.75		0	0	0	0	0	0	0	0
12	6	1		6	0	0.00	4.16		0	0	0	0	0	0	0	0
13	4	2		4	0	0.00	3.49		0	0	0	0	0	0	0	0
14	2	1		2	0	0.00	2.17		0	0	0	0	0	0	0	0
15	2	2		2	0	0.00	2.65		0	0	0	0	0	0	0	0
16				0	0	0.00	0.00		0	0	0	0	0	0	0	0
17				0	0	0.00	0.00		0	0	0	0	0	0	0	0
18				0	0	0.00	0.00		0	0	0	0	0	0	0	0
19				0	0	0.00	0.00		0	0	0	0	0	0	0	0
20				0	0	0.00	0.00		0	0	0	0	0	0	0	0
21				0	0	0.00	0.00		0	0	0	0	0	0	0	0
22	1			1	0	0.00	4.06		0	0	0	0	0	0	0	0
23				0	0	0.00	0.00		0	0	0	0	0	0	0	0
24				0	0	0.00	0.00		0	0	0	0	0	0	0	0
25				0	0	0.00	0.00		0	0	0	0	0	0	0	0
Total	48	16	13	79	16	61	36.88									

Appendix C: Plant Species and Photographs of the Transmission Corridor

Plant Lists

Area	Scientific Name	Common Name	Native/Introduced	Abundance
A	Apocynum cannabinum	Indian hemp	Native	Low
	Berteroa incana	Hoary alyssum	Introduced	Low
	Centaurea stoebe	Spotted knapweed	Introduced	High
	Elymus repens	Quackgrass	Introduced	Low
	Erigeron annuus	Daisy fleabane	Native	Low
	Hypericum perforatum	St. John's wort	Introduced	Low
	Melilotus officinalis	White sweet clover	Introduced	Medium
	Populus tremuloides	Trembling aspen	Native	Low
	Pteridium aquilinum	Bracken fern	Native	High
	Verbascum thapsus	Common mullein	Introduced	Low
		Bare—sand/gravel		High

Area	Scientific Name	Common Name	Native/Introduced	Abundance
B	Apocynum cannabinum	Indian hemp	Native	Low
	Asclepias syriaca	Common milkweed	Native	Low
	Berteroa incana	Hoary blyssum	Introduced	Low
	Bromus inermis	Smooth Brome	Introduced	Low
	Centaurea stoebe	Spotted knapweed	Introduced	Low
	Cirsium vulgare	Bull thistle	Introduced	Low
	Dianthus barbatus	Sweet William	Introduced	Low
	Elaeagnus umbellata	Autumn olive	Introduced	Low
	Elymus repens	Quackgrass	Introduced	Low
	Erigeron annuus	Daisy fleabane	Native	Low
	Erigeron canadensis	Horseweed	Native	Low
	Hypericum perforatum	St. John's wort	Introduced	Low
	Pinus resinosa	Red pine	Native	Low
	Pinus strobus	White pine	Native	Low
	Prunus serotina	Black cherry	Native	Low
	Pteridium aquilinum	Bracken fern	Native	High
	Schizachyrium scoparium	Little bluestem	Native	Low
	Sonchus oleraceus	Common sowthistle	Introduced	Low
	Verbascum thapsus	Common mullein	Introduced	Low
		Bare—sand		Medium

Area	Scientific Name	Common Name	Native/Introduced	Abundance
C	Apocynum cannabinum	Indian hemp	Native	Medium
	Berteroa incana	Hoary alyssum	Introduced	Low
	Bromus inermis	Smooth brome	Introduced	Medium
	Centaurea stoebe	Spotted knapweed	Introduced	Medium
	Daucus carota	Queen Anne's lace	Introduced	Low
	Erigeron annuus	Daisy fleabane	Native	Medium
	Melilotus officinalis	White sweet clover	Introduced	Medium
	Pteridium aquilinum	Bracken fern	Native	High
	Rhus typhina	Staghorn sumac	Native	Low
		Bare ground/mowed lawn		High

Area	Scientific Name	Common Name	Native/Introduced	Abundance
D	Pteridium aquilinum	Bracken fern	Native	Low
	Agrostis stolonifera	Bentgrass	Introduced	Low
	Apocynum cannabinum	Indian hemp	Native	Medium
	Asclepias syriaca	Common milkweed	Native	Low
	Bromus inermis	Smooth brome	Introduced	High
	Centaurea stoebe	Spotted knapweed	Introduced	Medium
	Erigeron annuus	Daisy fleabane	Native	Low
	Hypericum perforatum	St. John’s wort	Introduced	Low
	Melilotus officinalis	White sweet clover	Introduced	Low
	Prunus serotina	Black cherry	Native	Low
	Saponaria officinalis	Bouncing bet	Introduced	Low
	Schizachyrium scoparium	Little bluestem	Native	Low
	Rumex acetosella	Sorrel	Introduced	Low
	Bare—sand/gravel			High

Area	Scientific Name	Common Name	Native/Introduced	Abundance
E	Apocynum cannabinum	Indian hemp	Native	Low
	Asclepias syriaca	Common milkweed	Native	Low
	Berteroa incana	Hoary alyssum	Introduced	Low
	Bromus inermis	Smooth brome	Introduced	High
	Centaurea stoebe	Spotted knapweed	Introduced	High
	Daucus carota	Queen Anne's lace	Introduced	Low
	Elymus repens	Quackgrass	Introduced	Low
	Erigeron annuus	Daisy fleabane	Native	Medium
	Helenium autumnale	Sneezeweed	Native	Low
	Melilotus officinalis	White sweet clover	Introduced	Low
	Pinus resinosa	Red pine	Native	Low
	Prunus serotina	Black cherry	Native	Low
	Verbascum thapsus	Common mullein	Introduced	Low
	Bare—sand/gravel			High

FIGURE 1C. Photo Location Map

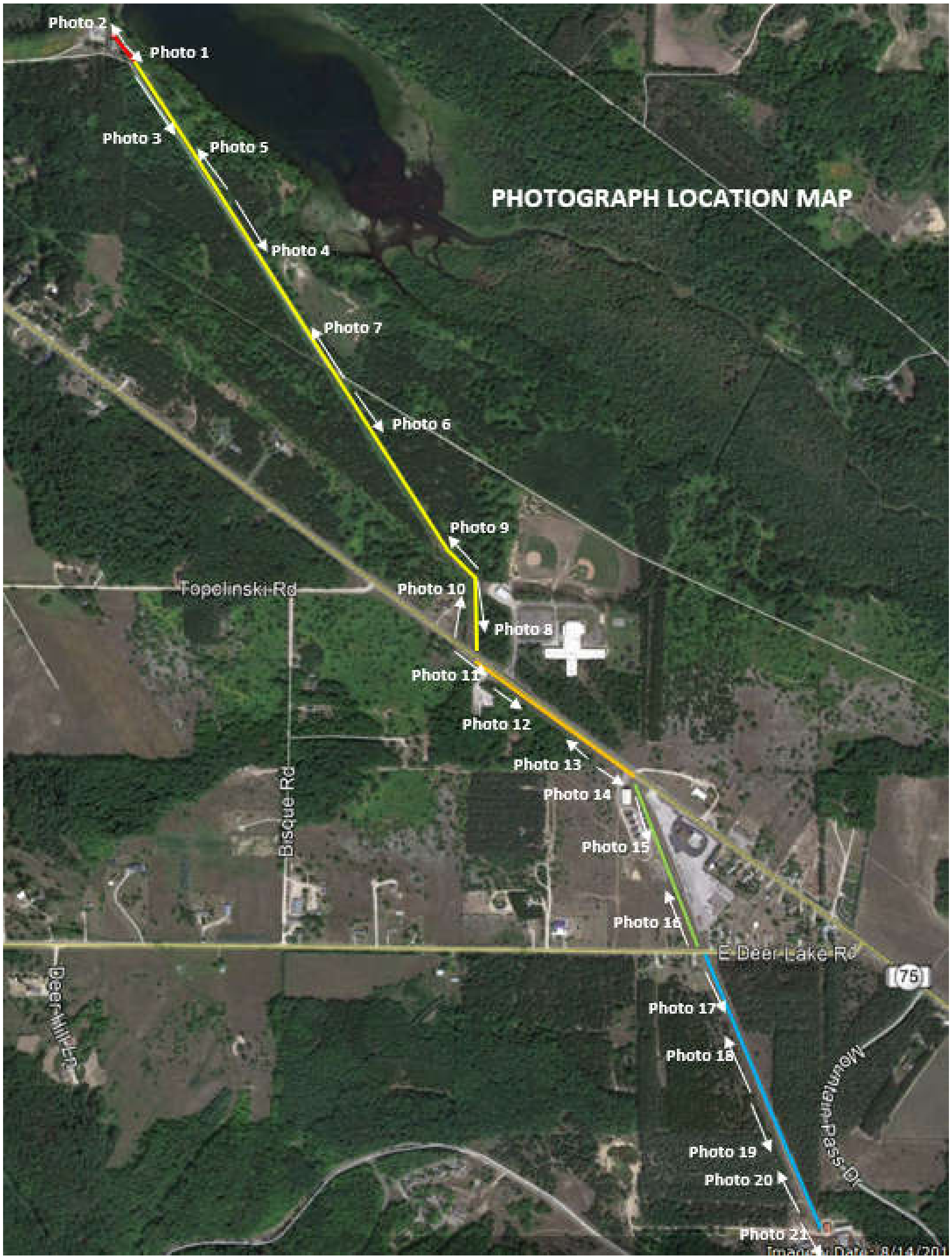


FIGURE 2C. Area A Photos

Area A—Photo One

Area A—Photo Two

FIGURE 3C. Area B Photos

Area B—Photo Three

Area B—Photo Four

Area B—Photo Five

Area B—Photo Six

Area B—Photo Seven

Area B—Photo Eight

Area B—Photo Nine

Area B—Photo Ten

FIGURE 4C. Area C Photos

Area C—Photo 11

Area C—Photo 12

Area C—Photo 13

Area C—Photo 14

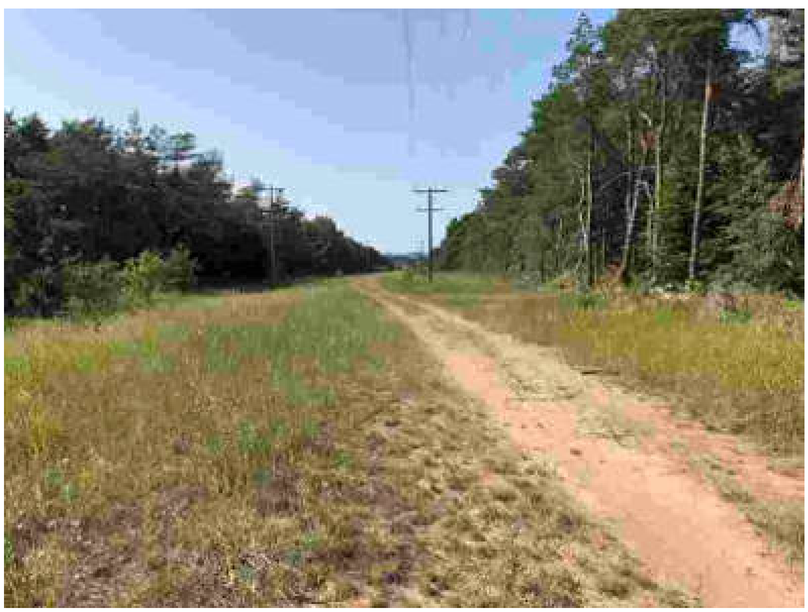
FIGURE 5C. Area D Photos

Area D—Photo 15

Area D—Photo 16

FIGURE 6C. Area E Photos

Area E—Photo 17



Area E—Photo 18

Area E—Photo 19

Area E—Photo 20

Area E—Photo 21

PUBLIC SECTOR CONSULTANTS

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Appendix B RECREATION STUDY REPORT

BOYNE RIVER HYDROELECTRIC PROJECT
FERC PROJECT NO. 3409

RECREATION RESOURCES STUDY REPORT

REVISED JUNE 15, 2020, UPDATING FIGURES 2 (PAGE 3) AND 4.3.1 (PAGE 12)

RECREATION STUDY CONSULTANT:
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1.0 INTRODUCTION

Boyne USA Inc (hereafter Boyne or Licensee), owns and operates, under a license issued by the Federal Energy Regulatory Commission (FERC or Commission), the Boyne River Hydroelectric Project (Project), FERC Project No. 3409. The Project is located on the Boyne River in Charlevoix County, Michigan (Figure 1 – Page 2). Boyne is in the process of relicensing the 250 kW Project.

The Licensee filed its Notice of Intent to relicense the Boyne Project with the FERC January 31, 2017, together with a request for approval to utilize the Commission's Traditional Licensing Process (TLP). Boyne subsequently filed its Pre-Application Document (PAD) with FERC on March 20, 2017. On May 17, 2018 FERC issued a decision approving the use of the TLP, stating in part, "Our review of the PAD suggests that the complexity of the resource issues is likely to be low, the level of anticipated controversy and disputes over studies is expected to be minimal, and there is a substantial amount of available information relevant to potential impacts." (5/17/2018 Ltr. - Vince Yearick, Director, FERC Division of Hydropower Licensing)

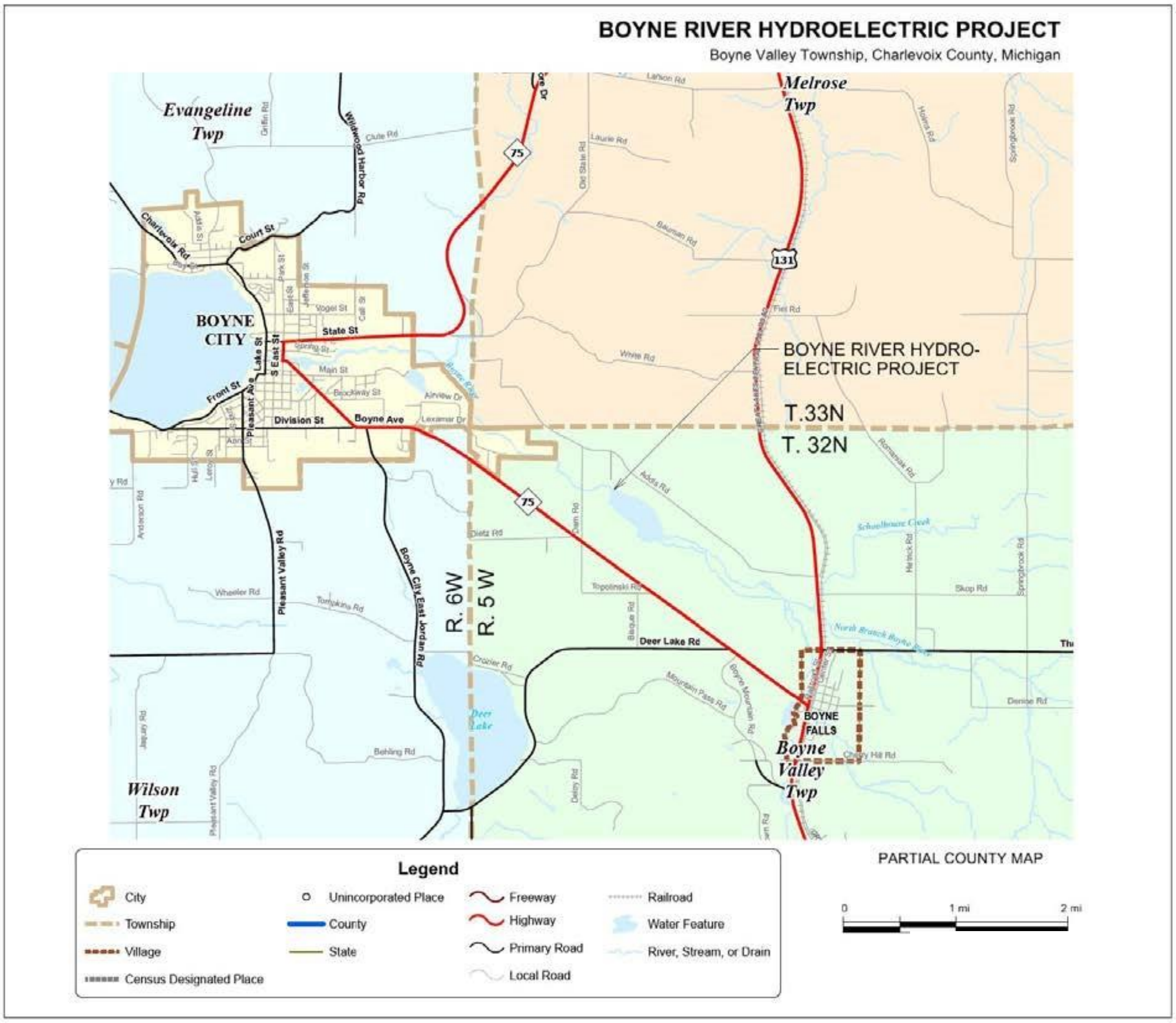
The Exhibit G drawing of the Boyne Hydro Project, showing Project Boundary, which corresponds to the Recreation Study Area, is shown in Figure 2 (page 3). With the exception of the Project works associated with the powerhouse, plant intake and embankment, where public access is prohibited for public safety and project infrastructure security reasons, the upstream Project boundary corresponds with the normal maximum water elevation of the reservoir, as established by metes and bounds survey following an approximate contour elevation 638' NAVD 88 (see Figure 2). The Project boundary extends downstream from the power plant to Dam Road, a distance of approximately ¼ mile, for a lateral corridor distance of approximately 10± feet on both sides of the river.

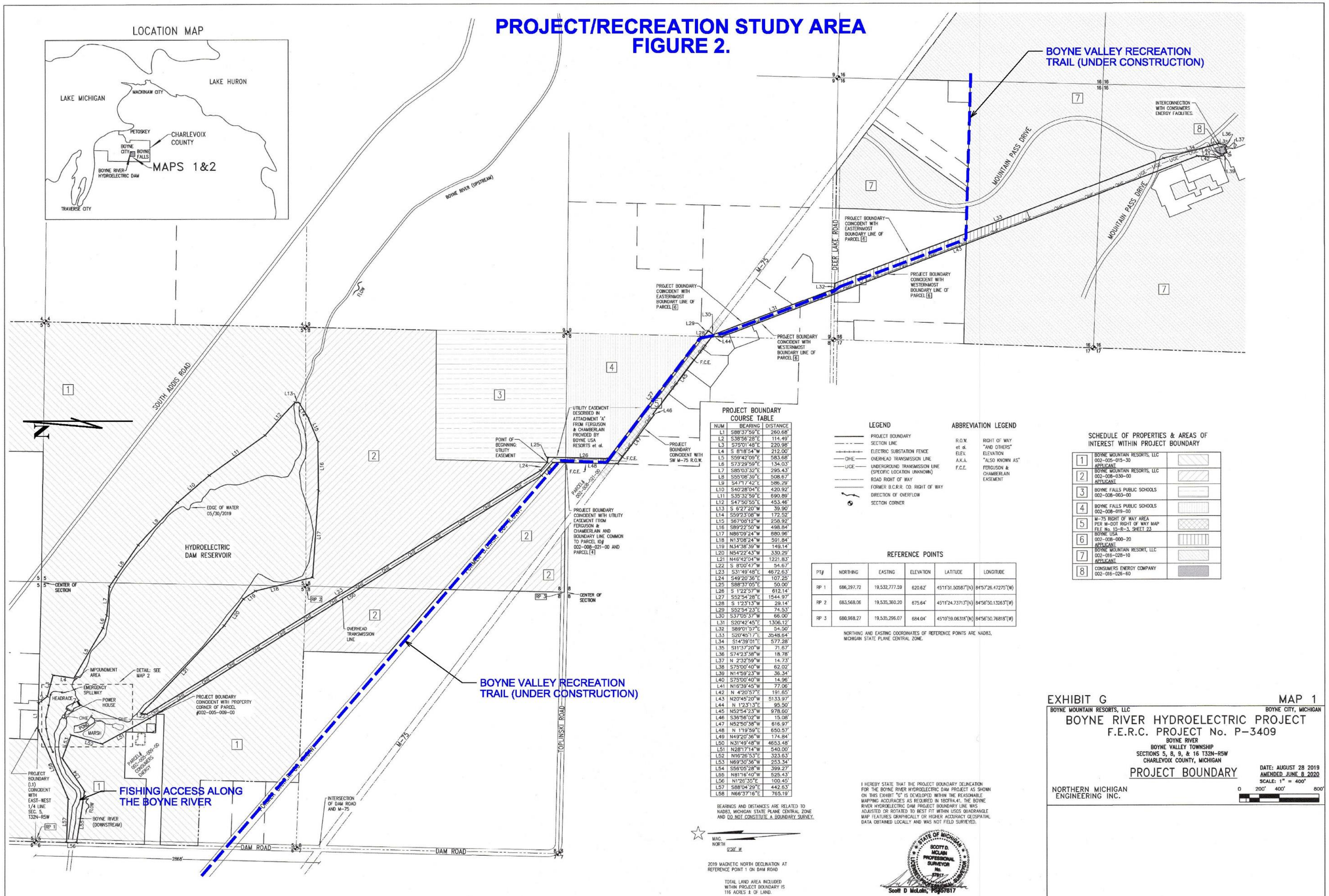
The PAD provided an overview of the existing Project recreation facilities provided by the Licensee at the Boyne Project, which consists of developed access from the power plant downstream to Dam Road. Access is provided by the Licensee within this reach of the Boyne River on both the north and south sides of the river.

FERC regulations require that the license application discuss existing and proposed recreational facilities and opportunities at the Project. The Licensee was specifically requested to perform a recreation study by the Michigan Department of Natural Resources (MDNR) and by the Michigan Hydro Relicensing Coalition (MHRC).

In order to provide the necessary information to complete the license application and respond to the MDNR and MHRC requests, in conjunction with other proposed relicensing studies Boyne issued a "Recreational Resources Study Plan" (RSP) June 8, 2018, prepared with assistance from JMB Associates LLC, Cadillac, Michigan.

Figure 1. Project Location





PROJECT BOUNDARY COURSE TABLE

NUM	BEARING	DISTANCE
L1	S88°37'59"E	260.68'
L2	S38°56'28"E	114.49'
L3	S75°01'48"E	220.98'
L4	S 8°18'54"W	212.00'
L5	S59°42'09"E	583.68'
L6	S73°29'59"E	134.03'
L7	S85°03'32"E	295.43'
L8	S55°08'39"E	508.67'
L9	S47°17'42"E	586.29'
L10	S40°28'04"E	420.92'
L11	S35°32'59"E	690.89'
L12	S47°50'55"E	453.46'
L13	S 6°27'20"W	39.90'
L14	S59°23'08"W	172.52'
L15	S67°08'12"W	258.92'
L16	S89°22'50"W	498.84'
L17	N86°09'24"W	880.96'
L18	N13°08'24"W	591.84'
L19	N34°38'39"W	149.14'
L20	N54°22'43"W	330.29'
L21	N46°42'04"W	1221.83'
L22	S 8°00'47"W	54.67'
L23	S31°49'48"E	4672.63'
L24	S49°20'36"E	107.25'
L25	S88°37'05"E	50.00'
L26	S 1°22'57"W	612.14'
L27	S52°54'28"E	1544.97'
L28	S 1°23'13"W	29.14'
L29	S52°54'23"E	74.53'
L30	S37°05'37"W	66.00'
L31	S20°42'45"E	1306.12'
L32	S89°01'57"E	54.50'
L33	S20°45'17"E	3548.64'
L34	S14°39'01"E	577.28'
L35	S11°37'20"W	71.67'
L36	S74°23'38"W	18.78'
L37	N 2°32'59"W	14.73'
L38	S75°00'40"W	62.02'
L39	N14°59'23"W	36.34'
L40	S75°00'40"W	14.96'
L41	N16°39'45"W	77.06'
L42	N 4°20'57"E	191.65'
L43	N20°45'20"W	5133.97'
L44	N 1°23'13"E	95.50'
L45	N52°54'23"W	978.60'
L46	S36°56'02"W	15.08'
L47	N52°50'38"W	616.97'
L48	N 1°19'59"E	650.57'
L49	N49°20'36"W	174.84'
L50	N31°49'48"W	4653.48'
L51	N28°17'14"W	540.00'
L52	N16°26'53"E	323.63'
L53	N69°30'36"W	253.34'
L54	S56°05'28"W	399.27'
L55	N81°16'40"W	525.43'
L56	N1°26'35"E	100.45'
L57	S88°04'29"E	442.63'
L58	N66°37'16"E	765.19'

BEARINGS AND DISTANCES ARE RELATED TO NAD83, MICHIGAN STATE PLANE CENTRAL ZONE AND DO NOT CONSTITUTE A BOUNDARY SURVEY.

REFERENCE POINTS

PT#	NORTHING	EASTING	ELEVATION	LATITUDE	LONGITUDE
RP 1	686,297.72	19,532,777.59	620.62'	45°11'51.50587"(N)	84°57'26.47275"(W)
RP 2	683,568.06	19,535,360.20	675.64'	45°11'24.73713"(N)	84°56'50.13263"(W)
RP 3	680,968.27	19,535,296.07	684.04'	45°10'59.06318"(N)	84°56'50.76818"(W)

NORTHING AND EASTING COORDINATES OF REFERENCE POINTS ARE NAD83, MICHIGAN STATE PLANE CENTRAL ZONE.

SCHEDULE OF PROPERTIES & AREAS OF INTEREST WITHIN PROJECT BOUNDARY

1	BOYNE MOUNTAIN RESORTS, LLC 002-005-015-30 APPLICANT	
2	BOYNE MOUNTAIN RESORTS, LLC 002-008-030-00 APPLICANT	
3	BOYNE FALLS PUBLIC SCHOOLS 002-008-003-00	
4	BOYNE FALLS PUBLIC SCHOOLS 002-008-019-00	
5	M-75 RIGHT OF WAY AREA PER M-DOT RIGHT OF WAY MAP FILE No. 15-R-3, SHEET 23	
6	BOYNE USA 002-008-000-20 APPLICANT	
7	BOYNE MOUNTAIN RESORT, LLC 002-016-028-10 APPLICANT	
8	CONSUMERS ENERGY COMPANY 002-016-026-60	

2.0 PURPOSE OF THIS RECREATION REPORT

The purpose of this recreational resources report is to provide the information needed to fulfill the provision of 18CFR §4.61(d)(2)(i), which provides for a description of the Project's environmental setting that includes a description of recreation uses; and §4.61(d)(2)(ii), which provides for an explanation of the specific measures proposed by the applicant, the agencies, and others to protect and enhance environmental resources as it relates to recreational use.

To fulfill these requirements, this report includes:

- a description of existing recreational facilities at the Project that are available for public use;
- an estimate of existing and potential recreational use of the Project area, in daytime and nighttime visits;
- a description of any measures or facilities recommended by the agencies consulted for the purpose of creating, preserving, or enhancing recreational opportunities at the Project;
- a statement of the existing measures or facilities to be continued and any new measures or facilities proposed by the applicant for the purpose of creating, preserving, or enhancing recreational opportunities at the Project, including an explanation of why the Licensee has rejected any measures or facilities recommended by an agency;
- identification of the entities responsible for implementing, constructing, operating, or maintaining any existing or proposed recreation use facilities;
- a schedule showing the intervals following issuance of a license at which implementation of the measures or construction of any proposed facilities would be constructed;
- an estimate of the costs of construction, operation, and maintenance of recreation use facilities;

3.0 RECREATION STUDY PLAN OBJECTIVES AND CONSULTATION

As outlined in the RSP, the purpose of the Recreation Study was to compile existing data and develop additional information sufficient to complete the recreational resources report and support the Boyne River Project relicense application.

The primary goals of the study were to:

- Develop an inventory and condition assessment of the existing Project recreation facilities;
- Estimate the level of daytime and nighttime recreational use occurring at the Project;
- Assess the adequacy of Project recreation relative to applicable existing public recreation plans and goals; and
- Develop recommendations for Project recreation access for inclusion in the license application.

3.1 Description of Project Recreation Facilities

Under the current FERC license, the Licensee provides facilitated access to both the north and south side of the tailwater, from the hydro plant downstream to Dam Road, the nearest public road, a distance of approximately ¼ mile. These sites are located within the Project boundary, as shown on Exhibit G (page 3 of this report). These North and South Tailwater sites are primarily used for fishing, but also for walking / hiking / sightseeing activities.

These are the only Project recreation facilities under the current Boyne River Hydro FERC license. There are no public roads that provide access to the Project reservoir or nearby upstream locations on the Boyne River. The Licensee does not provide developed public access to the Project reservoir. There are no public access points upstream of the Project for launching watercraft, including canoes and kayaks. Accordingly, there is no watercraft portage use at the dam.

3.2 Adjoining Non-Project Recreation Facilities

Immediately adjoining the Project tailwater access sites on the downstream (west) side of Dam Road is additional fishing access to the Boyne River on Michigan State Forest land, as discussed further in this report and shown in Appendix A. Anglers move back and forth between the Project tailwater access and the downstream State Forest access. The State Forest Land is also where users park for access to both the Project Tailwater and the State Forest land in an area within the Dam Road right-of-way, which the Charlevoix County Road Commission has widened for this purpose.

As is discussed further in Section 6.4.4 of this report, Boyne City Recreation Plan, the Licensee has also recently agreed to allow access to a portion of the Project transmission line for the construction of a recreation trail, as shown on the Figure 2 – Exhibit G Map.

3.3 Resource Agency/ Environmental Organization Initial Recommendations

In comments submitted on the Boyne River PAD, the Michigan Department of Natural Resources (MDNR) and the Michigan Hydro Relicensing Coalition (MHRC) recommended specific elements be included in a recreation study.

In their letter of August 31, 2017, MDNR recommended that the recreation study review the potential for expanding recreational access opportunities to include access to the impoundment for shore fishing, kayaking and a small boat launch. MDNR also recommends that the study evaluate current tailwater access parking.

In their letter of September 1, 2017, the MHRC provided similar recommendations, requesting that the recreation study include an assessment of:

- Downstream tailwater access and parking area
- Public access to the Boyne River at Dam Road.
- Canoe/kayak portage at the hydroelectric dam.
- Upstream impoundment public access.

3.4 Recreation Study Plan Response to MDNR / MHRC Recommendations

The RSP noted that there is no public access available to the river upstream of the powerplant and dam, including the Project reservoir. These locations are not served by any public roads or public access points. Without public road access to those areas, the Licensee concluded it would not be appropriate or productive to include them in the study of Project recreation facilities and use.

The Licensee would have to develop major public use infrastructure outside the Project boundary to make such recreational enhancements as shore fishing, kayaking and small boat launching on the reservoir available to the public. The Licensee does not believe that the financial investment required for such developments would be consistent with the level of recreation access that is appropriate for this Project; and believes that there is limited interest in such activities on the reservoir.

The tailwater access parking analysis has been included as part of the inventory and condition assessment of the Project Tailwater recreation facilities.

3.5 MDNR / MHRC Recreation Study Plan Comments

MDNR comments on the RSP stated that “The Department disagrees with the intent of the recreation study to limit review the current as built recreation facilities. The license term will be a minimum of 30 years and therefore forward looking considerations need to be made. Access to the impoundment should be part of the recreation plan for the project and the Department expects that provisions to provide access to the impoundment will be included in any new license issued for the project."

MHRC comments on the RSP stated that [the RSP] "does not include an assessment of impoundment and upstream-related recreation opportunities. MHRC feels that this is a serious omission that needs to be addressed… MHRC feels that this is a premature conclusion and does not agree with this rationale, especially for the impoundment. MHRC requests an assessment of impoundment recreation opportunities at a minimum."

3.6 Licensee response to MDNR / MHRC Recreation Study Plan Comments

The scope of the recreation study has been expanded to include a more thorough analysis of the issue of public recreational access upstream of the powerplant and dam.

4.0 PROJECT RECREATION SITE INVENTORY AND CONDITION ASSESSMENT

4.1 Methods

The Project Tailwater Access sites were visited on several occasions by JMB Associates, including May 25, May 31, September 23, and November 3, 2018. Notes regarding the existing access facilities and their condition were taken during the visits, along with appropriate documentation photographs.

4.2 Results

The Licensee provides facilitated access to both the north and south side of the tailwater, from the hydro plant downstream to Dam Road, the nearest public road, a distance of approximately ¼ mile. These North and South Tailwater Project recreation sites are primarily used for fishing, but also for walking / hiking / sightseeing activities.

The tailwater area is accessed from Dam Road, a Charlevoix County system road that crosses the Boyne River ¼ mile downstream of the powerplant. In addition to providing access to fishing and related activities that occur within the Project, upstream of the river crossing, Dam Road also provides access to the non-Project MDNR property located immediately downstream of the road on the north side of the river.

The Charlevoix County Road Commission has installed signage to support the fishing access use.

Boyne provides the Project tailwater fishing sites, which includes access from both the north and south sides of the river. Access on both sides is by developed pathways with stairways located periodically to facilitate user access to the river and help to prevent erosion. The North Tailwater Project recreation site includes six raised stairway locations along the ¼ mile pathway, while the South Tailwater Project recreation site has four raised stairway locations. Both sites have additional terraced in-ground erosion control – stairway structures, as well as other erosion control measures (e.g. rip-rap) to address erosion that is mostly related to user activity.

Signage complying with FERC regulations is located at the head of the pathways, as is a trash barrel. Additional signage along the pathway requests users to pick up any trash and help to keep the area clean by depositing the trash in the barrel or carrying it out. Field observation visits during the study period indicate these management methods appear to be quite effective, as no trash problems were observed, even during heavy use periods.

Recreation access sign at fishing access entry point

Typical fishing access pathway with foot-bridge structure

Typical raised access stairway leading from the pathway to the river

Signage requesting user cooperation in trash removal and resource care

Typical terraced river access / erosion control

4.3 Tailwater Access Parking

As discussed in Section 3.1, above, both MDNR and MHRC requested an evaluation of tailwater parking as part of the site inventory and condition assessment process.

Parking for the fishing access is located along the aforementioned Dam Road. Dam Road is constructed on a substantial fill profile to form the approaches for the bridge that spans the Boyne River. On the upstream (Project) side of the road, beyond the clearing and out-sloping of Dam Road, the natural profile falls off quickly to wetlands.

As noted earlier, the downstream, north side of Dam Road is Michigan DNR owned property; it is part of the State Forest Gaylord Unit, the Jordan Valley Management Area. It is an isolated, in terms of State Forest ownership, 3.2-acre parcel, as shown in Appendix – A. The Appendix – A information is taken from the MDNR Forest Management Division's most recent field examination results for the area, termed a compartment review, reported June 10, 2014. The field examiner notes that the parcel's principle purpose is to provide public access to the Boyne River, presumably as opposed to other more common forest management objectives like timber and wildlife goals. The examiner suggests in his notes that the property may be a candidate for the MDNR property disposal / ownership adjustment program, again presumably, because of its small size and isolated nature in terms of the State's preferred ownership pattern.

The only parking permitted by the Charlevoix Road Commission on the downstream side of Dam Road is on the MDNR parcel where the road profile has been widened and a gravel / dirt surface is provided for parking. The cleared, compacted surface area is approximately 140 feet long, extending about 20 feet deep from the paved edge of Dam Road. While parking spaces are not specifically delineated, typical vehicle parking allowance is normally laid out as 9' x 20', indicating that 15 vehicles may park in this location at one time. This is the primary parking location for the Project Tailwater recreation sites and the adjoining non-Project MDNR river access. Maintenance of the gravel parking surface is performed by the Charlevoix County Road Commission, since it is within the county road right-of-way (R-O-W).

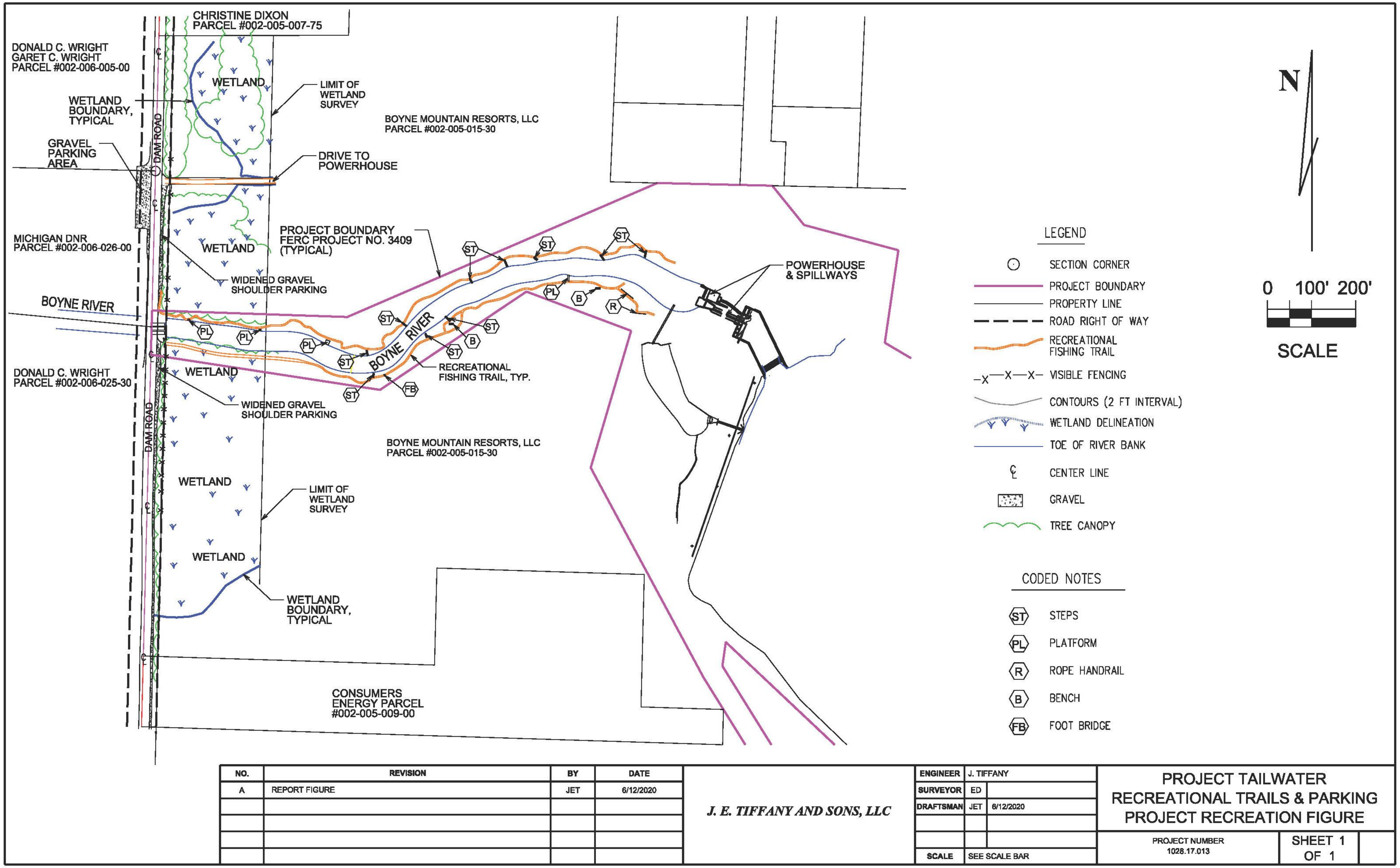
Twelve vehicles were observed, parked in the Dam Road R-O-W on the downstream State Forest land during the September 23 field visit, with a couple open spaces where users had apparently been parked earlier in the day, but had since departed.

When the MDNR property (i.e. Dam Road R-O-W) parking area is full, users park along the upstream side (east) of Dam Road on the road shoulder, which is also permitted by the Road Commission. The Road Commission has widened the shoulder in this area and provided additional gravel to provide a stable road shoulder parking surface.

During the September 23 visit, 11 additional vehicles, including the observer's vehicle, were parked along the upstream shoulder of Dam Road when this observation was made. No Parking signs are placed along the downstream side of Dam Road, as noted above.

Figure 4.3.1, Project Tailwater Facilities / Wetlands Delineation Sketch shows the existing parking area in the downstream Dam Road R-O-W, the widened shoulder along the upstream edge of Dam Road, the location of tailwater access stairs and pathways; and the extensive wetlands along the upstream side of Dam Road, based on a recent wetlands survey conducted for the Licensee.

Figure 4.3.1 Project Tailwater Facilities / Wetlands Delineation Sketch



In addition to the vehicle counts included as part of this study, Boyne also collected daily vehicular counts dating back to May 2017 for use in completing its 2017 Form 80 FERC Recreation Use Survey requirement.

Based on this data, the highest counts recorded of vehicles parked at one time occurred on Saturday and Sunday, September 29 and 30, 2018, when 49 and 47 vehicles, respectively, were observed at the time of the daily count. Similarly, in 2017 the highest counts were seen on weekend days during the fall salmonid migration on Saturday, September 30, 28 vehicles, and the following Sunday, October 8, when 26 vehicles were observed.

During the highest use demand fall salmonid migration months of September and October in 2017, the average weekend (Saturday, Sunday, plus full four day – Labor Day weekend) vehicle counts were 7.5 vehicles in September and 9.5 vehicles in October. In 2018, the results for the corresponding weekend and holiday use periods showed an average 13 vehicles in September and 4.6 vehicles in October. During the 123-day 2018 study period for this recreation study, the 15-vehicle parking capacity of the downstream Dam Road R-O-W area was exceeded on eight days, or 6% of the time.

As the Commission discusses in its guidance to licensees for the Form 80 Report, Peak Weekends are defined as "*weekends when recreational use is at its peak for the season (typically Memorial Day, July 4th & Labor Day). On these weekends, recreational use may exceed the capacity of the area to handle such use.*" In the case of the Boyne Hydro Tailwater, peak weekends occur in conjunction with the fall salmonid migration when fishing for these species is at its peak in terms of potential angler success. During this period there are points in time when the parking capacity provided by the Dam Road R-O-W area is exceeded, requiring the remaining users to park on the road shoulder

However, as indicated by the average use data outlined above, and the additional data discussed below in Section 5.0 Recreation Use Estimates, the demand for parking exceeds the 15-vehicle capacity of the Dam Road R-O-W parking area on only a few days per year. Developing additional parking capacity to accommodate these peak demand times is unwarranted and is further complicated by the fact that the wetlands areas adjacent to Dam Road are likely to be adversely impacted by such development. In addition to the unwarranted wetlands impact involved, the associated wetlands mitigation that may be required could substantially increase the cost of parking construction. Based on these factors, Boyne does not believe additional parking development is needed or appropriate. Boyne does recommend that MDNR not include the downstream State Forest parcel in its property adjustment program because the river recreational access it provides is important to serve the Boyne River public use needs.

4.4 Conclusions and Recommendations

The Boyne River Hydro Project Tailwater Sites offers anglers an excellent opportunity to enjoy the high-quality fishing available on the Boyne River. While the potamodromous salmonid migration of the fall, and to a lesser extent the spring, are a prime attraction for users, the tailwater site attracts people throughout the year, as the use analysis in Section 5.0, below, will discuss. Boyne has maintained the access and worked with local partners to enhance the site with the development of the stairways and erosion control measures in recent years. Overall the access is in good condition and serves the public well.

Providing and maintaining the tailwater access for public use is a significant recreational investment by the Licensee, considering the small 250kW size of the Boyne River Hydro Project. The public clearly enjoys and benefits from the availability of these sites, as is discussed further below in Section 5.0, reporting on recreation use.

5.0 EXISTING AND POTENTIAL PROJECT RECREATION USE ESTIMATE

5.1 Methods

In order to assess the level of use at the North and South Tailwater access sites, Boyne personnel working in conjunction JMB Associates, undertook daily counts of the number of vehicles and the number of users. These observations were made in conjunction with daily visits staff make to the powerplant. The observations were made at random times, but typically were more often made in the mid-morning hours, as opposed to afternoon visits. The morning hours are believed to be the more concentrated use periods, although evening hours around dusk are also popular. The Recreation Use Observation Form is shown in Appendix B.

The relicensing study data covers the period July 1, 2018 through October 31, 2018. According to the 2018 MDNR Michigan Fishing Guide, the Boyne River downstream of the Boyne Hydro is classified by the MDNR as a class 4 stream, which means that salmon and trout fishing is open all year. Accordingly, observations continued through the months of November and December 2018, but no use was observed during these months. During these periods, and continuing through the winter months, snow removal work by the Charlevoix County Road Commission on Dam Road results in snow banks along the road that eliminate the available parking area, effectively closing the site to public use. Interest in stream fishing during these winter months is generally minimal in any event.

As noted earlier in Section 4.0, in addition to the data collected specifically for this licensing study, Boyne personnel also made daily vehicle count observations from May 1 through October 31, 2017, and March 1 through April 30, 2018. These observations were made by the Licensee for the purpose of completing the 2017 FERC Form 80 Recreation Use reporting requirement, for which Boyne had been granted an extension of time to August 31, 2018. Since the data recorded for the Form 80 process did not include separate user counts, an average of 1.25 users per vehicle was assumed, since that is consistent with the results of the relicensing study data. Further, use was assumed to be about evenly divided between the North and South Tailwater, which is again consistent with 2018 study findings.

5.2 Results

The North and South Boyne Tailwater sites are used consistently outside the winter snow covered season from mid-April through the end of October. They are particularly popular with fisherman in the fall, and to a lesser extent spring, salmonid spawning migration periods; but they also attract anglers seeking brown trout and other stream resident species throughout the remainder of the spring, summer and fall. Table 5.1 combines data from recreation study observations (July – October 2018 data) and the Form 80 observations (April 2018, May and June 2017) to provide a summary of the recreation use observations for the full April through October use season. The spreadsheets showing the daily data are attached as Appendix C. For the July through October 2018 period, the data sheets include a notation of the weather conditions.

Table 5.1 Recreation Use Observations (Number of Anglers Observed)

Month		North Tailwater	South Tailwater	Total
April 2018	Weekdays – 21	25	24	49
	Weekend/Holiday – 9	9	9	18
May 2017	Weekdays - 23	95	94	189
	Weekend/Holiday – 8	62	62	124
June 2017	Weekdays – 22	104	104	208
	Weekend/Holiday – 8	35	34	69
July 2018	Weekdays – 21	56	56	112
	Weekend/Holiday - 10	11	9	20
August 2018	Weekdays – 22	19	13	30
	Weekend/Holiday - 9	28	19	49
September 2018	Weekdays - 19	90	83	173
	Weekend/Holiday - 11	84	90	174
October 2018	Weekday - 23	108	86	194
	Weekend/Holiday – 8	20	20	40
TOTAL	214 Days	746	703	1449

The recreation use observations do not purport to capture all of the recreation use at the Project, as they are daily point in time observations, as opposed to continuous user counts. In its most recent Form 80 Recreation Use Report filed 8/26/2018, and attached as Appendix D to this report, Boyne estimated total daytime use of 5,200 visits. That estimate is consistent with these use results, as the point in time observation records are believed to capture about one-third of the total visitors on any given day. This would include many users who may fish for one part of the day and then depart the site and return later in the same day. These would be counted as separate site use visits, following FERC Form 80 protocol.

The peak use periods associated with spring and fall salmonid spawning migration are borne out by the observations shown in Table 5.1. September's 347 users is the highest number of users observed for any month, followed by May (313 users).

It should be noted that observers did not attempt to separate out those who had vehicles parked along Dam Road, but may have been fishing downstream of the road on the Non-Project MDNR parcel. Indeed, users typically move back and forth upstream and downstream of Dam Road while fishing this river stretch, often wading to work various portions of the stream. As a result, many of the anglers are utilizing both the Project Tailwater sites and the non-Project MDNR River access during the same visit.

Depending on the weather conditions in any given year, some shoulder season use is also known to occur; fishing activity begins in March if snowmelt comes early and extends into November when snow cover comes later in the season. Overall, 5,000 daytime visits is believed to be a sound estimate of the total daytime use for the Project. Occasional night time fishing occurs, but is limited at the site. Night time use is estimated to be about 10 percent of the daytime use, or 500 visits.

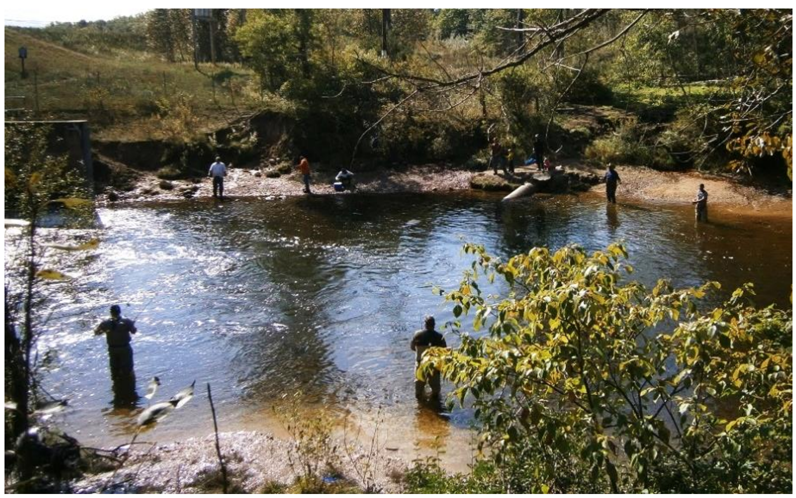
The Boyne River is located within the 1836 Ceded Territory pursuant to Native American treaty rights; and the Little Traverse Bay Bands of Odawa Indians (LTBB) retains the rights to hunt, fish and gather within that territory. Tribal members consider the Boyne Tailwater to be an important location for Fall salmon harvest activity (personal communication Lauren Dey, LTBB Water Quality Technician).

Based on observational visits performed by JMB Associates staff on May 25, May 31, September 23, and November 3, 2018, a combination of harvest activity and catch and release fishing occur at the site.

Fishing downstream of the spillway area, these fishermen prepare to release a salmon they have landed.

Fishermen working the area downstream near Dam Road prepare to depart with their harvest.

Angler fishing from the South Tailwater side about mid-way between the dam and Dam Road



Fishing activity immediately downstream of the Boyne Hydro Plant, which is the area of most concentrated activity during fall salmon runs.

The potential capacity of the Project Tailwater Access sites is based on the recreation use measure, PAOT (People At One Time), historically used by the USDA – Forest Service as a measure of a site's capacity. The site's PAOT capacity has been developed based on the assumption that it could accommodate an angler every 50 feet without causing an unreasonable level of user conflict. The two, one-quarter mile trails (North and South Tailwater) added together total 2,640 feet, indicating the Project recreation sites could accommodate 52 people at one time, 26 on each side of the river (2,640' / 50'). Using this capacity measure and its use observations, the Licensee reported an average non-peak weekend use level of 42% on the 8/26/2018 Form 80 Recreation Report (Appendix D). This indicates adequate site capacity to accommodate additional use if demand warrants.

6.0 EXISTING PROJECT RECREATION FACILITIES TO BE CONTINUED AND EVALUATION OF AGENCY RECOMMENDED MEASURES

6.1 Existing Project Recreation Facilities to be Continued

Maintaining access to the existing Project Tailwater recreation sites by Boyne Hydro provides a significant recreational use benefit to the public. While the public could legally wade the Boyne River upstream of Dam Road, were the adjacent privately owned river shoreline property not included in the FERC Project license area and made available for access, fishing use would be adversely impacted to a significant extent.

As discussed earlier in Section 4.0, Boyne does maintain signage along the tailwater access pathways that encourages users to remove trash. In conjunction with this effort, for user convenience Boyne does provide a trash barrel at the Dam Road entrance to the tailwater area, which allows users to deposit refuse before they leave the site. Boyne regularly provides for the removal of the refuse deposited there.

Boyne proposes to continue to make the North and South Tailwater Access sites available under a new FERC license as Project recreation facilities.

6.2 Licensee Costs to Construct, Operate, and Maintain Recreation Use Facilities

Currently, the Licensee spends an estimated $5,000 annually to maintain the Tailwater access sites. These costs include access trail maintenance to remove deadfalls, etc., trash removal, fencing and signage maintenance for user safety and powerhouse protection, use monitoring and other incidental recreation access related activities.

These costs are expected to be similar for providing the proposed Project recreation facilities and no additional construction costs are proposed.

6.3 Agency Recommended Facilities

MDNR and MHRC recommended that the recreation study review the potential for expanding recreational access opportunities to include access to the impoundment for shore fishing, kayaking and a small boat launch. As discussed earlier in this report, there are no public access roads that lead to the reservoir or the Boyne River upstream of the reservoir where the public can access the river. Boyne Hydro personnel access the powerplant by way of a gated two-track road that leads from Dam Road up to the reservoir and powerplant, a distance of about 0.3 miles.

In order to make this low-grade native surface route safe and useful for the public, substantial investment would be required, in addition to the investment required to develop boating access facilities, as are recommended by MDNR and MHRC. The costs would include substantial improvement to the road surface, including widening, grading, gravel surfacing, and multiple new culvert installations. The boat launch related costs are assumed to include a paved launch, skid pier, accessible pathways and a vault toilet. In addition, new gate installations and fencing to prohibit trespass upstream of the Project onto private property, and new fencing to protect Project critical energy infrastructure at the powerhouse would also be necessary. These costs would be in addition to the cost of parking and boating access facilities at the reservoir. The capital costs for such development is estimated by the Licensee to easily exceed $250,000: and the Licensee would also need to provide ongoing maintenance expense that includes periodic grading, toilet building cleaning and maintenance, skid pier installation and removal and other related costs.

Studies conducted for this relicensing have verified that the reservoir is relatively shallow and its resident fishery consists largely of warm water species, tending toward smaller size classes of fish. According to the results of the reservoir fish community surveys conducted for the relicensing, pumpkinseed sunfish (*Lepomis gibbosus*), yellow perch (*Perca flavescens*), and rock bass (*Ambloplites rupestris*) were the most frequently observed species; and the fish tended to be small with the pumpkinseed averaging 3.3 inches, the yellow perch 5.2 inches and the rock bass averaging 4.3 inches. The study also noted, somewhat to the surprise of the study personnel, that no bluegill were even found in the reservoir. (see Boyne River Hydroelectric Project Environmental Studies).

Generally, a fish community comprised of these small, less desirable warmwater species is not attractive to the majority of anglers. Public access to warm water fisheries with better species diversity, age and size components is common at many nearby lakes. Examples include Thumb Lake Park, located five miles east of Boyne Falls, Fall Park on Deer Lake, two miles south of the Boyne Hydro, and the 17,200-acre Lake Charlevoix located 3.5 miles west of the Boyne Hydro, where several public access locations include Young State Park. These nearby locations provide the fishing and boating public much better recreational opportunities for lake-based fishing and watercraft activities than access to the Boyne River Hydro impoundment could provide.

The Licensee believes that the investment that would be required to make the Boyne reservoir available for public use exceeds the objective of giving equal consideration to recreation objectives and is not justified.

6.4 Other Recreation Management Plans

Several recreation planning efforts apply generally to the vicinity of the Boyne Hydro, but do not contain any recommendations or goals that are specifically oriented toward the Project. These include a statewide planning effort completed on a five-year update basis, and community-based planning efforts that most communities in Michigan complete, also on a five-year update basis. These plans are required components of federal and state recreation grant programs. One of the plans, the Boyne City Recreation Plan, does have a tangential impact on the Project, using a portion of the Project transmission line for a new trail, as discussed in Section 6.4.4, below.

6.4.1 Michigan SCORP

The Michigan Statewide Comprehensive Outdoor Recreation Plan 2018 – 2022 (SCORP) is a five-year strategic plan that shapes investment by the State of Michigan and local communities in priority outdoor recreation infrastructure and programming. It is prepared under the provisions of the Federal Land & Water Conservation Act and is a component of the required planning to qualify state and community facilities for federal outdoor recreation funding programs. The SCORP is designed to be broad – serving as a guide for all outdoor recreation activities and communities throughout Michigan.

The SCORP does not contain specific goals that would be applicable to the Boyne Project. However, the SCORP does include statewide recreation use survey results that lists fishing as number eight on a list of 22 outdoor recreation activities, showing 41% of Michigan residents participate in fishing activities. The SCORP also notes that while the number of hunting licenses issued in Michigan in recent years has declined steadily, the number of fishing licenses issued has remained relatively stable. The Boyne Tailwater access sites contribute to the availability of fishing, benefiting a segment of the many Michigan residents that enjoy this outdoor pursuit.

6.4.2 Charlevoix County Recreation Plan

The Charlevoix County Recreation Plan 2015 – 2019 is the current outdoor recreation planning document for the county. The stated purpose of this plan is to provide general guidance and direction for Charlevoix County and all local units of government within the county concerning future recreation needs. This plan also provides a framework for the acquisition and improvement of recreational facilities currently owned by or to be acquired by the county. The plan's principle development / investment goals are focused on four existing county parks, the largest being Whiting Park located on the 17,200-acre Lake Charlevoix, located at the mouth of the Boyne River. The plan does include the Boyne River tailwater access among its inventory of recreation sites in the county, but does not include any goals or action items that call for additional recreation facilities within the Boyne River Project area..

6.4.3 Boyne Valley Community Recreation Plan

In addition to the Charlevoix County Recreation Plan, a separate recreation plan has been jointly developed by the Village of Boyne Falls and Boyne Valley Township, where the Boyne Hydro is located. The Boyne Valley Community Recreation Plan 2014 – 2018 was adopted by both entities.

Like the Charlevoix County Plan, the Boyne Valley Plan does include the Boyne Hydro Tailwater Access among its site inventory, but does not include any goals or objectives related to the tailwater access. The plan does have a stated long-term goal for pursuing the development of an additional community owned access site on the Boyne River to provide fishing and canoeing / kayak access, but does not suggest any target location to meet that objective.

6.4.4 Boyne City Recreation Plan

Boyne City is located about 3.5 miles below the Boyne Hydro where the Boyne River discharges into Lake Charlevoix. Due to its location on Lake Charlevoix and the access it provides to Lake Michigan, Boyne City has a strong tourism economy and many public recreation sites managed pursuant to its 2015 Boyne City Recreation Plan. One aspect of Boyne City's recreation development efforts is a sub-plan titled Trail Town Master Plan – Capturing Trail Based Tourism In Boyne City and Boyne Falls (Trail Plan).

A central objective of the Trail Plan is the development of a non-motorized trail between Boyne City and Boyne Falls. The project, the planning for which has been in the works since about 2000, will create a 10-foot wide trail extending roughly 7.2 miles, beginning with a trailhead near the Boyne City Municipal Airport and terminating in Boyne Falls. A portion of the trail will be located on the Project transmission line, as shown on Figure 2, Project Recreation Study Area (see page 3). Construction of the $1.8 million trail, which is being funded through various grants and community sources, began recently and completion is targeted for summer 2020.

REFERENCES

Federal Energy Regulatory Commission, Office of Energy Projects, 2017. Boyne Hydroelectric Project #3409-031, Letter Authorizing Use of Traditional Licensing Process, May 17, 2017

Boyne USA Inc., Boyne River Hydroelectric, 2017. Boyne River Project Pre-Application Document, March 20, 2017

Michigan Department of Natural Resources, 2017. Letter Providing Scoping Comments on the Boyne River Hydro Project, August 31, 2017

Michigan Hydro Relicensing Coalition, 2017. Letter Providing Scoping Comments on the Boyne River Hydro Project, September 1, 2017

Michigan Department of Natural Resources, 2018. Letter Providing Comments on the Boyne River Hydro Project Study Plans, June 28, 2018

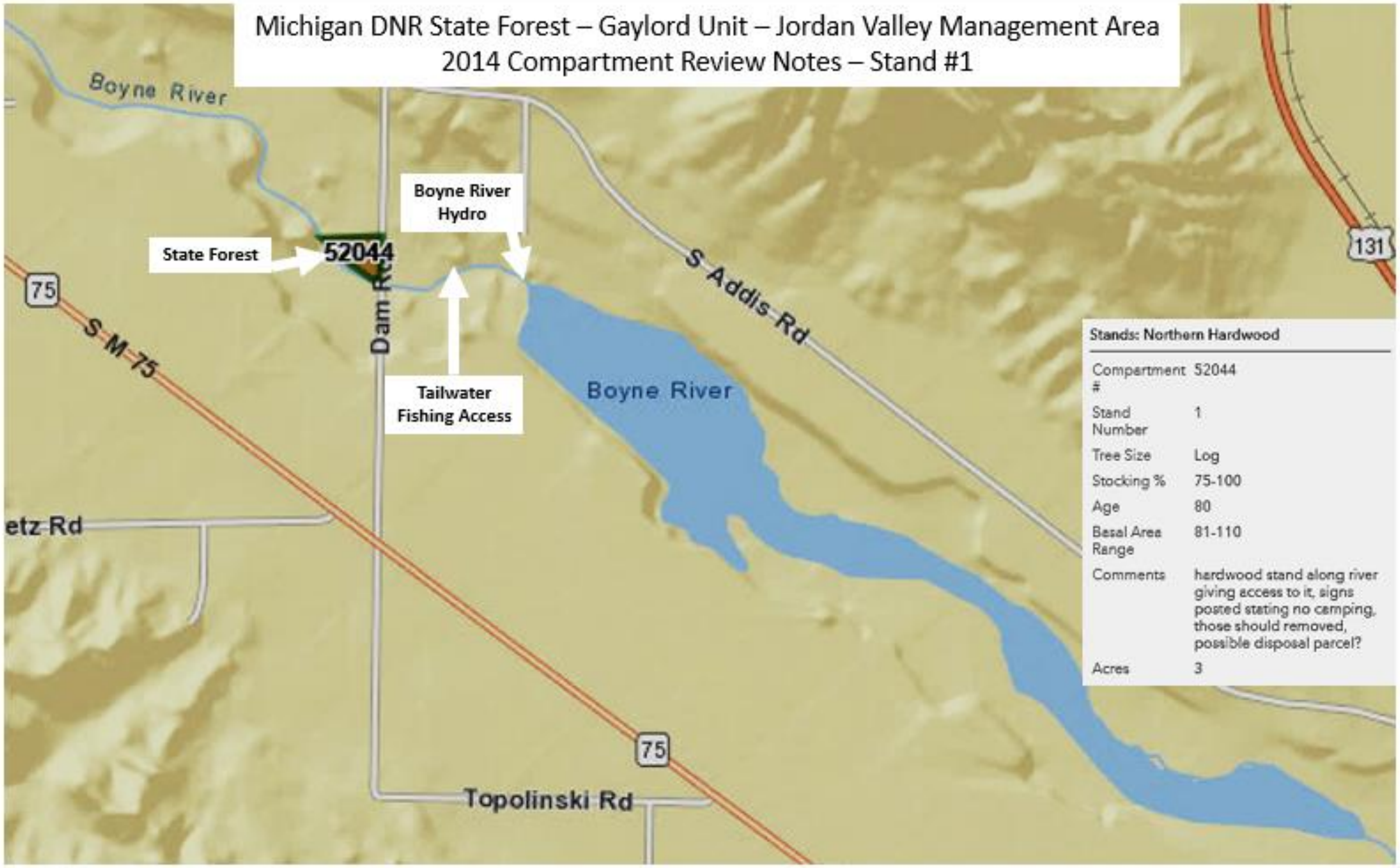
Michigan Hydro Relicensing Coalition, 2018. Letter Providing Comments on the Boyne River Hydro Project Study Plans, June 20, 2018

Michigan Department of Natural Resources, Forest Management Division, 2014. Gaylord Management Unit Compartment 52044 Review, June 10, 2014

Michigan Department of Natural Resources, Fisheries Division, 2018. 2018 Michigan Fishing Guide, ND

APPENDIX A

MICHIGAN DEPARTMENT OF NATURAL RESOURCES
FOREST MANAGEMENT DIVISION PROPERTY
NON-PROJECT BOYNE RIVER RECREATION ACCESS


Michigan DNR State Forest – Gaylord Unit – Jordan Valley Management Area
2014 Compartment Review Notes – Stand #1
Boyne River
State Forest
52044
Boyne River Hydro
Tailwater Fishing Access
Dam Rd
S Addis Rd
131
75
S M-75
Boyne River
etz Rd
Topolinski Rd
Stands: Northern Hardwood
Compartment # 52044
Stand Number 1
Tree Size Log
Stocking % 75-100
Age 80
Basal Area Range 81-110
Comments hardwood stand along river giving access to it, signs posted stating no camping, those should removed, possible disposal parcel?
Acres 3

APPENDIX B

BOYNE RIVER HYDRO
PROJECT RECREATION SITE
USE OBSERVATION FORM

BOYNE RIVER HYDRO PROJECT
RECREATION USE OBSERVATION FORM

Observer:____________________ Date / Time: ____________________

Weather Conditions: ______________________________________

Recreation Site: ____Tailwater Access Sites________

Number of Vehicles: ____________________

Number of People / Activity Observed:

North Tailwater

Fishing ____________ Walking / Hiking ____________ Other ____________

South Tailwater

Fishing ____________ Walking / Hiking ____________ Other ____________

Comments:

____

____

____

____

____

APPENDIX C

BOYNE RIVER HYDRO
PROJECT RECREATION SITE
MONTHLY USE DATA SUMMARIES

April 2018

2018 Date	Day	Morning Cars	Afternoon Cars	Total Vehicles	Users
4/1/2018	Sun	0	2	2	2.5
4/2/2018	Mon	1	2	3	3.8
4/3/2018	Tues	0	0	0	0.0
4/4/2018	Wed	2	1	3	3.8
4/5/2018	Thurs	0	0	0	0.0
4/6/2018	Fri	3	2	5	6.3
4/7/2018	Sat	0	0	0	0.0
4/8/2018	Sun	1	3	4	5.0
4/9/2018	Mon	2	0	2	2.5
4/10/2018	Tues	0	1	1	1.3
4/11/2018	Wed	0	1	1	1.3
4/12/2018	Thurs	1	2	3	3.8
4/13/2018	Fri	2	0	2	2.5
4/14/2018	Sat	0	1	1	1.3
4/15/2018	Sun	0	0	0	0.0
4/16/2018	Mon	0	2	2	2.5
4/17/2018	Tues	1	0	1	1.3
4/18/2018	Wed	2	1	3	3.8
4/19/2018	Thurs	0	0	0	0.0
4/20/2018	Fri	2	2	4	5.0
4/21/2018	Sat	3	0	3	3.8
4/22/2018	Sun	0	1	1	1.3
4/23/2018	Mon	0	0	0	0.0
4/24/2018	Tues	1	2	3	3.8
4/25/2018	Wed	0	0	0	0.0
4/26/2018	Thurs	0	1	1	1.3
4/27/2018	Fri	1	0	1	1.3
4/28/2018	Sat	1	2	3	3.8
4/29/2018	Sun	0	0	0	0.0
4/30/2018	Mon	1	3	4	5.0
Weekend		5	9	14	18
Weekday		19	20	39	49
Totals	0	24	29	53	66

May 2017

2017 Date	Day	Morning Cars	Afternoon Cars	Total Vehicles	Users
5/1/2017	Mon	3	3	6	7.5
5/2/2017	Tues	2	1	3	3.8
5/3/2017	Wed	4	3	7	8.8
5/4/2017	Thurs	3	2	5	6.3
5/5/2017	Fri	6	6	12	15.0
5/6/2017	Sat	2	3	5	6.3
5/7/2017	Sun	3	4	7	8.8
5/8/2017	Mon	4	2	6	7.5
5/9/2017	Tues	2	0	2	2.5
5/10/2017	Wed	1	0	1	1.3
5/11/2017	Thurs	0	0	0	0.0
5/12/2017	Fri	3	1	4	5.0
5/13/2017	Sat	6	2	8	10.0
5/14/2017	Sun	7	8	15	18.8
5/15/2017	Mon	5	6	11	13.8
5/16/2017	Tues	9	12	21	26.3
5/17/2017	Wed	2	1	3	3.8
5/18/2017	Thurs	0	0	0	0.0
5/19/2017	Fri	1	2	3	3.8
5/20/2017	Sat	3	2	5	6.3
5/21/2017	Sun	2	3	5	6.3
5/22/2017	Mon	6	7	13	16.3
5/23/2017	Tues	5	6	11	13.8
5/24/2017	Wed	8	9	17	21.3
5/25/2017	Thurs	7	10	17	21.3
5/26/2017	Fri	6	6	12	15.0
5/27/2017	Sat	9	9	18	22.5
5/28/2017	Sun	10	11	21	26.3
5/29/2017	Mon	1	2	3	3.8
5/30/2017	Tues	2	2	4	5.0
5/31/2017	Wed	3	2	5	6.3
Weekend		49	50	99	124
Weekday		76	75	151	189
Total		125	125	250	313

June 2017

2017 Date	Day	Morning Cars	Afternoon Cars	Total Vehicles	Users
6/1/2017	Thurs	2	3	5	6.3
6/2/2017	Fri	1	2	3	3.8
6/3/2017	Sat	3	4	7	8.8
6/4/2017	Sun	2	3	5	6.3
6/5/2017	Mon	1	0	1	1.3
6/6/2017	Tues	0	2	2	2.5
6/7/2017	Wed	2	3	5	6.3
6/8/2017	Thurs	4	5	9	11.3
6/9/2017	Fri	3	4	7	8.8
6/10/2017	Sat	3	4	7	8.8
6/11/2017	Sun	5	6	11	13.8
6/12/2017	Mon	2	3	5	6.3
6/13/2017	Tues	1	1	2	2.5
6/14/2017	Wed	0	0	0	0.0
6/15/2017	Thurs	2	2	4	5.0
6/16/2017	Fri	4	4	8	10.0
6/17/2017	Sat	1	2	3	3.8
6/18/2017	Sun	0	3	3	3.8
6/19/2017	Mon	2	2	4	5.0
6/20/2017	Tues	3	2	5	6.3
6/21/2017	Wed	6	5	11	13.8
6/22/2017	Thurs	2	3	5	6.3
6/23/2017	Fri	1	2	3	3.8
6/24/2017	Sat	4	5	9	11.3
6/25/2017	Sun	5	5	10	12.5
6/26/2017	Mon	0	1	1	1.3
6/27/2017	Tues	1	3	4	5.0
6/28/2017	Wed	3	4	7	8.8
6/29/2017	Thurs	5	6	11	13.8
6/30/2017	Fri	4	5	9	11.3
Weekend		23	32	55	69
Weekday		72	94	166	208
Total		95	126	221	276

JULY 2018	VEHICLES PARKED	NO TAILWATER FISHING	SO TAILWATER FISHING	OTHER ACTIVITIES	WEATHER - NOTES
Sun 7/1	0	0	0		Cloudy
Mon 7/2	0	0	0		Partly cloudy
Tues 7/3	4	2	2		Sunny
Wed 7/4	7	3	5		Sunny
Thurs 7/5	18	10	12		Sunny
Fri 7/6	11	6	7		Cloudy
Sat 7/7	1	1	0		Rainy
Sun 7/8	2	1	1		Rainy
Mon 7/9	3	2	1		Cloudy / Overcast
Tues 7/10	3	2	2		Sunny
Wed 7/11	0	0	0		Rain
Thurs 7/12	1	1	1		Cloudy
Fri 7/13	7	3	5		Rain
Sat 7/14	3	2	1		Rain
Sun 7/15	4	3	1		Rainy / Partly Cloudy
Mon 7/16	5	3	3		Cloudy
Tues 7/17	4	3	3		Cloudy
Wed 7/18	5	3	3		Sunny
Thurs 7/19	2	2	0		Sunny
Fri 7/20	0	0	0		Partly Sunny
Sat 7/21	0	0	0		Rain / Cloudy
Sun 7/22	0	0	0		Rain
Mon 7/23	7	4	4		Cloudy
Tues 7/24	7	5	4		Sunny
Wed 7/25	5	3	2		Sunny
Thurs 7/26	3	3	0		Sunny
Fri 7/27	5	3	3		Rain
Sat 7/28	2	1	1		Cloudy
Sun 7/29	0	0	0		Cloudy
Mon 7/30	2	0	2		Sunny
Tues 7/31	2	1	2		Sunny
Weekend	19	11	9		
Weekday	94	56	56		
MONTHLY TOTAL	113	67	65		
TOTAL USERS OBSERVED		132			An average of 1.2 Visitors per vehicle
DAILY AVERAGE	3.65	2.16	2.10		

AUGUST 2018	VEHICLES PARKED	NO TAILWATER FISHING	SO TAILWATER FISHING	OTHER ACTIVITIES	WEATHER - NOTES
Wed 8/1	3	2	2		Cloudy / Overcast
Thurs 8/2	0	0	0		Cloudy
Fri 8/3	3	2	2		Sunny
Sat 8/4	8	6	4		Sunny
Sun 8/5	5	3	4		Sunny
Mon 8/6	2	2	0		Sunny
Tues 8/7	3	2	2		Sunny
Wed 8/8	1	1	0		Rain / Cloudy
Thurs 8/9	0	0	0		Cloudy
Fri 8/10	1	1	0		Sunny
Sat 8/11	0	0	0		Sunny
Sun 8/12	1	1	1		Sunny
Mon 8/13	1	2	0		Sunny
Tues 8/14	2	2	1		Sunny
Wed 8/15	0	0	0		Sunny
Thurs 8/16	3	2	1		Rain
Fri 8/17	3	2	2		Cloudy
Sat 8/18	2	1	1		Cloudy
Sun 8/19	4	3	3		Sunny
Mon 8/20	4	3	3		Sunny
Tues 8/21	3	2	1		Sunny
Wed 8/22	2	1	1		Sunny
Thurs 8/23	2	1	2		Sunny
Fri 8/24	0	0	0		Sunny
Sat 8/25	1	3	0		Thunder Storms
Sun 8/26	0	0	0		Partly Cloudy / Fog
Mon 8/27	2	1	1		Cloudy
Tues 8/28	1	1	0		Cloudy
Wed 8/29	2	1	1		Partly Cloudy / Overcast
Thurs 8/30	0	0	0		Rain
Fri 8/31	2	2	0		Partly Cloudy
Weekend	23	19	13		
Weekday	38	28	19		
MONTHLY TOTAL	61	47	32		
TOTAL USERS OBSERVED		79		An average of 1.3 Visitors per vehicle	
DAILY AVERAGE	2	2	1		

SEPTEMBER 2018	VEHICLES PARKED	NO TAILWATER FISHING	SO TAILWATER FISHING	OTHER ACTIVITIES	WEATHER - NOTES
Sat 9/1	8	4	6		Sunny
Sun 9/2	2	2	1		Sunny
Mon 9/3	3	2	2		Cloudy / Rain
Tues 9/4	1	1	0		Rain
Wed 9/5	1	1	1		Rain / Cloudy
Thurs 9/6	2	2	2		Mostly Cloudy
Fri 9/7	2	2	1		Cloudy
Sat 9/8	2	1	2		Sunny
Sun 9/9	2	2	1		Sunny
Mon 9/10	3	3	2		Sunny
Tues 9/11	4	2	3		Sunny
Wed 9/12	2	1	1		Sunny
Thurs 9/13	1	1	0		Cloudy
Fri 9/14	0	0	0		Cloudy
Sat 9/15	2	2	2		Sunny
Sun 9/16	3	2	1		Sunny
Mon 9/17	3	2	1		Partly Cloudy
Tues 9/18	2	1	1		Cloudy / Rain
Wed 9/19	3	2	2		Cloudy
Thurs 9/20	4	2	3		Cloudy / Rain
Fri 9/21	4	3	3		Cloudy / Rain
Sat 9/22	14	8	8		Cloudy
Sun 9/23	22	12	14		Sunny
Mon 9/24	33	18	20		Sunny
Tues 9/25	38	24	18		Sunny
Wed 9/26	12	10	4		Rain
Thurs 9/27	14	6	9		Cloudy / Rain
Fri 9/28	18	9	12		Rain
Sat 9/29	49	26	28		Rain
Sun 9/30	47	23	25		Cloudy
Weekend	154	84	90		
Weekday	147	90	83		
MONTHLY TOTAL	301	174	173		
TOTAL USERS OBSERVED		347			An average of 1.2 Visitors per vehicle
DAILY AVERAGE	10.03	5.80	5.77		

OCTOBER 2018	VEHICLES PARKED	NO TAILWATER FISHING	SO TAILWATER FISHING	OTHER ACTIVITIES	WEATHER - NOTES
Mon 10/1	28	14	16		Cloudy
Tues 10/2	14	12	4		Rain
Wed 10/3	12	10	4		Rain
Thurs 10/4	22	14	16		Rain / Cloudy
Fri 10/5	10	8	4		Cloudy
Sat 10/6	6	3	2		Cloudy
Sun 10/7	6	3	4		Cloudy
Mon 10/8	6	4	4		Cloudy / Overcast
Tues 10/9	5	3	4		Cloudy / Rain
Wed 10/10	4	2	3		Rain
Thurs 10/11	3	2	2		Rain
Fri 10/12	6	6	4		Cloudy
Sat 10/13	2	1	1		Cloudy
Sun 10/14	3	2	2		Overcast
Mon 10/15	5	3	3		Cloudy
Tues 10/16	4	3	2		Cloudy
Wed 10/17	12	8	6		Cloudy
Thurs 10/18	6	4	4		Partly Sunny
Fri 10/19	5	3	3		Partly Cloudy
Sat 10/20	10	6	4		Cloudy
Sun 10/21	8	4	6		Cloudy
Mon 10/22	4	3	2		Cloudy
Tues 10/23	2	1	1		Cloudy
Wed 10/24	2	1	1		Cloudy
Thurs 10/25	2	2	0		Cloudy
Fri 10/26	1	1	0		Cloudy
Sat 10/27	2	1	1		Cloudy / Rain
Sun 10/28	0	0	0		Cloudy
Mon 10/29	1	1	0		Partly Sunny
Tues 10/30	3	2	2		Cloudy
Wed 10/31	2	1	1		Partly Sunny
Weekend	37	20	20		
Weekday	159	108	86		
MONTHLY TOTAL	196	128	106		
TOTAL USERS OBSERVED		234		An average of 1.2 Visitors per vehicle	
DAILY AVERAGE	6.32	4.13	3.42		

Appendix D

Boyne River Hydro
Form 80 Project Recreation Use Report

Federal Energy Regulatory Commission (FERC)
FERC Form 80

Licensed Hydropower Development Recreation Report

Form Approved
OMB No. 1902-0106
Expires: 09/30/2016
Burden 3.0 hours

General Information:
This form collects data on recreation amenities at projects licensed by FERC under the Federal Power Act (16 USC 791a-825r). This form must be submitted by licensees of all projects except those specifically exempted under 18 CFR 8.11 (c). For regular, periodic filings, submit this form on or before April 1, 2015. Submit subsequent filings of this form on or before April 1, every 6th year thereafter (for example, 2021, 2027, etc.). For initial Form No. 80 filings (18CFR 8.11(b)), each licensee of an unconstructed project shall file an initial Form No. 80 after such project has been in operation for a full calendar year prior to the filing deadline. Each licensee of an existing (constructed) project shall file an initial Form No. 80 after such project has been licensed for a full calendar year prior to the filing deadline. Filing electronically is preferred. (See http://www.ferc.gov for more information.) If you cannot file electronically, submit an original and two copies of the form to the: Federal Energy Regulatory Commission, Office of the Secretary, 888 First St., NE, Washington, DC 20426.

The public burden estimated for this form is three hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing the collection of information. Send comments regarding the burden estimate or any aspect of this collection of information, including suggestions for reducing burden, to: FERC via e-mail DataClearance@ferc.gov; or mail to 888 First Street NE, Washington, DC 20426 (Attention: Information Clearance Officer) and Office of Management and Budget (OMB), via e-mail to oira_submission@omb.eop.gov; or mail to OMB, Office of Information and Regulatory Affairs, Attention: Desk Officer for FERC, Washington, DC 20503. Include OMB Control Number 1902-0106 as a point of reference. No person shall be subject to any penalty for failing to comply with a collection of information if the collection of information does not display a valid control number (44 U.S.C. § 3512 (a)).

Instructions:
a. All data reported on this form must represent publicly available recreation amenities and services located within the project boundary.
b. To ensure a common understanding of terms, please refer to the Glossary on page 3.
c. Report actual data for each item. If actual data are unavailable, then please estimate.
d. Submit a completed form for each development at your project.

Schedule 1. General Data

1. Licensee Name: Boyne USA Inc.	**Complete the following for each development if more than one.**
2. Project Name: Boyne River Hydro	8. Reservoir Surface Area at Normal Pool (acres): 80.00
3. Project Number: 3409	9. Shoreline Miles at Normal Pool: 1.80
4. Development Name: Boyne River Hydro	10. Percent of Shoreline Available for Public Use: 0.0
States Development/Project Traverses (List state with largest area within the development/project boundary first): 5. State #1: MI 6. State #2: ____ 7. Type of Project License: (check one) Major ____ Minor X	11. Data Collection Methods (enter percent for each method used; total must equal 100%): 80 traffic count/trail count ____ attendance records 20 staff observation ____ visitor counts or surveys ____ estimate (explain)

For 2014, enter only the licensee's annual recreational construction, operation, and maintenance costs for the development (project). Also, enter the annual recreational revenues for that year.

Item	Licensee's Annual Recreation Costs and Revenues (In Whole Dollars)	
	Construction, Operation and Maintenance Costs	Recreation Revenues for Calendar Year
12. Dollar Values	$ 5,000.00	$ 0.00

13. Length of Recreation Season: Summer: From (MM/DD) 05/01 To 09/30 Winter: From (MM/DD) 10/01 To 04/30

Period	Number of visits to all recreational areas at development/project (in Recreation Days)	
	Annual Total	Peak Weekend Average (see Glossary)
14. Daytime	5,200	110
15. Nighttime	500	11

Respondent Certification: The undersigned certifies that he/she examined this report; and to the best of his/her knowledge, all data provided herein are true, complete, and accurate.

Randall C Sutton	Area Manager	(231) 549-6076
Legal Name	Title	Area Code/Phone No.
[signature]	8-26-2018	2017
Signature	Date Signed	Reporting Year Ending

Title 18 U.S.C.1001 makes it a crime for any person knowingly and willingly to make to any Agency or department of the United States any false, fictitious or fraudulent statement or misrepresentation as to any matter within its jurisdiction.

Licensed Hydropower Development Recreation Report

Schedule 2. Inventory of Publicly Available Recreation Amenities Within the Project Boundary

16. Enter data for each Recreation Amenity Type (a). For User Free (b) and User Fee (c) enter the number of publicly available recreation amenities, located within the project boundary, regardless of provider. For FERC Approved (d) enter the number of amenities identified under User Free (b) and User Fee (c) for which the licensee has an ongoing responsibility for funding or maintenance (see Glossary for further detail). For Capacity Utilization(f), of the total publicly available amenities (b) + (c), compare the average non-peak weekend use (see Glossary) for each recreation amenity type (during the recreation season, with the highest use, reported on Schedule 1, Item 13) with the total combined capacity of each amenity type and enter a percentage that indicates their overall level of use. For example, if all public boat launches are used to half capacity during the non-peak weekend days, enter 50% (should use exceed capacity for an amenity type, enter the appropriate percentage above 100).

Recreation Amenity Type (a)	Number of Recreation Amenities: User Free (b)	User Fee (c)	FERC Approved (d)	Total Units (e)	Capacity Utilization (%) (f)
Boat Launch Areas. Improved areas having one or more boat launch lanes (enter number in column e) and are usually marked with signs, have hardened surfaces, and typically have adjacent parking.	0	0		Lanes	
Marinas. Facilities with more than 10 slips on project waters, which include one or more of the following: docking, fueling, repair and storage of boats; boat/equipment rental; or sell bait/food (see Glossary FERC approved).	0	0		N/A	
Whitewater Boating. Put-ins/Take-outs specifically designated for whitewater access.	0	0		N/A	
Portages. Sites designed for launching and taking out canoes/kayaks and the improved, designated, and maintained trails connecting such sites (enter length of trail in column e).	0	0		Feet	
Tailwater Fishing. Platforms, walkways, or similar structures to facilitate below dam fishing.	2	0	2	N/A	42
Reservoir Fishing. Platforms, walkways, or similar structures to facilitate fishing in the reservoir pool or feeder streams.	0	0		N/A	
Swim Areas. Sites providing swimming facilities (bath houses, designated swim areas, parking and sanitation facilities).				Acres	
Trails. Narrow tracks used for non-automobile recreation travel which are mapped and designated for specific use(s) such as hiking, biking, horseback riding, snowmobiling, or XC skiing (excludes portages, paths or accessible routes; See Glossary).				Miles	
Active Recreation Areas. Playground equipment, game courts/fields, golf/disc golf courses, jogging tracks, etc.				Acres	
Picnic Areas. Locations containing one or more picnic sites (each of which may include tables, grills, trash cans, and parking).				Sites	
Overlooks/Vistas. Sites established to view scenery, wildlife, cultural resources, project features, or landscapes.				Acres	
Visitor Centers. Buildings where the public can gather information about the development/project, its operation, nearby historic, natural, cultural, recreational resources, and other items of interest.				N/A	
Interpretive Displays. Signage/Kiosks/Billboards which provide information about the development/project, its operation, nearby historic, natural, cultural, recreational resources, and other items of interest.				N/A	N/A
Hunting Areas. Lands open to the general public for hunting.				Acres	
Winter Areas. Locations providing opportunities for skiing, sledding, curling, ice skating, or other winter activities.				Acres	
Campgrounds. Hardened areas developed to cluster campers (may include sites for tents, trailers, recreational vehicles [RV], yurts, cabins, or a combination, but excludes group camps).				Acres	N/A
Campsites. Sites for tents, trailers, recreational vehicles [RV], yurts, cabins, or a combination of temporary uses.				N/A	
Cottage Sites. Permanent, all-weather, buildings rented for short-term use, by the public, for recreational purposes.				N/A	
Group Camps. Areas equipped to accommodate large groups of campers that are open to the general public (may be operated by public, private, or non-profit organizations).				Sites	
Dispersed Camping Areas. Places visitors are allowed to camp outside of a developed campground (enter number of sites in clmn. e).				Sites	
Informal Use Areas. Well used locations which typically do not include amenities, but require operation and maintenance and/or public safety responsibilities					
Access Points. Well-used sites (not accounted for elsewhere on this form) for visitors entering project lands or waters, without trespassing, for recreational purposes (may have limited development such as parking, restrooms, signage).				N/A	
Other. Amenities that do not fit in the categories identified above. Please specify (if more than one, separate by commas):					

End of Recreational Resources Study Report

Appendix C USDA-SC CUSTOMIZED SOILS REPORT

United States Department of Agriculture

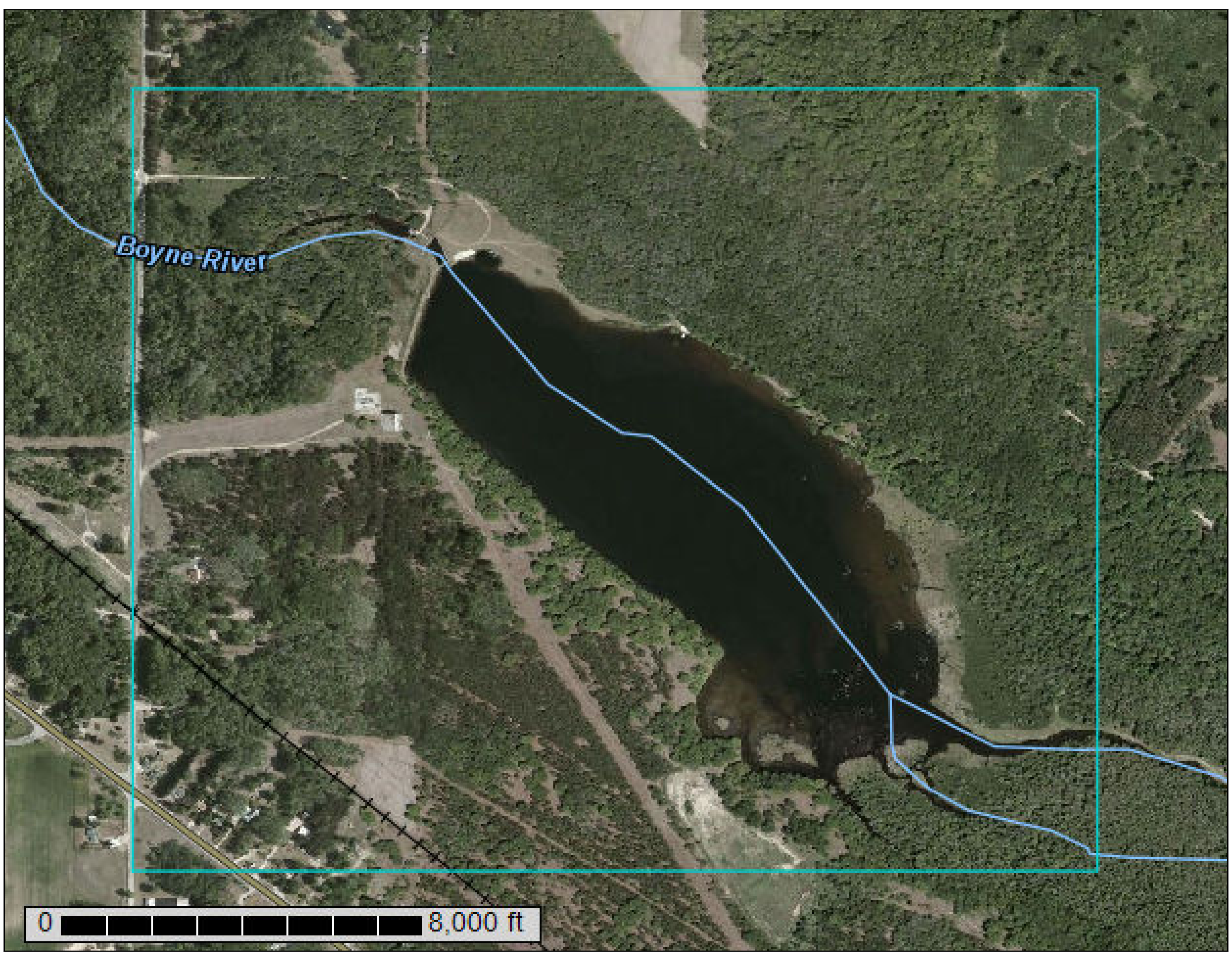
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Charlevoix County, Michigan

Boyne River Hydroelectric Project Vicinity



March 2, 2017

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

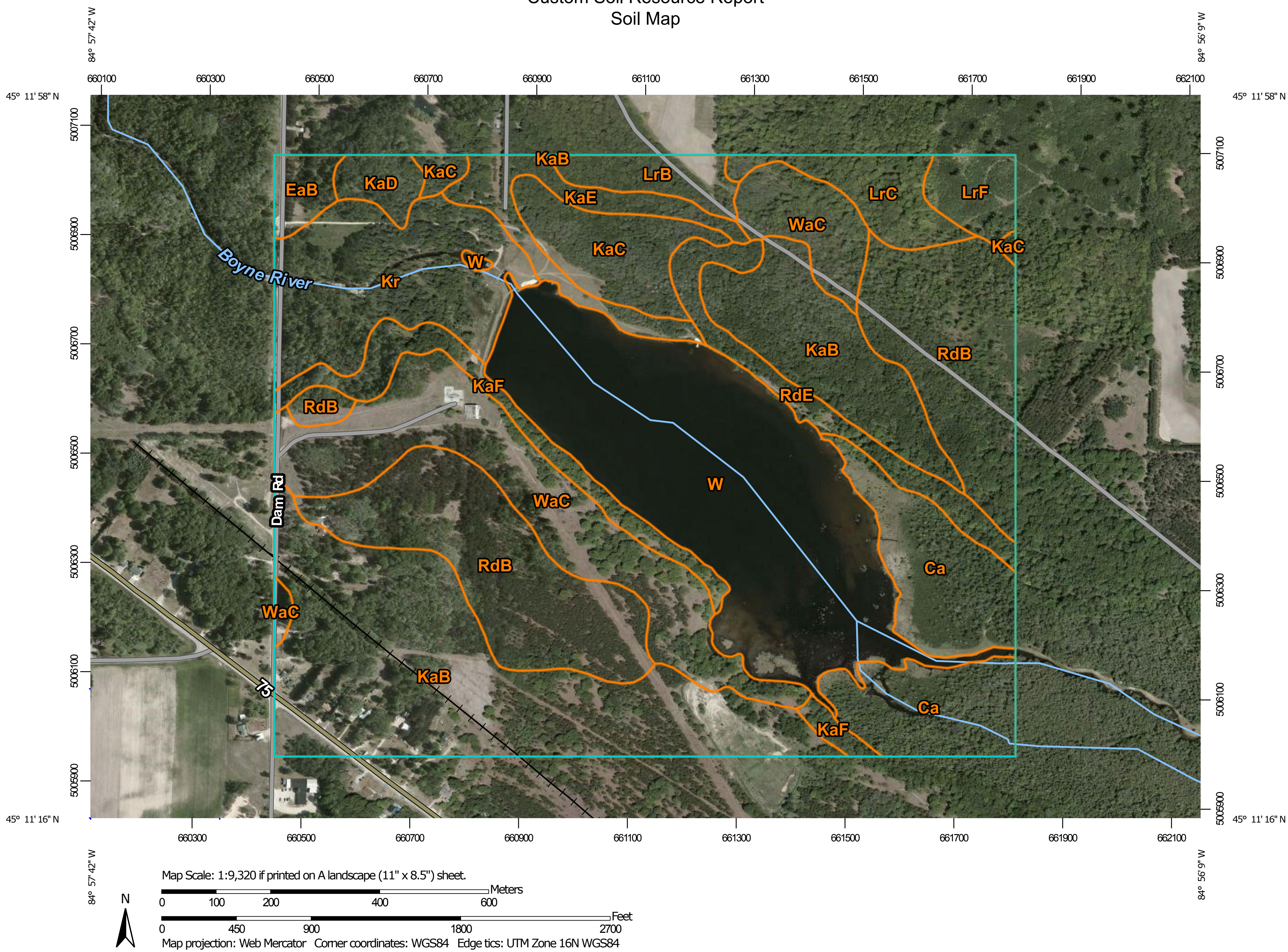
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map


84° 57' 42" W
84° 56' 9" W
45° 11' 58" N
45° 11' 16" N
660100
660300
660500
660700
660900
661100
661300
661500
661700
661900
662100
5007100
5006900
5006700
5006500
5006300
5006100
5005900
EaB
KaD
KaC
KaB
KaE
LrB
LrC
LrF
WaC
KaC
W
Kr
Boyne River
KaF
RdB
RdE
Dam Rd
W
Ca
75
KaF
Map Scale: 1:9,320 if printed on A landscape (11" x 8.5") sheet.
N
Meters
0 100 200 400 600
Feet
0 450 900 1800 2700
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Charlevoix County, Michigan
Survey Area Data: Version 12, Sep 21, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 23, 2010—May 16, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Charlevoix County, Michigan (MI029)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
Ca	Carbondale muck	28.9	7.8%
EaB	East Lake loamy sand, 0 to 6 percent slopes	3.6	1.0%
KaB	Kalkaska sand, 0 to 6 percent slopes	76.6	20.6%
KaC	Kalkaska sand, 6 to 12 percent slopes	13.4	3.6%
KaD	Kalkaska sand, 12 to 18 percent slopes	3.7	1.0%
KaE	Kalkaska sand, 18 to 25 percent slopes	10.3	2.8%
KaF	Kalkaska sand, 25 to 50 percent slopes	11.4	3.1%
Kr	Kerston muck	27.3	7.3%
LrB	Leelanau-Rubicon loamy sands, 0 to 6 percent slopes	6.0	1.6%
LrC	Leelanau-Rubicon loamy sands, 6 to 12 percent slopes	8.3	2.2%
LrF	Leelanau-Rubicon loamy sands, 25 to 50 percent slopes	5.4	1.5%
RdB	Rubicon sand, 0 to 6 percent slopes	55.5	14.9%
RdE	Rubicon sand, 18 to 35 percent slopes	10.2	2.7%
W	Water	68.4	18.4%
WaC	Wallace sand, 0 to 12 percent slopes	43.1	11.6%
Totals for Area of Interest		**372.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Charlevoix County, Michigan

Ca—Carbondale muck

Map Unit Setting

National map unit symbol: 6d4c
Elevation: 600 to 2,000 feet
Mean annual precipitation: 22 to 44 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 60 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Carbondale and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Carbondale

Setting

Landform: Depressions on till plains, depressions on outwash plains
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: >51" of organic material

Typical profile

Oa1 - 0 to 14 inches: muck
Oa2 - 14 to 28 inches: muck
Oe - 28 to 60 inches: mucky peat

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 5.95 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water storage in profile: Very high (about 27.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: A/D
Hydric soil rating: Yes

Minor Components

Linwood

Percent of map unit: 5 percent
Landform: Depressions on outwash plains, depressions on till plains
Landform position (three-dimensional): Dip
Down-slope shape: Linear

Across-slope shape: Linear
Hydric soil rating: Yes

Tawas

Percent of map unit: 5 percent
Landform: Depressions on outwash plains, depressions on till plains
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Roscommon

Percent of map unit: 5 percent
Landform: Depressions on outwash plains, depressions on till plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

EaB—East Lake loamy sand, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6d4p
Elevation: 600 to 1,200 feet
Mean annual precipitation: 27 to 33 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 80 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

East lake and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of East Lake

Setting

Landform: Beach ridges, lake terraces, lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 20 to 40 inches of sandy material over calcareous, sandy and gravelly glaciofluvial deposits

Typical profile

A - 0 to 11 inches: gravelly sand
Bs - 11 to 32 inches: loamy sand
2C - 32 to 60 inches: very gravelly sand

Properties and qualities

Slope: 0 to 6 percent

Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 25 percent
Available water storage in profile: Low (about 3.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Gladwin

Percent of map unit: 5 percent
Landform: Beach ridges, lake terraces, lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

KaB—Kalkaska sand, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6d5p
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Kalkaska and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kalkaska

Setting

Landform: Lake plains, moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

A - 0 to 4 inches: sand
E - 4 to 10 inches: sand
Bhs - 10 to 16 inches: sand
C - 16 to 60 inches: sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

East lake

Percent of map unit: 5 percent
Landform: Lake plains, moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Blue lake

Percent of map unit: 5 percent
Landform: Moraines, lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

KaC—Kalkaska sand, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 6d5q
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days

Farmland classification: Not prime farmland

Map Unit Composition

Kalkaska and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kalkaska

Setting

Landform: Valley trains, moraines
Landform position (two-dimensional): Toeslope, footslope, backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Linear, convex
Parent material: Sandy glaciofluvial deposits

Typical profile

A - 0 to 4 inches: sand
E - 4 to 10 inches: sand
Bhs - 10 to 16 inches: sand
C - 16 to 60 inches: sand

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Blue lake

Percent of map unit: 5 percent
Landform: Moraines, valley trains
Landform position (two-dimensional): Toeslope, footslope, backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Linear, convex
Hydric soil rating: No

Leelanau

Percent of map unit: 5 percent
Landform: Valley trains, moraines
Landform position (two-dimensional): Toeslope, footslope, backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Linear, convex
Hydric soil rating: No

KaD—Kalkaska sand, 12 to 18 percent slopes

Map Unit Setting

National map unit symbol: 6d5r
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Kalkaska and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kalkaska

Setting

Landform: Moraines, valley trains
Landform position (two-dimensional): Toeslope, footslope, backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Sandy glaciofluvial deposits

Typical profile

A - 0 to 4 inches: sand
E - 4 to 10 inches: sand
Bhs - 10 to 16 inches: sand
C - 16 to 60 inches: sand

Properties and qualities

Slope: 12 to 18 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.3 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Leelanau
Percent of map unit: 5 percent
Landform: Valley trains, moraines
Landform position (two-dimensional): Toeslope, footslope, backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

Blue lake
Percent of map unit: 5 percent
Landform: Valley trains, moraines
Landform position (two-dimensional): Toeslope, footslope, backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

KaE—Kalkaska sand, 18 to 25 percent slopes

Map Unit Setting
National map unit symbol: 6d5s
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition
Kalkaska and similar soils: 90 percent
Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kalkaska

Setting

Landform: Moraines, valley trains
Landform position (two-dimensional): Toeslope, footslope, backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Sandy glaciofluvial deposits

Typical profile

A - 0 to 4 inches: sand
E - 4 to 10 inches: sand
Bhs - 10 to 16 inches: sand
C - 16 to 60 inches: sand

Properties and qualities

Slope: 18 to 25 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Blue lake

Percent of map unit: 5 percent
Landform: Valley trains, moraines
Landform position (two-dimensional): Toeslope, footslope, backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

Leelanau

Percent of map unit: 5 percent
Landform: Valley trains, moraines
Landform position (two-dimensional): Toeslope, footslope, backslope, shoulder, summit

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

KaF—Kalkaska sand, 25 to 50 percent slopes

Map Unit Setting

National map unit symbol: 6d5t
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Kalkaska and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kalkaska

Setting

Landform: Valley trains, moraines
Landform position (two-dimensional): Toeslope, footslope, backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Sandy glaciofluvial deposits

Typical profile

A - 0 to 4 inches: sand
E - 4 to 10 inches: sand
Bhs - 10 to 16 inches: sand
C - 16 to 60 inches: sand

Properties and qualities

Slope: 25 to 50 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Leelanau

Percent of map unit: 5 percent
Landform: Moraines, valley trains
Landform position (two-dimensional): Toeslope, footslope, backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

Kr—Kerston muck

Map Unit Setting

National map unit symbol: 6d5z
Elevation: 600 to 1,600 feet
Mean annual precipitation: 22 to 35 inches
Mean annual air temperature: 36 to 46 degrees F
Frost-free period: 60 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Kerston and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kerston

Setting

Landform: Flood plains
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 16 to 40 inches of organic deposits over stratified mineral alluvium

Typical profile

Oa - 0 to 13 inches: muck
C - 13 to 17 inches: sandy loam
O'a - 17 to 28 inches: muck
C' - 28 to 60 inches: stratified sand to sandy loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 5.95 in/hr)
Depth to water table: About 0 to 24 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Calcium carbonate, maximum in profile: 25 percent
Available water storage in profile: Very high (about 13.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: A/D
Hydric soil rating: Yes

Minor Components

Lupton

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Tawas

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

LrB—Leelanau-Rubicon loamy sands, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6d69
Elevation: 600 to 1,800 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 80 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition

Leelanau and similar soils: 50 percent
Rubicon and similar soils: 45 percent

Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Leelanau

Setting

Landform: Till plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: 20 to 52 inches of sandy and loamy material over calcareous sandy glaciofluvial deposits

Typical profile

A - 0 to 4 inches: loamy sand
Bs - 4 to 20 inches: loamy sand
E and Bt - 20 to 42 inches: loamy sand
C - 42 to 60 inches: loamy sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Hydric soil rating: No

Description of Rubicon

Setting

Landform: Till plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

A - 0 to 9 inches: loamy sand
Bs - 9 to 18 inches: sand
C - 18 to 60 inches: sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Emmet

Percent of map unit: 5 percent
Landform: Till plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

LrC—Leelanau-Rubicon loamy sands, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 6d6b
Elevation: 600 to 1,800 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 80 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition

Leelanau and similar soils: 50 percent
Rubicon and similar soils: 45 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Leelanau

Setting

Landform: Moraines
Landform position (two-dimensional): Toeslope, footslope, backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Linear, convex
Parent material: 20 to 52 inches of sandy and loamy material over calcareous sandy glaciofluvial deposits

Typical profile

A - 0 to 4 inches: loamy sand
Bs - 4 to 20 inches: loamy sand
E and Bt - 20 to 42 inches: loamy sand
C - 42 to 60 inches: loamy sand

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Hydric soil rating: No

Description of Rubicon

Setting

Landform: Moraines
Landform position (two-dimensional): Toeslope, footslope, backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Linear, convex
Parent material: Sandy glaciofluvial deposits

Typical profile

A - 0 to 9 inches: loamy sand
Bs - 9 to 18 inches: sand
C - 18 to 60 inches: sand

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A

Hydric soil rating: No

Minor Components

Emmet

Percent of map unit: 5 percent
Landform: Moraines
Landform position (two-dimensional): Toeslope, footslope, backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Linear, convex
Hydric soil rating: No

LrF—Leelanau-Rubicon loamy sands, 25 to 50 percent slopes

Map Unit Setting

National map unit symbol: 6d6f
Elevation: 600 to 1,800 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 80 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Leelanau and similar soils: 50 percent
Rubicon and similar soils: 45 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Leelanau

Setting

Landform: Moraines
Landform position (two-dimensional): Toeslope, footslope, backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: 20 to 52 inches of sandy and loamy material over calcareous sandy glaciofluvial deposits

Typical profile

A - 0 to 4 inches: loamy sand
Bs - 4 to 20 inches: loamy sand
E and Bt - 20 to 42 inches: loamy sand
C - 42 to 60 inches: loamy sand

Properties and qualities

Slope: 25 to 50 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Hydric soil rating: No

Description of Rubicon

Setting

Landform: Moraines
Landform position (two-dimensional): Toeslope, footslope, backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Sandy glaciofluvial deposits

Typical profile

A - 0 to 9 inches: loamy sand
Bs - 9 to 18 inches: sand
C - 18 to 60 inches: sand

Properties and qualities

Slope: 25 to 50 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Emmet

Percent of map unit: 5 percent

Landform: Moraines
Landform position (two-dimensional): Toeslope, footslope, backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

RdB—Rubicon sand, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: 6d78
Elevation: 600 to 1,800 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 80 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Rubicon and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rubicon

Setting

Landform: Outwash plains, lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

A - 0 to 9 inches: loamy sand
Bs - 9 to 18 inches: sand
C - 18 to 60 inches: sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Croswell

Percent of map unit: 5 percent
Landform: Outwash plains, lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

RdE—Rubicon sand, 18 to 35 percent slopes

Map Unit Setting

National map unit symbol: 6d7b
Elevation: 600 to 1,800 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 80 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Rubicon and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rubicon

Setting

Landform: Moraines
Landform position (two-dimensional): Toeslope, footslope, backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Sandy glaciofluvial deposits

Typical profile

A - 0 to 9 inches: loamy sand
Bs - 9 to 18 inches: sand
C - 18 to 60 inches: sand

Properties and qualities

Slope: 18 to 35 percent

Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Leelanau

Percent of map unit: 5 percent
Landform: Moraines
Landform position (two-dimensional): Toeslope, footslope, backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Hydric soil rating: No

W—Water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

WaC—Wallace sand, 0 to 12 percent slopes

Map Unit Setting

National map unit symbol: 6d7p
Elevation: 600 to 1,900 feet
Mean annual precipitation: 27 to 34 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 70 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Wallace and similar soils: 95 percent
Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wallace

Setting

Landform: Beach ridges, outwash plains
Landform position (two-dimensional): Toeslope, footslope, shoulder, summit, backslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Linear, convex
Parent material: Sandy deposits with ortstein on glaciofluvial, eolian and/or glaciolacustrine deposits

Typical profile

A - 0 to 7 inches: sand
Bhsm - 7 to 30 inches: sand
C - 30 to 60 inches: sand

Properties and qualities

Slope: 0 to 12 percent
Depth to restrictive feature: About 7 inches to ortstein
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 0.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Kalkaska

Percent of map unit: 5 percent
Landform: Beach ridges, outwash plains
Landform position (two-dimensional): Toeslope, footslope, backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Linear, convex
Hydric soil rating: No

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Appendix D INITIAL CONSULTATION DOCUMENTS

BOYNE USA, Inc.
1 Boyne Mountain Road
Boyne Falls, MI 49713

March 20, 2017

AGENCIES, TRIBES, INTERESTED PARTIES

Re: FERC Project No. 3409 – Boyne USA, Inc. – Boyne River Hydroelectric Project – Pre-Application Document Transmittal

Dear Sir or Madam:

Boyne USA, Inc. ("Boyne USA") is the licensee for the Boyne River Hydroelectric Project (FERC Project No. 3409). The current Federal Energy Regulatory Commission (FERC) License for the Boyne River Dam expires on January 31, 2022.

In accordance with 18 CFR, Chapter I, Part 5, Boyne USA is hereby filing the Preliminary Application Document (PAD). It should be noted that along with a time extension to file this PAD, the FERC has extended the deadline for filing comments on the request to use the Traditional Licensing Process (TLP) to April 19, 2017.

A public meeting will be held on or about June 29, 2017 to discuss the project, current and potential resource needs and management objectives, potential studies and time frames. Sometime in the second week of June we will be sending you a formal notice of the date, time and place of meeting and will also provide you with an agenda for the meeting. There will also be an opportunity for a site visit in conjunction with the meeting.

If there are any questions, please do not hesitate to contact me via email or telephone.

Sincerely,

Randall Sutton

Area Manager – Boyne Mountain Resort
1 Boyne Mountain Road
Boyne Falls, MI 49713
231.549.6076
rsutton@boynemountain.com

Enclosure

BOYNE HYDRO- PAD MAILING LIST

Local Units of Government in the Area:

Charlevoix County
301 State Street
Charlevoix, MI 49720

Boyne Valley Township
Boyne Falls, Michigan 49713

City of Petoskey
101 E. Lake Street
Petoskey, MI 49770

Village of Boyne Falls
Boyne Falls, MI 49713

City of Boyne City
319 N. Lake Street
Boyne City, MI 49712

Potentially Affected Indian Tribes:

Bay Mills Indian Community
President
12140 W. Lakeshore Drive
Brimley, MI 49715

Grand Traverse Band of Ottawa and Chippewa Indians
Chairperson
2605 N.W. Bayshore Dr.
Suttons Bay, MI 49682

Hannahville Indian Community
Chairperson
N14911 Hannahville B1 Rd.
Wilson, MI 49896-9728

Keweenaw Bay Indian Community
Tribal Historic Preservation Officer
107 Beartown Road
Baraga, MI 49908

Little River Band of Ottawa Indians
Tribal Historic Preservation Officer
375 River Street
Manistee, MI 49660

Little Traverse Bay Bands of Odawa Indians
Tribal Historic Preservation Officer
7500 Odawa Circle
Harbor Springs, MI 49740-

Match-e-be-nash-she-wish Band of Pottawatomi Indians of Michigan
Chairperson
PO Box 218
Dorr, MI 49323

Pokagon Band of Potawatomi Indians
Chairperson
P.O. Box 180
Dowagiac, MI 49047

Saginaw Chippewa Indian Tribe of Michigan
Chief
7070 East Broadway Road
Mt. Pleasant, MI 48858

Sault Ste. Marie Tribe of Chippewa Indians of Michigan
Chairperson
523 Ashmun Street
Sault Ste. Marie, MI 49783

Darrell Seki, Chairman
Red Lake Band of Chippewa Indians, Minnesota
P.O. Box 550 / Welch, MN 55089

John “Rocky” Barrett, Chairman
Citizen Potawatomi Nation, Oklahoma
1601 South Gordon Cooper Drive
Shawnee OK 74801

Liana Onnen, Chairperson
Prairie Band Potawatomi Nation
16281 Q Road
Mayetta, KS 66509

James Williams, Jr., Chairperson
Lac Vieux Desert Band of Lake Superior Chippewa Indians, Michigan
PO Box 249
Watersmeet, MI 49969

Steven Pego, Chief
Saginaw Chippewa Indian Tribes of Michigan
7070 East Broadway Road
Mt. Pleasant, MI 48858

Nottawaseppi Huron Band of the Potawatomi, Michigan
Homer A Mandoka, Chairperson
1485 Mno-Bmadzewn Way / Fulton, MI 49052

Forest County Potawatomi Community, Wisconsin
Harold Frank, Chairman
P.O. Box 340 / Crandon, WI 54520
(715) 478-7200

Federal Agencies:

Bureau of Indian Affairs
U.S. Department of the Interior
Regional Director
One Federal Drive
Room 550
Fort Snelling, MN 55111-4007

Federal Emergency Management Agency
Regional Administrator
536 South Clark Street
6th Floor
Chicago, IL 60605

Federal Energy Regulatory Commission
Division of Dam Safety and Inspections
Regional Engineer
230 South Dearborn Street
Room 3130
Chicago, IL 60604

Federal Energy Regulatory Commission
Office of the General Counsel
888 First Street NE, Rm 101-56
Washington, D.C. 20426

Federal Energy Regulatory Commission
Office of Energy Projects
888 First Street NE, Rm 61-02
Washington, D.C. 20426

Office of Senator Levin
U.S. Senator
269 Russell Senate Office Building
Washington, DC 20510

Office of Senator Stabenow
U.S. Senator
133 Hart Senate Office Building
Washington, DC 20510

U.S. Army Corps of Engineers
District Engineer
P.O. Box 1027
Detroit, MI 48231-1027

U.S. Environmental Protection Agency
Office of Enforcement and Compliance Assurance
Supervisor - NEPA Implementation
77 West Jackson Boulevard
Mailcode: E-197
Chicago, IL 60604-3507

U.S. Fish and Wildlife Service
BHW Federal Building
Regional Director
One Federal Drive
Fort Snelling, MN 55111-4056

U.S. Fish and Wildlife Service
East Lansing Field Office
Field Supervisor
2651 Coolidge Road
Suite 101
East Lansing, MI 48823-6360

Regional Administrator
Fisheries Regional Office
National Oceanic and Atmospheric Administration
55 Great Republic Drive
Gloucester, MA 01930-2298

Director
Northeast Fisheries Science Center
National Oceanic and Atmospheric Administration
166 Water Street
Woods Hole, MA 02543-1026

U.S. Department of the Interior Headquarters
National Park Service, Director
1849 C Street NW
Washington, DC 20240

Regional Director
National Park Service, Northeast Region
U.S. Custom House
200 Chestnut Street 5th Floor
Philadelphia, PA 19106

National Park Service
U.S. Department of the Interior
Regional Director
601 Riverfront Drive
Omaha, NE 68102-4226

U.S. Environmental Protection Agency
Ariel Rios Building
Administrator
1200 Pennsylvania Ave NW
Washington, DC 20460

United States Geological Survey
U.S. Department of the Interior
Director
12201 Sunrise Valley Dr
Reston, VA 20192

Advisory Council on Historic Preservation
Executive Director
401 F Street NW, Suite 308
Washington, DC 20001-2637

State Agencies:

Michigan Department of Environmental Quality
Air Quality Division Chief
PO Box 30260
Lansing, MI 48909-7760

Michigan Department of Environmental Quality
Land and Water Management Division Chief
PO Box 30458
Lansing, MI 48909-7958

Michigan Department of Natural Resources
Director
PO Box 30028
Mason Bldg
Lansing, MI 48909-7757

Michigan Department of Natural Resources
Fisheries Division Director
P.O. Box 30446
Mason Bldg
Lansing, MI 48909

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

Michigan Department of Natural Resources
Wildlife Division Director
P.O. Box 30444
Mason Bldg
Lansing, MI 48909

Michigan Historical Center
SHPO
702 West Kalamazoo St
P.O. Box 30740
Lansing, MI 48909-8240

Office of the Attorney General
Attorney General
P.O. Box 30212
Lansing, MI 48909-0212

Office of the Governer
Governor
P.O. Box 30013
Lansing, MI 48909

Non-Governmental Agencies:

Federation of Fly Fishers
Great Lakes Council
P.O. Box 828
Pentwater, MI 49949

Michigan Hydro Relicensing Coalition
P.O. Box 828
Pentwater, MI 49949

Michigan Trout Unlimited
Dr. Bryan Burroughs
P.O. Box 442
Dewitt, MI 48820-8820

Conservation Resource Alliance
Bayview Professional Centre
10850 Traverse Highway, Suite 1180
Traverse City, MI 49684

Friends of the Boyne River
P.O. Box 186
Boyne City, MI 49712-0186

Tip of the Mitt Watershed Council
426 Bay Street
Petoskey, MI 49770

June 19, 2017

Re: FERC Project No. 3409 – Boyne USA, Inc. – Boyne River Hydroelectric Project –Joint Agency/Public Meeting

Dear Sir or Madam:

Boyne USA, Inc., is the licensee of the Boyne River Hydroelectric Project, located on the Boyne River in Boyne Valley Township, Charlevoix County, Michigan, which is licensed by the Federal Energy Regulatory Commission (FERC), Project Number 3409 (Project).

On July 10, 2017*,* Boyne USA will hold a meeting to explain the project and potential environmental impacts and discuss the data and studies to be provided in its upcoming application to the Federal Energy Regulatory Commission for re-licensing the Project.

The meeting will be held at 7 p.m. on July 10, 2017 in the Graz room in the lower level of the Mountain Grand Lodge, Boyne Mountain Resort, 1 Boyne Mountain Rd, Boyne Falls, MI 49713.

The major issues to be discussed include:

- Summary of Process to Date
- Process Ahead
- Potential Studies to be Completed prior to Application.

A site visit is also scheduled to follow immediately afterwards. For more information, contact Randall Sutton (231) 549-6076 or at rsutton@boynemountain.com.

Sincerely,

Boyne USA, Inc.

Randall Sutton

Attachment- Joint Meeting Agenda

BOYNE RIVER HYDROELECTRIC PROJECT
JOINT MEETING RE: RE-LICENSING WITH FERC
AGENDA

- Introduction- Boyne USA is applying for re-licensing of Boyne River Hydroelectric Project, FERC No. 3409
- Introductions, sign-in sheet
- Sign up sheet for meeting recording
- Summary of Process to Date:
  - Notice of Intent
  - Preliminary Application Document (PAD)
    - Sign up sheet for PDF Copy by e-mail. See us after if you need a hard copy
  - Traditional Licensing Process (TLP) Request
    - Granted by FERC on May 17, 2017
- Process Ahead:
  - Consultation with Stakeholders, Regulatory Agencies
  - Study Phase (Summer 2018)
  - Draft License Application (May, 2019)
  - Final Application (January 31, 2020)
  - Existing License Expires (January 31, 2022)
- Purpose of Today's Meeting- Consultation with Interested Parties, Discuss Potential Studies to be Completed prior to Application.
- Study Process
  - Request for Studies (see attached)
    - 60 days from today
    - Written Request
    - Submit to:

      Mr. Randall Sutton
Boyne USA
1 Boyne Mountain Rd
Boyne Falls, MI 49713
  - Study design- this winter
  - Studies to be completed over next summer
  - Study results to be included in draft application
- Discussion of Potential Studies
- Site Visit

STUDY REQUEST PROCESS

CFR Title 18, Chapter 1, Subchapter B, Part 16.8 (b):

(5) Not later than 60 days after the joint meeting held under paragraph (b)(3) of this Section (unless extended within this time period by a resource agency, Indian tribe, or members of the public for an additional 60 days by sending written notice to the applicant and the Director of the Office of Energy Projects within the first 60 day period, with an explanation of the basis for the extension), each interested resource agency and Indian tribe must provide a potential applicant with written comments:

(i) Identifying its determination of necessary studies to be performed or the information to be provided by the potential applicant;

(ii) Identifying the basis for its determination;

(iii) Discussing its understanding of the resource issues and its goals and objectives for these resources;

(iv) Explaining why each study methodology recommended by it is more appropriate than any other available methodology alternatives, including those identified by the potential applicant pursuant to paragraph (b)(2)(vii) of this section;

(v) Documenting that the use of each study methodology recommended by it is a generally accepted practice; and

(vi) Explaining how the studies and information requested will be useful to the agency, Indian tribe, or member of the public in furthering its resource goals and objectives that are affected by the proposed project.

SO MANY JULY 4 FESTIVITIES
PAGES 8-9

BOYNE CITY Gazette

DAILY NEWS & PHOTOS AT BOYNEGAZETTE.COM

EST. 2009 • NO. 409 - VOL. 8 - ISSUE 45 • *SEEK THE TRUTH, SERVE THE CITIZENS* • WEDNESDAY JUNE 28, 2017 • **$1.00**

Don't miss Boyne's big July Fourth celebration

Boyne City celebrates Independence Day this year on Monday July 3 and Tuesday July 4 with the area's biggest and best family fun.

The two days of fun include the Waterside Arts & Crafts Show and Inflatable Alley and a Boyne City schools all-class reunion.

The fun continues with the Independence Day Run, breakfast at the Eagles Hall, and the Grand Parade.

There will also be a Boyne Valley Garden Club pie sale, BBQ chicken in the park, a kids pie-eating contest, kids games, live music, a raft race and more.

MONDAY JULY 3

10 a.m.- 9 p.m. - "Bouncers and More" Inflatable Alley

10 a.m.-5 p.m. - 41st Annual Waterside Arts & Crafts Show - Veterans Park

1-3 p.m. - All-Class Reunion for Boyne City Schools, Veterans Park. Application form.

1 p.m. - Soap Box Derby School - Required of all kids who want to

see **FOURTH** on **PAGE 8**

EAST JORDAN FREEDOM FESTIVAL

The Community of East Jordan is getting ready to display the red, white and blue Buntings and fly the American Flag for the 2017 East Jordan Freedom Festival, June 27 – July 2.

The six day annual event features activities and entertainment for the entire family and for all ages. Two parades, outdoor movie, free kids games in the park, 3-on-3 Basketball Tournament, Co-ed Grass Volleyball Tournament, three nights of live music including northern Michigan's own Derailed on Thursday evening in Memorial Park Saturday afternoon you will be treated to the sounds of the Sault Ste. Marie Pipe Band and The Acoustic Tribute following the Grand Parade and Saturday night local favorites, Full Circle featuring John Slough, Nick Lilak, Roger Lilak and special guest Joe Trojanek on drums will perform prior to the fantastic fireworks show, shot from a barge and synchronized to music (download the app to hear the music on your mobile device – Great Lakes Fireworks) over the South Arm of Lake Charlevoix.

A Community Block Party on Friday attracts hundreds of people onto Main Street for music with the Northern Nites Band, food, games plus the popular "Button Drawing," Schmidt Amusements will operate the carnival downtown from Thursday thru Saturday with rides and games for all ages to enjoy.

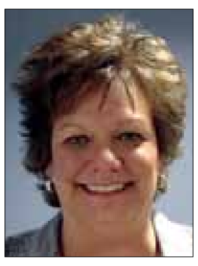
For a complete schedule of events visit www.eastjordanfreedomfestival.org or 536-7351.

PHOTO BY CHRIS FAULKNOR

Last of the demolition

The former Boyne City Fire Department and Boyne City Police Department are now only a memory. They were demolished throughout the week, reducing to a final pile of rubble on Friday June 23. The painting that can be seen was a mural that hung on the wall of the Fire Department Training Room for many years.

Meet Charlevoix Hospital's new president



SCHROEDER

Joanne L. Schroeder, FACHE, officially began her role with Munson Healthcare last week as the new president of Charlevoix Hospital.

She comes to Charlevoix from Bronson South Haven Hospital in South Haven, where she served the chief operating officer and vice president.

Prior to that hospital's merger with Bronson Healthcare earlier this year, she had served as the president and CEO of the hospital since 2006.

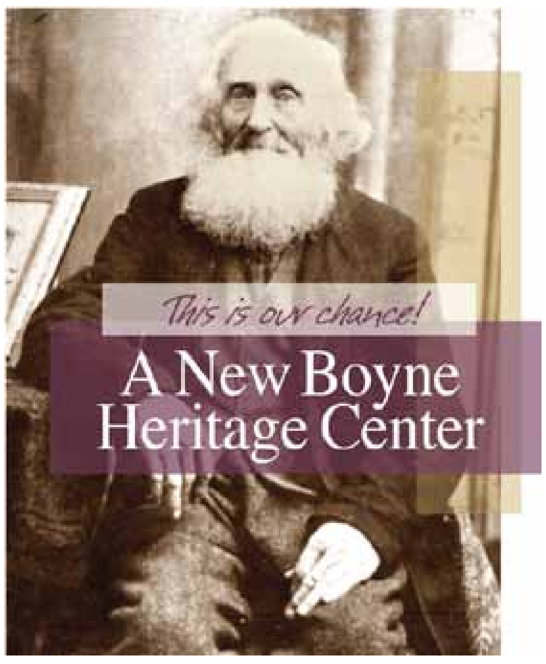
"The team at Charlevoix Hospital is overjoyed to welcome Joanne to our family," said Cathy Fischl, marketing and public relations specialist. "She has had more than 25 years of health care experience and understands the unique challenges that face rural hospitals today. We are grateful to have someone with her skill, experience, and leadership abilities."

Both Joanne and her husband have a real love for northern Michigan and the Charlevoix area. "She's already become part of the community," said Sandra Bennett, Emergency Room Nurse Manager at the hospital. "She even made a special trip to Charlevoix back in May to participate in our annual petunia planting. Now there's a person who understands what it's like to be part of our community!"

Prior to her CEO role at South Haven, Joanne served in roles as vice president of

see **HOSPITAL** on **PAGE 5**

Founding board members sought



There is a new opportunity for community to remake Boyne City's Historical Museum.

With dedicated space in the city's beautiful new municipal complex, there is an opportunity to transform the museum into a flagship attraction and heritage center for Boyne City and surrounding areas.

By committing to a bold, well-planned strategy, professional design and dynamic new leadership, we can emerge as a vibrant, engaged generator of history, ideas, energy and resources.

The proposed vision is an exciting exhibit space that transports the visitor back in time and brings the fascinating stories of Boyne's people and industry to rich, vivid life.

It would satisfy the serious history but as well as the casual visitor looking for something fun and different to do.

The heritage center could serve the area as a hub for all things historical—sharing resources, energy and ideas with the library, schools, historical groups and businesses.

We plan to be active in the community and creative in new programming and partnerships with those who share our history and our mission.

Breathing life into a new heritage center will take boldness, vision, engagement and money.

But in the process, we'll discover new resources and opportunities to become a spearhead of heritage tourism for our region.

The City of Boyne City is excited about the community's goal to form a new nonprofit with a board of directors, executive director, support staff, membership and an organized pool of volunteers.

In the plan, leadership and management of the new heritage center will be transferred to the new board who will take over the former duties of the historical commission.

Those with passion, vision, optimism, expertise, connections and a strong sense of teamwork will make all the difference in these crucial formative days.

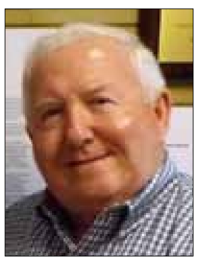
Excited about what we can build? Contact Kecia Freed at (231) 622-2492 or kecia@twin-valley.net

see **MUSEUM** on **PAGE 5**

Lockman makes MI Outdoor Hall of Fame

■ By Rick Fowler
Special to the Boyne Gazette

The Michigan Outdoor Writers Association (MOWA) in partnership with the DNR dedicated a new wing at the Carl T. Johnson facility in Cadillac on June 17.



DON LOCKMAN

This event was to welcome in the first class of individuals (and one company) to the Michigan Outdoor Hall of Fame which included Boyne City resident Don "Buz" Lockman. He along with Mort Neff, Tom Huggler, Fred Bear, Larry Kelly, and the Eppinger Lure Company were voted in unanimously. Ed Shaw, Outdoor Skills Coordinator and Interpreter at the Carl T, Johnson Center who, along with MOWA President Mark Sak spearheaded the MOHOF effort added, "To be in a room with these

see **LOCKMAN** on **PAGE 4**

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MAKING SENSE OF INVESTING

Ruth A. Skop AAMS©
Financial Advisor
101 S. Lake St.
Boyne City, MI 49712
Bus. (231) 582-3416
Fax (877) 408-3474
ruth.skop@edwardjones.com
www.edwardjones.com

We're getting close to the Fourth of July, when we celebrate the freedoms we enjoy in this country.

The U.S. constitution grants us many of these liberties, but we have to earn others – such as our financial freedom.

What steps can you take to achieve the financial independence you need to reach your long-term goals?

For starters, always work to build your resources. Contribute as much as you can afford to your IRA and your 401(k) or other employer-sponsored retirement plan.

At a minimum, put in enough to earn your employer's matching contribution, if one is offered.

If you don't take advantage of this match, you are essentially leaving money on the table.

While how much you invest is an essential factor in gaining your financial freedom, how you invest your money is equally important.

So make sure you have sufficient growth potential in all your accounts.

While growth-oriented investments, such as stocks and stock-based vehicles, carry investment risk, you can help moderate this risk by also including other investments, such as bonds.

Another way to gain your financial independence is to liberate yourself from the shackles of debt.

This isn't always easy, of course – most of us have experienced times when our cash flow simply wasn't sufficient to meet our expenses, so we had to take on some type of debt, either through a credit card or a loan.

But the more you can control your debts, the more money you'll have to save and invest for your future.

One way to manage your debt load is to build an emergency fund, containing three to six months' worth of living expenses, which you can use to pay unexpected costs such as a major car repair or a large medical bill.

Ideally, you should keep this money in a liquid, low-risk account, so you can access the funds quickly and without penalty.

Aside from possibly helping you control your debts, an emergency fund also may enable you to avoid dipping into your long-term investments to pay for short-term needs.

Thus far, we've only discussed achieving your financial freedom through methods of saving and investing. But you also need to consider your protection needs, too. If you were to become ill or suffer a serious injury, and you could not work for a while, your financial security could be jeopardized. Your employer might offer you disability insurance as an employee benefit, but it may not be enough for your needs, so you might need to purchase some additional coverage on your own.

And to help ensure your family's financial security, you'll also need sufficient life insurance.

You also might want to protect yourself from the catastrophic costs of long-term care, such as an extended nursing home stay.

The average annual cost for a private room in a nursing home is more than $92,000, according to the 2016 Cost of Care Study issued by the insurance company Genworth. And Medicare generally covers only a small percentage of these expenses.

You may want to consult with a financial professional to learn about ways you can protect yourself from the long-term care burden.

By following these suggestions, you can go a long way toward declaring your own financial independence. Consider taking action soon.

This article was written by Edward Jones for use by your local Edward Jones Financial Advisor.

PUBLIC NOTICE • PUBLIC NOTICE

NOTICE JOINT AGENCY/PUBLIC MEETING

On July 10, 2017, Boyne USA will hold a meeting to explain the project and potential environmental impacts and discuss the data and studies to be provided in its upcoming application to the Federal Energy Regulatory Commission for a re-licensing application for the Boyne River Hydroelectric Project, FERC No. 3409. The project is located between Boyne Falls and Boyne City on the Boyne River in Charlevoix County, Michigan.

The meeting will be held at 7 p.m. on July 10, 2017 in the Graz room in the lower level of the Mountain Grand Lodge, Boyne Mountain Resort, 1 Boyne Mountain Rd, Boyne Falls, MI 49713.

The major issues to be discussed include:

Summary of Process to Date

Process Ahead

Potential Studies to be Completed prior to Application.

A site visit is also scheduled to follow immediately afterwards. For more information, contact Randall Sutton (231) 549-6076.

CHARLEVOIX COUNTY TOWNSHIPS & CITIES

PUBLIC NOTICE

APPLICATIONS FOR DEFERMENT OF SUMMER 2017 TAXES

All Township and City treasurers in Charlevoix County are currently accepting applications for summer 2016 tax deferments (deferments are not exemptions). To qualify, a household annual income cannot exceed $40,000. The Applicant(s) must also be:

1. 62 years of age or older, including the unmarried surviving spouse of a person was 62 years or older at the time of death.
2. Paraplegic or quadriplegic.
3. An eligible service person, eligible veteran, or their eligible widow or widower.
4. A blind person
5. A totally and permanently disabled person.

Deferments can only be filed and dated from 7/1/2017 thru 9/17/2017.

Those that farm agricultural real property may also qualify if the gross receipts of the farming operation are not less than the household income of the owner. More information and deferment applications may be obtained from the following Treasurers:

STEPHEN RITTER
Bay Township
231-582-3594

MARIE KELENSKE
Boyne Valley Township
231-549-3130

CAREY STRONG
Chandler Township
231-549-3404

THEDA WILLIAMS
Charlevoix Township
231-547-4611

JODI ADAMS
Evangeline Township
231-582-9161

RON CHAPMEN
Eveline Township
231-547-6724

ROBBIN KRAFT
Hayes Township
231-547-0234

MAGDALENA WASYLEWSKI
Hudson Township
231-549-3019

MIKE JAREMA
Marion Township
231-547-2488

SHELLEY BURR
Melrose Township
231-535-2589

LYNN SMOLENYAK
Norwood Township
231-547-4037

LARRY KUBIC
Peaine Township
231-448-2907

DIANE MCDONOUGH
St. James Township
231-448-2260

JOANNE THOMAS
South Arm Township
231-536-2971

KERRI REINHARDT
Wilson Township
231-582-9963

CINDY GRICE
City of Boyne City
231-582-6597

KELLY MCGINN
City of Charlevoix
231-547-3261

HEATHER JACKSON
City of East Jordan
231-536-3381

CHARLEVOIX COUNTY TRANSIT JOB OPENING

PART-TIME DISPATCHER/ CUSTOMER SERVICE REPRESENTATIVE

Charlevoix County Transit is accepting applications for a part-time customer service/dispatcher position. Qualified applicants must demonstrate strong problem solving, multi-tasking, interpersonal and computer skills. Must be able to work in a fast paced environment performing a variety of customer service tasks.

Applications and a full job posting can be obtained at the Transit's Business Office, 1050 Brockway, Boyne City, MI or online at www.charlevoixcounty.org Deadline for application submission is July 6, 2017.

Charlevoix County is an Equal Opportunity Employer. Drug Free, Smoke Free Work Place.

CITY OF BOYNE CITY NOTICE OF PUBLIC HEARING

TO CONSIDER ESTABLISHING AN INDUSTRIAL DEVELOPMENT DISTRICT

Pursuant to Public Act 198 of 1974, Plant Rehabilitation and Industrial Development District Act, a public hearing is scheduled to consider establishing an Industrial Development District requested by Van Dam Marine Co., known as 970 and 974 E. Division St, Boyne City, MI and. The property tax identification numbers are: 15-051-302-002-50 and 15-051-302-002-80.

The public hearing and City Commission consideration of this request will be Tuesday, July 11th, 2017, 7:00 pm, at the temporary City of Boyne City Hall, 364 North Lake Street, Boyne City, MI 49712.

All affected parties are invited to attend this public hearing and will be afforded an opportunity to speak. Written comments will be accepted until 4:30 pm, July 6th, 2017 at the temporary City of Boyne City Hall located at 364 North Lake Street, Boyne City, MI 49712. All written comments will become part of the records of the hearing.

Cindy Grice, Clerk/Treasurer
City of Boyne City

BOYNE USA

BOYNE RIVER HYDROELECTRIC PROJECT

JOINT MEETING SIGN IN SHEET- JULY 10, 2017

NAME	ORGANIZATION	PHONE	E-MAIL
Kyle Kruger	MDNR - Fisheries	989 826 3211 x7073	Krugerk@michigan.gov
Gary Kohlhepp	MDEQ - Water Resources	517-284-5540	Kohlheppg@michigan.gov
Amina Oun	MDEQ - water Resources	517-284-5541	ouna@michigan.gov
Kimberly Balke	Conservation Res. Alliance	231-946-6817	kim@rivercare.org
Bob Stuber	Michigan Hydro Relicensing	231-775-4321	stuber-bob@gmail.com
Randall Sutton	Boyne Mountain	231-675-7515	rsutton@boynemountain.com
ETHAN WINCHESTER	BOYNE OUTFITTERS	231 497 4104	ewinchester@boyneoutfitters.com
Jim Tiffany	J.E. Tiffany and Sons	231-735-4546	James.E.Tiffany@gmail.com
Madhu Anderson	Michigan Agency for Energy	517 284-8332	andersonM32@mi.gov

Appendix E FIRST STAGE CONSULTATION DOCUMENTS

J.E. TIFFANY AND SONS, LLC

1707 N. 39 Road, Manton, Michigan 49663 Telephone:231-735-4546

January 31, 2017

Re: FERC Project No. 3409 – Boyne USA, Inc. – Boyne River Hydroelectric Project – Relicensing Process and Request for Information and Studies

Dear Sir or Madam:

Boyne USA, Inc. ("Boyne USA"), is the licensee of the Boyne River Hydroelectric Project, located on the Boyne River in Boyne Valley Township, Charlevoix County, Michigan, which is licensed by the Federal Energy Regulatory Commission (FERC), Project Number 3409. Boyne USA is in the process of preparing a Pre-Application Document (PAD) for the relicensing of the Boyne River Hydroelectric Project. The current 40-year license term for the Boyne River Hydroelectric Project is scheduled to expire on January 31, 2022, pursuant to the Commission's order issued on February 22, 1982.

Boyne USA, Inc. (Boyne USA) has retained J. E. Tiffany and Sons, LLC to assist Boyne USA in its efforts to relicense the above-referenced project. Under Federal Energy Regulatory Commission (FERC) regulations, Boyne USA is preparing a Preliminary Application Document (PAD) that provides the FERC and other entities with existing, relevant and reasonably available information pertaining to the Project to help identify issues and related information needs, develop study requests and study plans, and prepare documents analyzing Project impacts. For that effort, we are in the process of identifying sources of existing, relevant, and reasonably available information that is not in Boyne USA's possession.

We have included an Attachment A which is a detailed description of the information we are soliciting for this project. We request that you provide us with any existing pertinent information or reports you may have within 30 days of the date of this letter. Not responding within 30 days will indicate that you are not aware of any existing, relevant, and reasonably available information that describes the existing Project's environment or known existing/potential impacts of the Project.

We sincerely appreciate your help with this effort. Should you have any questions, please do not hesitate to contact me at 231-735-4546 or at James.E.Tiffany@gmail.com.

Sincerely,

J.E. Tiffany and Sons, LLC

James E. Tiffany

James E. Tiffany, P.E.
Project Principal

Enclosure: Attachment A

ATTACHMENT A

§ 5.6 (d)(3)(i) - Existing environment and resource impacts. A potential applicant must, based on the existing, relevant, and reasonably available information, include a discussion with respect to each resource that includes:

(A) Description of existing environment (See 5.6 (d)(3)(ii)-(xiii) below)

(B) Summaries (with references to sources of information or studies) of existing data or studies regarding the resource *(Include here or incorporate into resource sections 5.6 (d)(3)(ii)-(xiii) below)*

(C) A description of any known or potential adverse impacts and issues associated with the construction, operation or maintenance of the proposed project, including continuing and cumulative impacts *(Include here or incorporate into resource sections 5.6 (d)(3)(ii)-(xiii) below)*

§ 5.6 (d)(3)(ii) - Geology and soils. Descriptions and maps showing the existing geology, topography, and soils of the proposed project and surrounding area. Components of the description must include:

(A) Description of geological features, including bedrock lithology, stratigraphy, structural features, glacial features, unconsolidated deposits, and mineral resources

(B) Description of soil types, occurrence, physical and chemical characteristics, erodability and potential for mass soil movement, and soil characteristics

(C) Description of reservoir shorelines and streambanks, including

(1) Steepness, composition (bedrock and unconsolidated deposits), and vegetative cover

(2) Existing erosion, mass soil movement, slumping, or other forms of instability, including identification of project facilities or operations that are known to or may cause these conditions

§ 5.6 (d)(3)(iii) - Water resources. A description of the water resources of the proposed project and surrounding area. This must address the quantity and quality (chemical/physical parameters) of all waters affected by the project, including but not limited to the project reservoir(s) and tributaries thereto, bypassed reach, and tailrace. Components of the description must include:

(A) Drainage area

(B) The monthly minimum, mean, and maximum recorded flows in cubic feet per second of the stream or other body of water at the powerplant intake or point of diversion, specifying any adjustments made for evaporation, leakage, minimum flow releases, or other reductions in available flow

(C) A monthly flow duration curve indicating the period of record and the location of gauging station(s), including identification number(s), used in deriving the curve; and a specification of the critical streamflow used to determine the project's dependable capacity

(D) Existing and proposed uses of project waters for irrigation, domestic water supply, industrial and other purposes, including any upstream or downstream requirements or constraints to accommodate those purposes

(E) Existing instream flow uses of streams in the project area that would be affected by project construction and operation; information on existing water rights and water rights applications potentially affecting or affected by the project

(F) Relevant federally-approved water quality standards applicable to project waters

(G) Project effects on seasonal variation of water quality data, including

(1) Water temperature and dissolved oxygen, including seasonal vertical profiles in the reservoir

(2) Other physical and chemical parameters to include, as appropriate for the project; total dissolved gas, pH, total hardness, specific conductance, cholorphyll a, suspended sediment concentrations, total nitrogen (mg/L as N), total phosphorus (mg/L as P), and fecal coliform (*E. Coli*) concentrations

(H) The following data with respect to any existing or proposed lake or reservoir associated with the proposed project; surface area, volume, maximum depth, mean depth, flushing rate, shoreline length, substrate composition

(I) Gradient for affected downstream reaches

§ 5.6 (d)(3)(iv) - Fish and aquatic resources. A description of the fish and other aquatic resources, including invasive species, in the project vicinity. This section must discuss the existing fish and macroinvertebrate communities, including the presence or absence of anadromous, catadromous, or migratory fish, and any known or potential upstream or downstream impacts of the project on the aquatic community. Components of the description must include:

(A) Identification of existing fish and aquatic communities

(B) Identification of essential fish habitat as defined under the Magnuson-Stevens Fishery Conservation and Management Act and established by the National Marine Fisheries Service

(C) Temporal and spatial distribution of fish and aquatic communities and trends with respect to:

(1) Species life stage composition

(2) Standing crop

(3) Age and growth data

(4) Spawning run timing

(5) Extent and location of spawning, rearing, feeding, and wintering habitat

§ 5.6 (d)(3)(v) - Wildlife and botanical resources. A description of the wildlife and botanical resources, including invasive species, in the project vicinity. Components of this description must include:

(A) Upland habitat(s) in the project vicinity, including the project's transmission line corridor or right-of-way and a listing of plant and animal species that use the habitat(s)

(B) Temporal or special distribution of commercially, recreationally, or culturally important species

§ 5.6(d)(3)(vi) Description of floodplains, wetlands, riparian, and littoral habitat. A description of the floodplain, wetlands, riparian habitats, and littoral in the project vicinity. Components of this description must include:

(A) A list of plant and animal species, including invasive species, that use the wetland, littoral, and riparian habitat

(B) Map of wetlands, riparian and littoral habitat

(C) Estimates of acreage for each type of wetland, riparian, or littoral habitat, including variability in such availability as a function of storage at a project that is not operated in run-of-river mode

§ 5.6 (d)(3)(vii) - Rare, threatened, and endangered species. A description of any listed rare, threatened and endangered, candidate, or special status species that may be present in the project vicinity. Components of this description must include:

(A) Description of listed rare, threatened and endangered, candidate, or special status species in the project vicinity.

(B) Identification of habitat requirements

(C) References to known biological opinion, status reports, or recovery plans pertaining to a listed species

(D) Extent and location of federally-designated critical habitat or other habitat for listed species in the project area

(E) Temporal and spatial distribution of the listed species within the project vicinity

§ 5.6 (d)(3)(viii) - Recreation and land use. A description of the existing recreational and land uses and opportunities within the project boundary. The components of this description include:

(F) A discussion of whether the project is located within or adjacent to a:

(1) Designated or under study for inclusion in the National Wild and Scenic River system

(2) A state-protected river segment

§ 5.6 (d)(3)(x) - Cultural Resources. A description of the known cultural or historical resources of the proposed project and surrounding area. Components of this description include:

(A) Identification of any historic or archaeological site in the proposed project vicinity, with particular emphasis on sites or properties either listed in, or recommended by the State Historic Preservation Officer or Tribal Historic Preservation Officer for inclusion in, the National Register of Historic Places

(B) Existing discovery measures, such as surveys, inventories, and limited subsurface testing work, for the purpose of locating, identifying, and assessing the significance of historic and archaeological resources that have been undertaken within or adjacent to the project boundary

(C) Identification of Indian tribes that may attach religious and cultural significance to historic properties within the project boundary or in the project vicinity; as well as available information on Indian traditional cultural and religious properties, whether on or off of any Federally-recognized Indian reservation.

§ 5.6 (d)(3)(xii) - Tribal Resources. A description of Indian tribes, tribal lands, and interests that may be affected by the project Components of this description include:

(A) Identification of information on resources specified in paragraphs (d)(2)(ii)-(xi) of this section to the extent that existing project construction and operation affecting those resources may impact tribal cultural or economic interests, e.g., impacts of project-induced soil erosion on tribal cultural sites

(B) Identification of impacts on Indian tribes of existing project construction and operation that may affect tribal interests not necessarily associated with resources specified in paragraphs (d)(3)(ii)-(xi) of this section, e.g., tribal fishing practices or agreements between the Indian tribe and other entities other than the potential applicant that have a connection to project construction and operation.

Local Units of Government in the Area:

Charlevoix County
301 State Street
Charlevoix, MI 49720

Boyne Valley Township
Boyne Falls, Michigan 49713

City of Petoskey
101 E. Lake Street
Petoskey, MI 49770

Village of Boyne Falls
Boyne Falls, MI 49713

City of Boyne City
319 N. Lake Street
Boyne City, MI 49712

Affected Indian Tribes:

There are no Indian Tribes known to be affected by this Project. However, potentially affected Indian Tribes are listed here.

Potentially Affected Indian Tribes:
Bay Mills Indian Community
President
12140 W. Lakeshore Drive
Brimley, MI 49715

Grand Traverse Band of Ottawa and Chippewa Indians
Chairperson
2605 N.W. Bayshore Dr.
Suttons Bay, MI 49682

Hannahville Indian Community
Chairperson
N14911 Hannahville B1 Rd.
Wilson, MI 49896-9728

Keweenaw Bay Indian Community
Tribal Historic Preservation Officer
107 Beartown Road
Baraga, MI 49908

Little River Band of Ottawa Indians
Tribal Historic Preservation Officer
375 River Street
Manistee, MI 49660

Little Traverse Bay Bands of Odawa Indians
Tribal Historic Preservation Officer
7500 Odawa Circle
Harbor Springs, MI 49740-

Match-e-be-nash-she-wish Band of Pottawatomi Indians of Michigan
Chairperson
PO Box 218
Dorr, MI 49323

Nottawaseppi/ Huron/ Potawatomi
Tribal Environmental Director
2221 One Half Mile Road
Fulton, MI 49025-

Ottawa Tribe of Oklahoma
Historic Preservation Officer
P.O. Box 110
Miami, OK 74355

Pokagon Band of Potawatomi Indians
Chairperson
P.O. Box 180
Dowagiac, MI 49047

Saginaw Chippewa Indian Tribe of Michigan
Chief
7070 East Broadway Road
Mt. Pleasant, MI 48858

Sault Ste. Marie Tribe of Chippewa Indians of Michigan
Chairperson
523 Ashmun Street
Sault Ste. Marie, MI 49783

Wyandotte Tribe of Oklahoma
Chief
64700 E. Highway 60
Wyandotte, OK 74370

Federal Agencies:

Bureau of Indian Affairs
U.S. Department of the Interior
Regional Director
One Federal Drive
Room 550
Fort Snelling, MN 55111-4007

Federal Emergency Management Agency
Regional Administrator
536 South Clark Street
6th Floor
Chicago, IL 60605

Federal Energy Regulatory Commission
Division of Dam Safety and Inspections
Regional Engineer
230 South Dearborn Street
Room 3130
Chicago, IL 60604

Office of Senator Levin
U.S. Senator
269 Russell Senate Office Building
Washington, DC 20510

Office of Senator Stabenow
U.S. Senator
133 Hart Senate Office Building
Washington, DC 20510

U.S. Army Corps of Engineers
District Engineer
P.O. Box 1027
Detroit, MI 48231-1027

U.S. Environmental Protection Agency
Office of Enforcement and Compliance Assurance
Supervisor - NEPA Implementation
77 West Jackson Boulevard
Mailcode: E-197
Chicago, IL 60604-3507

U.S. Fish and Wildlife Service
BHW Federal Building
Regional Director
One Federal Drive
Fort Snelling, MN 55111-4056

U.S. Fish and Wildlife Service
East Lansing Field Office
Field Supervisor
2651 Coolidge Road
Suite 101
East Lansing, MI 48823-6360

National Park Service
U.S. Department of the Interior
Regional Director
601 Riverfront Drive
Omaha, NE 68102-4226

U.S. Environmental Protection Agency
Ariel Rios Building
Administrator
1200 Pennsylvania Ave NW
Washington, DC 20460

United States Geological Survey
U.S. Department of the Interior
Director
12201 Sunrise Valley Dr
Reston, VA 20192

State Agencies:

Michigan Department of Environmental Quality
Air Quality Division Chief
PO Box 30260
Lansing, MI 48909-7760

Michigan Department of Environmental Quality
Land and Water Management Division Chief
PO Box 30458
Lansing, MI 48909-7958

Michigan Department of Natural Resources
Director
PO Box 30028
Mason Bldg
Lansing, MI 48909-7757

Michigan Department of Natural Resources
Fisheries Division Director
P.O. Box 30446
Mason Bldg
Lansing, MI 48909

Michigan Department of Natural Resources
Wildlife Division Director
P.O. Box 30444
Mason Bldg
Lansing, MI 48909

Michigan Historical Center
SHPO
702 West Kalamazoo St
P.O. Box 30740
Lansing, MI 48909-8240

Office of the Attorney General
Attorney General
P.O. Box 30212
Lansing, MI 48909-0212

Office of the Governer
Governor
P.O. Box 30013
Lansing, MI 48909

Non-Governmental Agencies:

Federation of Fly Fishers
Great Lakes Council
P.O. Box 828
Pentwater, MI 49949

Michigan Hydro Relicensing Coalition
P.O. Box 828
Pentwater, MI 49949

Michigan Trout Unlimited
Dr. Bryan Burroughs
P.O. Box 442
Dewitt, MI 48820-8820

Conservation Resource Alliance
Bayview Professional Centre
10850 Traverse Highway, Suite 1180
Traverse City, MI 49684

Friends of the Boyne River
P.O. Box 186
Boyne City, MI 49712-0186

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES
LANSING

RICK SNYDER
GOVERNOR

KEITH CREAGH
DIRECTOR

February 24, 2017

Mr. James Tiffany
J.E. Tiffany and Sons, LLC
1717 N. 39 Road
Manton, MI 49663

RE: REQUEST FOR INFORMATION AND STUDIES FOR THE BOYNE RIVER HYDROELECTRIC PROJECT (FERC NO. 3409) ON THE BOYNE RIVER, MICHIGAN

Dear Mr. Tiffany,

The Michigan Department of Natural Resources (Department) is in receipt of your information request for the relicensing of the Boyne River Hydropower Project (project) on the Boyne River, Charlevoix County, Michigan. In your letter requesting information, your Attachment A appears to be a cut and paste from the FERC licensing requirements and not a specific request for information you are lacking in preparing the Preliminary Application Document and in preparation for addressing licensing issues. From this list it is hard to determine the exact needs, but we will try to direct you to sources to help you move forward on relicensing the Boyne River Hydropower Project.

I have enclosed a copy of the MDNR Fisheries Division's relicensing study guidelines to help you determine what items you will need to begin preparing for the licensing process from our perspective.

For the fisheries resources related to the project, I suggest you contact Heather Hettinger, Fisheries Biologist at our Traverse City Office (231-922-6056, HettingerH@michigan.gov). She has provided the enclosed report and may be able provide you with other records related to the Boyne River and if any impoundment data exists. You may need to conduct a survey of the impoundment to characterize the current status of the fish population in the impoundment.

For specific recreational needs, you can contact Parks and Recreation Division. For more general information on recreation trends and needs, The Michigan Statewide Comprehensive Outdoor Recreation Plan 2013–2017 can be found online at:

http://www.michigan.gov/documents/dnr/SCORPfnlrprt_513881_7.pdf

For the current and existing recreational facilities and use, you will need to acquire that information from the project owner.

For wildlife resources you will need to contact Wildlife Division for any plans or species of concern to the Department. You should be able to get that information from the Gaylord Operations Service Center in Gaylord (989-732-3541).

For endangered species distribution or communities of special concern in the area, you should contact Michigan Natural Features Inventory (https://mnfi.anr.msu.edu). They should be able to help you determine if any endangered or species of special concern are in the area of influence of the project.

For soils and geology, you'll need to contact the Soil Conservation Service and review their soil maps. They may also have information on underlying geology.

Wetland determinations can be acquired through the US Fish and Wildlife Service. I believe they have resources on wetland delineation online.

For coastal zone management, you'll have to contact Michigan Department of Environmental Quality (MDEQ) and the Army Corps of Engineers. They should be able to inform you where the delineations between regulatory authorities are drawn.

You will also need to contact MDEQ for the requirements monitoring water quality and any studies you may need to conduct for applying for the Water Quality Certification that FERC will require for the license.

If you have any further questions or need clarification, please feel free to contact me at:

MICHIGAN DEPARTMENT OF NATURAL RESOURCES
MIO FIELD OFFICE
191 S MT TOM RD
MIO MI 48647

Sincerely,

Kyle Kruger

Kyle Kruger
Senior Fisheries Biologist
Habitat Assessment Unit
FISHERIES DIVISION
(989) 826-3211 x 7073

cc Randall Sutton, Boyne USA
Burr Fisher, USFWS, E. Lansing w\o enclosures
Koren Carpenter, MDEQ, Lansing w\o enclosures
Heather Hettinger, Fisheries, Traverse City w\o enclosures

Enclosures

Appendix F STUDY REQUEST CONSULTATION DOCUMENTS

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES
LANSING

RICK SNYDER
GOVERNOR

KEITH CREAGH
DIRECTOR

August 31, 2017

Mr. Randall Sutton, Manager
Boyne USA
1 Boyne Mountain Rd.
Boyne Falls, MI 49713

RE: SCOPING COMMENTS BY THE MICHIGAN DEPARTMENT OF NATURAL RESOURCES FOR THE BOYNE PROJECT (P-3409) ON THE BOYNE RIVER, MICHIGAN

Dear Mr. Randall,

The Michigan Department of Natural Resources (Department) has reviewed the *Boyne River Pre-Application Document (PAD) FERC Project No. 3409* by Boyne USA, Inc. dated March 20, 2017. We have the following comments:

Current Operation

The Department concurs with continued run of river operation at the project where instantaneous inflows to the project approximately equal instantaneous outflows from the project at all times. Run of river operation (ROR) will provide appropriate stream flows below the project and this will be beneficial for aquatic resources in the Boyne River below the project. Appropriate ROR operation will also minimize the impoundment fluctuations and reduce negative impacts to the shoreline due to changing water levels. The Department requests that an evaluation of the operating band be conducted. Currently the PAD indicates that the operates over a 0.82 foot operating band, from 0.24 feet below target (634.64 ft.) to 0.58 feet above target (635.46 ft.). This band is quite wide, and we recommend that an operating band of +/- 0.25 feet from the target elevation (634.88 ft.) be included in a new license. Narrowing the operating band will provide flows that closer follow inflows approximate outflows at all times. The elevation datum used to establish the impoundment elevations was not included in the PAD and should be included in the draft license application.

Erosion Control/Remediation

The PAD summarizes planned erosion control work to be conducted along the embankment and in the tailrace, however no formal inventory was indicated. A shoreline inventory should be conducted around the impoundment and in the reach between the powerhouse and Dam Road. This will provide a baseline if conditions change in the future at the project and help identify any areas of erosion currently not described in the PAD. Excessive erosion can negatively impact both impoundment habitats as well as stream habitat.

Water Quality Monitoring

Tailrace water temperatures should be monitored year around and dissolved oxygen (DO) should be monitored between June 1st and September 30th. The PAD acknowledges that the project exceeds State Water Quality Standards (WQS) for temperature. Some of the data presented is from 1999 and may not represent current conditions at the project. The PAD also notes that water passing through the impoundment is warmed, this may contribute to the exceedances of WQS which are noted in the PAD. As part of the evaluations for the proposed license application, water temperatures upstream of the influence of the impoundment and downstream in the tailrace should be monitored and the results compared. Continuous DO monitoring should be conducted in the tailrace of the project during the warm weather season. Both temperature and DO data should be collected on an hourly basis as a minimum.

For the preparing the license application, impoundment temperature and DO profiles should be collected bi-weekly for the months of June through September upstream of the power canal in two locations. One should in the deepest part of the impoundment and one location approximately halfway between the deepest location and the inflow of the Boyne River to the impoundment. No profile data was provided in the PAD. This data will be required for conducting any studies on potential water quality enhancements that may be required for the project to meet SWQ standards.

Bathymetric Mapping

The PAD did not include a detailed bathymetric map of the impoundment. In order to better understand the characteristics of the impoundment and how flows affect conditions within the impoundment a detailed bathymetric map should be prepared. It should have contour lines at a minimum of every 5 feet of depth. The PAD indicates the surface area, volume, maximum depth, but does not include mean depth. We are unclear how the volume was calculated without such a detailed bathymetric map.

Flow Duration Curves

The PAD lacks monthly flow duration curves. Turbine and spillway rating curves should be developed for the project and the data used to construct flow duration curves from project operation records. These curves should be based on a minimum of 10 years of operational data. Estimated flow information will be required for temperature modeling for the project. This will allow a more thorough analysis of the annual hydrograph for the project.

Aquatic Community Analysis

The Department has limited information on the fisheries communities upstream of the dam. An aquatic survey of the impoundment should be conducted. This should include characterizing the fisheries community as well as important invertebrate species, including mussels. The fisheries surveys should include size and age distribution of gamefish and primary forage species. For invertebrates, relative density and locations should be noted.

Upstream Aquatic Community Analysis

The Department request a survey of the fisheries community and habitat in the reach immediately upstream of the impoundment for one quarter mile from the normal high-water elevation of the impoundment. This information will help determine potential impacts of the project and project operations downstream of the project. It will also provide information that may be useful in determining future fisheries management for the Boyne River, including fish passage.

Downstream Aquatic Community Analysis

There is more available information on the fishery below the project. The most recent Department survey was in 2012. The Boyne River below the project should be surveyed for one quarter mile downstream of the project. The data collected should be comparted to the previous surveys conducted below the project to determine if there were any changes to the population structure and attributes in the past several years that may have been influenced by the project.

Temperature Modeling

The Department requests a temperature modeling study to evaluate the potential to use the spill gate to draw cooler water from the lower depths of the impoundment to mitigate when tailraces temperatures exceed the state water quality standards. The PAD acknowledges that there are periods when the project has exceeded the state water quality standards in the tailrace. If it is possible to modify operations and use spill to correct this problem, then it should be implemented. A detailed analysis will be critical in determining the potential benefits that could be achieved by altering project operations at critical times.

Impingement\Entrainment Evaluation

The PAD does not include a summary of the approach velocities or characteristics of the trash racks for the project. The Department requests an analysis of the flow characteristics of the power house such that the level of potential impact to aquatic resources can be evaluated. Utilization of the swimming speed and burst speed data for the various fish found in the impoundment and based on the size distribution and abundance, the potential for the number and types of fish that may be at risk for impingement or entrainment at the project can be estimated. This analysis will provide needed insight to potential mitigation for fish protection at the project.

Exotic Nuisance Plant Surveys

The dam alters the stream environment and creates conditions conducive to the establishment of invasive aquatic nuisance species. The project includes a lengthy (2.5 miles) transmission corridor that connects the project to the resort facilities at Boyne Mountain Resort. The PAD lists a number of invasive species that exist in the vicinity of the project, but does not include a current inventory of the project lands and water. The Department requests that surveys for exotic nuisance plants be conducted for both the project waters and project lands.

Recreational Use

The Department requests a more detailed analysis of the recreational use and needs at the project. While the Department acknowledges that FERC has requested completion of the Form 80 filings under the current license, these forms are limited in information. Since the project under the current license lacks a full complement of recreational opportunities, the Form 80 report will be limited. A study should review the potential benefits of expanding recreational opportunities to include access to the impoundment for shore fishing, kayaking, and a small boat launch. The study should also evaluate the need for providing safe parking. The current tailrace fishing access provides no parking and anglers using the tailrace fishing facilities must park on the road and is less safe than a designated parking lot.

Recommended Survey Protocols – the Department recommends that the fishery resources be evaluated similar to the Department standards for surveys. For the mussel surveys, generally accepted practice should be utilized. For water quality data collection, the Department recommends consultation with the Michigan Department of Environmental Quality (MDEQ). Coordination with the MDEQ will assist with collecting data that will address the Department’s study request and will be useful for addressing issues related to determining the requirements that may be included in any request for a 401 Water Quality Certification for the project.

Stream Fishery Resources

Wills, Todd C., T. G. Zorn, and A. J. Nuhfer. 2006. Stream Status and Trends Program sampling protocols. Chapter 26 in Schneider, James C. (ed.) 2000. Manual of fisheries survey methods II: with periodic updates. Michigan Department of Natural Resources, Fisheries Special Report 25, Ann Arbor

http://www.michigandnr.com/PUBLICATIONS/PDFS/ifr/Manual/SMII_Chapter26.pdf

Impoundment Fishery Resources

Schneider, James C. (ed.) 2000. Manual of fisheries survey methods II: with periodic updates. Michigan Department of Natural Resources, Fisheries Special Report 25, Ann Arbor.

http://www.michigan.gov/documents/dnr/SMII_Assembled_Doc_2017_final_552610_7.pdf

Mussel Surveys

Dunn, H. 2000. Development of strategies for sampling freshwater mussels (Bivalvia; Unionidae). pp. 161-167 in Proceedings of the First Freshwater Mollusk Conservation Society Symposium, 1999.

Please feel free to contact me if you have any question or need clarification. I may be reached at: Michigan Department of Natural Resources, Mio Field Office, 191 S. Mt. Tom Rd., Mio, MI 48647 or krugerk@Michigan.gov.

Sincerely,

Kyle Kruger

Kyle Kruger
Senior Fisheries Biologist
Habitat Management Unit
FISHERIES DIVISION
(989) 826-3211 x 7073

cc Kimberly D. Bose, FERC, DC
Robert Stuber, MHRC, Traverse City

Burr Fisher, USFWS, E. Lansing
Amira Oun, DEQ, Lansing
Scott Heintzelman, Fisheries, Cadillac
Jessica Mistak, Fisheries, Escanaba

Michigan Hydro Relicensing Coalition
P.O. Box 828
Pentwater, MI 49449
September 1, 2017

Randall Sutton
Boyne USA, Inc.
1 Boyne Mountain Road
Boyne Falls, MI 49713

Re: Boyne River Hydroelectric Project P-3409

Dear Mr. Sutton:

The purpose of this letter is to identify the studies that the Michigan Hydro Relicensing Coalition (MHRC) feels are necessary for the decision making process for the relicensing of the Boyne River hydroelectric project (FERC P-3409). The MHRC's request follows the general format provided by Boyne USA at the July 10, 2017 joint agency/public meeting (CFR Title 16, Chapter 1, Subchapter B, Part 16.8 (b)).

The Michigan Hydro Relicensing Coalition (MHRC) is a coalition of four statewide, nonprofit conservation groups with an interest in the protection and enhancement of aquatic resources in the state. The members are the Michigan United Conservation Clubs, Michigan Council of Trout Unlimited, Great Lakes Council of Federation of Flyfishers, and Anglers of the Au Sable. All members are 501(c)(3) non-profit organizations. Formed in 1991, the MHRC's purpose is to participate as a formal intervenor in the relicensing process for hydroelectric dams that are under the jurisdiction of the Federal Energy Regulatory Commission (FERC). MHRC has been involved in the relicensing process of 86 hydro projects affecting 26 rivers in Michigan. Its mission is to ensure that conservation, environmental and recreational concerns are adequately addressed by FERC and given the fullest possible consideration throughout the licensing process.

The following are the specific relicensing study requests by the MHRC:

- Project operations - Boyne USA currently operates the Boyne hydroelectric project in a run-of-river mode (outflow = inflow). This is the preferred method of operation by the MHRC for hydroelectric projects in Michigan. However, the MHRC feels that such operations need sound compliance monitoring, Therefore, the MHRC requests that Boyne USA conduct an instream flow study to quantify the stage-discharge relationship. This should be done for both the inflow and outflow reaches of the Boyne River. A quantified stage discharge relationship for both upstream and downstream reaches would allow Boyne USA to utilize a system of staff gauges for compliance monitoring of the run-of-river operation. A recommended source of information for an instream flow study to quantify the stage-discharge relationship for the Boyne River is the United States Geological Survey Michigan Water Science Center (https://mi.water.usgs.gov/about/index.html). Actual methodologies to do this can be found at their USGS Water Science School website https://water.usgs.gov/edu/measureflow.html.

- Water quality - the Boyne River, including the reach below the hydroelectric project is classified as a coldwater fishery by the Michigan Department of Natural Resources. Summer water temperatures below the dam may at times be in violation of State water quality standards for coldwater streams. The MHRC requests a water quality monitoring study for the Boyne River hydroelectric relicensing. Monitoring is needed at a minimum of two locations, upstream and downstream of the project. Temperature and dissolved oxygen are the parameters of concern (temperature year-round, D.O. June 1 through September 30 monitoring). The purpose of this monitoring will be to evaluate the effects of the project on water temperature and dissolved oxygen in the Boyne River below the project. The MHRC defers to the judgment and supports recommendations of both the Michigan Department of Natural Resources and Michigan Department of Environmental Quality in terms of specific methodologies for implementing this water quality study.

- Aquatic resources (fisheries) - the MHRC feels that fisheries studies are needed for both the Boyne River and the impoundment formed by the hydroelectric dam itself. The purpose of this is to quantify the affected environment, a necessary step in the environmental analysis required by the National Environmental Policy Act (NEPA). As a FERC-licensed project, the relicensing of the Boyne project will be subject NEPA requirements (including any Endangered Species Act provisions and consultation). The MHRC requests the following studies be conducted as part of the relicensing process:

    - Stream fish community information is needed above and below the project. The purpose of this study is to evaluate project effects on the fish community (upstream representing an unaffected reach and downstream being the affected reach. Desired population parameters to be estimated are statistically valid population estimates (species composition, standing stock, relative abundance). The MHRC recommends using the standardized methodologies prescribed by the Michigan Department of Natural Resources Fisheries Division Stream Status and Trends Program (Wills et al. 2006). The MHRC also requests to be consulted on the actual site selection for the upstream and downstream fish community sampling sites. It is our request that at least two representative sites for both the upstream and downstream areas be selected, respectively. The reason for this is to account for site variability and ensure that the sites selected accurately represent actual conditions in the Boyne River, both upstream outside the hydro project influence and downstream within the influence of the hydro project.

Wills, Todd C., T. G. Zorn, and A. J. Nuhfer. 2006. Stream Status and Trends Program sampling protocols. Chapter 26 in Schneider, James C. (ed.) 2000. Manual of fisheries survey methods II: with periodic updates. Michigan Department of Natural Resources, Fisheries Special Report 25, Ann Arbor

http://www.michigandnr.com/PUBLICATIONS/PDFS/ifr/Manual/SMII_Chapter26.pdf

- Impoundment sampling also needs to done to characterize the fish population. Desired parameters are species composition and relative abundance. The MHRC recommends using the standardized methodologies prescribed by the Michigan Department of Natural Resources Fisheries Division (Manual of Fisheries Survey Methods:

  Schneider, James C. (ed.) 2000. Manual of fisheries survey methods II: with periodic updates. Michigan Department of Natural Resources, Fisheries Special Report 25, Ann Arbor.

  http://www.michigan.gov/documents/dnr/SMII_Assembled_Doc_2017_final_552610_7.pdf

  The MHTC also requests that detailed bathymetric mapping be done of the impoundment per the Michigan Department of Natural Resources Fisheries Division. Detailed information regarding the impoundment's physical characteristics will be useful for project operations purposes.

- Aquatic resources (mussels) - native freshwater mussels (Unionidae) are an important component of Michigan's aquatic ecosystems, They play a significant role in the ecology of freshwater ecosystems, and are useful indicators of water quality. They also serve as umbrella taxa because they are comparatively sensitive to habitat degradation and rely on fish hosts for reproduction. Many of Michigan's native mussel species are imperiled. One of the contributing factors are the presence of dams which fragment habitat, affecting fish species that serve as hosts, The Boyne River system provides habitat for mussel species given its connection to the Great Lakes (via Lake Charlevoix). The MHRC requests that Boyne USA conduct a study to assess the occurrence of mussel species in the Boyne River associated with its hydroelectric project (above, below, and within the impoundment). The initial assessment should utilize the Michigan Natural Features Inventory (MNFI) to ascertain the potential for occurrences of sensitive, threatened, or endangered mussel species (https://mnfi.anr.msu.edu/data/specialanimals.cfm#grp16). If there are any documented or potential occurrences within the Boyne River watershed, the recommended next step is to conduct an actual field survey within the project area using sampling techniques outlined by Dunn (2000).

Dunn, H. 2000. Development of strategies for sampling freshwater mussels (Bivalvia; Unionidae). pp. 161-167 in Proceedings of the First Freshwater Mollusk Conservation Society Symposium, 1999.

- Non-native invasive species (NNIS) - over the last two decades, the awareness of and occurrence of non-native invasive species has increased dramatically in Michigan. Many invasive species have entered the Great Lakes via the Great Lakes ecosystems. Given the Boyne River's interconnection with the Great Lakes, the MHRC requests that Boyne USA conduct a NNIS assessment on the hydroelectric project area. This assessment should focus on fish, mollusks, and plants (both aquatic and riparian). A recommended source of information and guidance is the Charlevoix - Antrim - Kalkaska - Emmet Cooperative Management Area, a partnership for collaborative outreach and management of invasive species on these four counties (http://www.michiganinvasives.org/cakecisma-2/).

- Recreation - FERC policy requires it to give equal consideration to non-developmental resources, including recreation, in the licensing of hydroelectric projects

Federal Energy Regulatory Commission, 1996. Recreation development at licensed hydropower projects. Division of Project Compliance and Administration, Office of Hydropower Licensing, Washington DC. 45pp.

https://www.ferc.gov/industries/hydropower/gen-info/guidelines/recreat-dev-hydro-licen.pdf

As such the MHRC has a number of concerns regarding recreation development and opportunities for the public associated with the Boyne River hydroelectric project. The MHRC requests an assessment of the following:

- Downstream tailwater access and parking area
- Public access to Boyne River at Dam Road.
- Canoe/kayak portage at the hydroelectric dam.
- Upstream impoundment public access.

This assessment should include a description of existing facilities and potential opportunities to meet the FERC guidelines of providing non-developmental recreation. In other words, how may the public be best served by providing recreation opportunities associated with the Boyne hydroelectric project which is located on a public trust waterway in Michigan? The MHRC also requests that Boyne USA file its FERC Form No. 80 as requested by the Commission in its June 2, 2017 correspondence, reporting recreation use data associated with the Boyne hydroelectric project, if it has not already done so.

In addition, while it may lie outside the project relicensing process, this process provides an opportunity to clarify public access to the upper Boyne River. It is the understanding of the MHRC that Boyne USA currently considers anyone using the river upstream of the project adjacent to Boyne USA land to be trespassing. While the Boyne River is not on the State's list of designated navigable streams, it most likely passes the "floating log" test for being a navigable stream given the abundance of historical information about logging and log drives in the Boyne River watershed. The MHRC desires that the issue of public access on the Boyne River be addressed. For clarification, please refer to the Michigan Department of Natural Resources' publication entitled "Public Rights on Michigan Waters".

http://michiganlakes.msue.msu.edu/uploads/files/FAQ%20Page/MI%20Water%20Laws.pdf

In addition to the above specific study requests, the MHRC is supportive of any additional specific study requests by the Michigan Department of Natural Resources, the Michigan Department of Environmental Quality, and the Department of Interior, U.S. Fish and Wildlife Service. Please contact the MHRC if you have any questions regarding our specific study requests. Thank you very much for providing the opportunity to do so as part of the FERC relicensing process for Boyne USA's hydroelectric project on the Boyne River.

Sincerely,

James D Schramm

James D. Schramm, Esq
Michigan Hydro Relicensing Coalition
(231) 740-7278
jdschramm@oceana.net

cc: Director of Office of Energy Projects, FERC
Bob Stuber, MHRC Consultant
Kyle Kruger, MDNR
Burr Fisher, USFWS
Amira Oun, MDEQ
Madhu Anderson, Michigan Agency for Energy
Kim Balke, Conservation Resource Alliance

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
LANSING

RICK SNYDER
GOVERNOR

C. HEIDI GRETHER
DIRECTOR

September 11, 2017

Mr. Randall Sutton, Manager
Boyne USA, Inc.
1 Boyne Mountain Road
Boyne Falls, Michigan 49713

Dear Mr. Sutton:

SUBJECT: Boyne Hydroelectric Project – Federal Energy Regulatory Commission (FERC) Project Number P-3409 – Scoping Comments by the Michigan Department of Environmental Quality (MDEQ)

The MDEQ reviewed the Boyne River's Pre Application Document (PAD) for the FERC Project Number P-3409 by Boyne USA, Inc. dated March 20, 2017. MDEQ staff also attended the public scoping meeting on July 10, 2017.

The purpose of this letter is to inform you of the state requirements outlined in Section 401(a) of the Clean Water Act when pursuing a FERC license. State agencies are responsible for setting and enforcing Water Quality Standards (WQS) and to ensure compliance with them. Section 401(a) requires states to certify that a project requiring a federal license or permit will comply with the state's WQS and other relevant laws. Any condition of a Section 401 certificate becomes a requirement of the license or permit. Typical conditions in Section 401 certifications include flow releases, impoundment level limits, erosion control and invasive species control, dissolved oxygen (DO) and temperature limits, woody debris management, and monitoring requirements (i.e., water quality, fish tissue, and sediment monitoring).

There are some issues that may require additional information, and the following are the specific relicensing studies requested by the MDEQ:

<u>Current and Proposed Project Operation</u>

The MDEQ agrees with the proposed continuity with the current license. This includes Run of River (ROR) operation; the ROR operation will help minimize the impoundment fluctuation and reduce negative impacts to the shoreline due to changing water levels. The MDEQ highly recommends that Boyne USA keep an operational band of +/-0.25 feet from the target elevation (635.46 feet), which will be included in the new license. The PAD indicated that the project currently operates over a 0.82-foot operating band.

<u>Water Quality Monitoring</u>

As part of the relicensing process application, Boyne USA shall monitor both water temperature and DO in the Boyne River. Data should be collected on an hourly basis as a minimum. Temperatures upstream of the influence of the impoundment and downstream in the tailrace should be monitored year-round and the results compared. Continuous DO should be monitored in the warm weather season between June 1 and September 30. The PAD indicated that the last completed continuous monitoring cycle for temperature at the Boyne River was conducted in 1999. The PAD did not reference a continuous DO study.

DO measurements are influenced by temperature (i.e., the higher the temperature, the lower the DO and vice versa). In addition, grab sampling results are dependent on the time of day. Sampling during the day would likely not capture the lowest DO readings. Continuous water quality monitoring is the industry standard because it provides a more robust dataset and captures the diurnal variation of both the highs and lows for DO and temperature.

The MDEQ Section 401 certifications typically require monitoring to be conducted upstream and within 500 feet downstream of the dam to determine if the facility is impacting WQS. Any recent water quality monitoring data, erosion and invasive species surveys, or flow data would be helpful in determining the requirements in the Section 401 certification. The MDEQ looks forward to working cooperatively with the Boyne USA on your application for a Section 401 certification for the project.

If you have any questions, please contact me at 517-284-5541; ouna@michigan.gov; or MDEQ, Water Resources Division, P.O. Box 30458, Lansing, Michigan 48909-7958.

Sincerely,

Amira Oun, Environmental Engineer
Surface Water Assessment Section
Water Resources Division
517-284-5541

cc: Ms. Kimberly D. Bose, FERC
Mr. Kyle Kruger, Michigan Department of Natural Resources
Ms. Gary Kohlhepp/Section 401 File, MDEQ

J.E. TIFFANY AND SONS, LLC

1707 N. 39 Road, Manton, Michigan 49663 Telephone:231-735-4546

June 8, 2018

Mr. Kyle Kruger, Senior Fisheries Biologist
Habitat Management Unit, Fisheries Division
Michigan Department of Natural Resources
P.O. Box 30028
Lansing, Michigan 48909-7528

Re: FERC Project No. 3409 – Boyne River Hydroelectric Project - Study Methodologies

Dear Mr. Kruger-

This letter serves to transmit to you the study methodologies that have been developed in response to the various requests for studies that we received subsequent to the joint consultation meeting on July 10, 2017.

Attached are documents detailing the environmental, recreational and engineering studies that will be undertaken throughout the remainder of this year.

Should you have any questions or comments, please do not hesitate to contact myself or Randall Sutton.

Sincerely,

J.E. Tiffany and Sons, LLC

James E. Tiffany

James E. Tiffany, P.E.
Owner

cc: Randall Sutton, Boyne USA
Ed Grice, Boyne USA

Enclosures

J.E. TIFFANY AND SONS, LLC

1707 N. 39 Road, Manton, Michigan 49663 Telephone:231-735-4546

June 8, 2018

Mr. James D. Schramm, Esq.
Michigan Hydro Relicensing Coalition
P.O. Box 828
Pentwater, MI 49449

Re: FERC Project No. 3409 – Boyne River Hydroelectric Project - Study Methodologies

Dear Mr. Schramm-

This letter serves to transmit to you the study methodologies that have been developed in response to the various requests for studies that we received subsequent to the joint consultation meeting on July 10, 2017.

Attached are documents detailing the environmental, recreational and engineering studies that will be undertaken throughout the remainder of this year.

Should you have any questions or comments, please do not hesitate to contact myself or Randall Sutton.

Sincerely,

J.E. Tiffany and Sons, LLC

James E. Tiffany

James E. Tiffany, P.E.
Owner

cc: Randall Sutton, Boyne USA
Ed Grice, Boyne USA

Enclosures

J.E. TIFFANY AND SONS, LLC

1707 N. 39 Road, Manton, Michigan 49663 Telephone:231-735-4546

June 8, 2018

Ms. Amira Oun, Environmental Engineer
Surface Water Assessment Section, Water Resources Division
Michigan Department of Environmental Quality
P.O. Box 30473
Lansing, MI 48909-7973

Re: FERC Project No. 3409 – Boyne River Hydroelectric Project - Study Methodologies

Dear Ms. Oun-

This letter serves to transmit to you the study methodologies that have been developed in response to the various requests for studies that we received subsequent to the joint consultation meeting on July 10, 2017.

Attached are documents detailing the environmental, recreational and engineering studies that will be undertaken throughout the remainder of this year.

Should you have any questions or comments, please do not hesitate to contact myself or Randall Sutton.

Sincerely,

J.E. Tiffany and Sons, LLC

James E. Tiffany, P.E.
Owner

cc: Randall Sutton, Boyne USA
Ed Grice, Boyne USA

Enclosures

PUBLIC SECTOR CONSULTANTS

streamside ecological services

Boyne River Hydroelectric Relicensing Project
Environmental Monitoring Methods
June 5, 2018

- **Shoreline Erosion Inventory** – An inventory of shoreline erosion will be completed to document existing conditions and to be used to guide any necessary stabilization work. The inventory will be completed using a boat to traverse the entire perimeter of the impoundment. The banks of the Boyne River, in the tailrace and between the powerhouse and Dam Road, will be assessed for erosion. The Bank Erosion Hazard Index (BEHI) (Rosgen, 2001) will be used to quantify and map erosion sites. GPS will be used to record data; all information collected will be converted to GIS shapefiles, CAD files or another format that can be used for mapping and analysis. Recommendations will be made for areas that might require stabilization work.

- **Water Temperature Monitoring** (Tailrace, Upstream and Downstream) – Year-round water temperature monitoring of the tailrace and the Boyne River, upstream and downstream of the impoundment, will be conducted. Onset Hobo U22 temperature loggers will be programmed to record on an hourly basis and will be deployed at all sites. Two loggers will be placed at each site to assure redundancy in data collection in case of malfunction, theft or loss of any loggers. Loggers will be downloaded on a quarterly basis, at a minimum. Data will be compared to Michigan's Water Quality Standards and will be used to thermally classify the stream reaches (cold, cold-transitional, etc).

- **Dissolved Oxygen Monitoring** (June 1 to September 30) – Dissolved Oxygen will be monitored on a continual basis, from June 1 to September 30, 2018, in the tailrace and in the river upstream of the impoundment. Onset Hobo U26 Dissolved Oxygen data loggers will be installed and programmed to record data at ten-minute intervals to assure necessary data is collected during the study period. These loggers also record water temperature and will provide additional redundancy. Loggers will be downloaded on a bi-weekly basis. Data will be compared to Michigan's Water Quality Standards for warm and coldwater streams.

- **Water Temperature and Dissolved Oxygen Vertical Profiles in Impoundment** – Two locations will be identified within the impoundment for water temperature and dissolved oxygen profiles. A watercraft will be launched to access the two sites on a bi-weekly basis (once every two weeks) between June 1 and September 30, 2018, for a total of nine samples over 17 weeks. A Yellow Springs Instrument (YSI) Professional Plus multi-parameter meter will be used to collect the data at established intervals from water surface to the bottom of the impoundment.

- **Aquatic Survey of the Impoundment**

    - Characterizing the Fish Community

The fish survey plan will target native and non-native species for the impoundment and is intended to provide species composition, relative abundance, and size statistics for selected species that are collected. Because fish collection gear is not equally selective among sizes and species of fish, a combination of a boat-mounted electroshocker, seine, gill nets, and fyke nets may be used to capture fish in the Boyne River impoundment.

Prior to sampling, existing data will be gathered and reviewed. The Michigan Natural Features Inventory (MNFI) County Element List will be reviewed to determine if any threatened, endangered, or special concern aquatic species potentially occurred within the impoundment and tailwater.

A boat-mounted shocking unit and generator (boom shocker) will be used to collect fish in shallow water, near-shore areas of the impoundment. Fish shocking will be conducted during the evening to minimize fish avoidance of electroshocking gear. Pulsed direct current (DC) will be used during the survey to minimize trauma to the fish. The sampling gear automatically records the electroshocking duration (total seconds of electricity discharged from the shocker) for each transect.

Multipanel monofilament gill nets consisting of five, 6 x 25-foot panels ranging from 1.5 to 6-inch stretch mesh will be deployed along the bottom of the impoundment in the deeper portions of the impoundment. To minimize fish mortality, gill nets will be set in the late afternoon or evening and lifted early in the morning.

Fyke nets measuring four feet in diameter with a 20-foot long center lead, and two, 6 x 50-feet wing leads will be deployed throughout the impoundment. The fyke nets will be fished overnight for approximately 24 hours.

Consistent with MDNR netting recommendations (Schneider et al. 2000), netting efforts using fyke and gill nets within the impoundment is expected to total between five and eight net nights over a period of two days of netting.

A seine measuring 6 x 50-feet long with a 0.19-inch mesh will be fished in shallow areas around the impoundment where possible. The typical seine haul procedure is to hold one end of the seine on shore and haul the free end upstream in a 90° arc to the shore.

Catch-per-unit-effort (CPUE) is used as an index of fish abundance. Fish sampling efforts will be standardized to units consistent with the MDNR sampling protocol (Schneider et al. 2000).

The species, length, weight, and number of fish captured will be recorded for all gear used. Fish will be returned alive to the system following collection and identification, when possible. One representative of each species that is not identifiable in the field will be placed in a voucher jar containing 10% formalin for later identification. Each voucher jar will be labeled according to the sample location and date.

Length-weight regressions will be evaluated for selected fish species and the data compared to state average length and weight values to evaluate the condition of the fish. Condition (robustness) sometimes reflects food availability and growth within the weeks prior to sampling (Schneider et al. 2000).

- **Characterizing the Macroinvertebrate Community**
  Macroinvertebrates within the impoundment will be collected using D-framed kick nets in shallow water around the shoreline, and using a petite PONAR sediment grabbing device in water too deep for the dip nets. Macroinvertebrates from different habitat types will be collected along the shoreline to provide a representative shoreline sample, and from randomized locations throughout the impoundment in deeper water. All collected macroinvertebrates will be stored in 250 mL plastic wide-mouth jars containing 70% ethanol and later identified to the lowest possible taxonomic level. We will attempt to collect approximately 300 macroinvertebrates from the impoundment.

  Shallow water areas will be surveyed for mussels using sampling techniques outlined by Dunn (2000). Both wading and snorkeling will be used to locate and collect mussels. All mussels encountered will be collected into mesh bags and kept in the water until identification takes place. Each species will be identified, enumerated and photographed before being returned, in its proper orientation, to its suitable habitat. If determined to be necessary, a scuba crew will be hired to explore deeper water areas. Ohio DNR protocols will be followed.

- **Impingement/Entrainment Evaluation** – Using flow data provided by the Engineer and swimming and burst speed data for the fish community (species, size, abundance, etc.) of the impoundment, an analysis of the potential for fish to be impinged or entrained will be completed.

- **Aquatic Survey of the Boyne River**

  - Fish Community at Two Sites (one within ¼ mile upstream and one within ¼ mile downstream of impoundment)

    The purpose of the Boyne River fish survey will be to describe fish community composition, relative abundance, and estimate population size of select species (e.g., salmonids). All data collected will be compared to any existing data for each site, including the 2012 MDNR survey data from the downstream project area.

Prior to sampling, existing data will be gathered and reviewed. The MNFI County Element List will be reviewed to determine if any threatened, endangered, or special concern aquatic species have been documented.

Fish will be collected from two, one-quarter mile long study reaches in the Boyne River using electrofishing gear. One reach will stretch approximately 0.25 miles downstream of the impoundment and the other reach will stretch approximately 0.25 miles upstream of the (normal high water mark) of the impoundment.

A barge-mounted electrofisher will be used to collect fish throughout each study reach. Shocking will be conducted in an upstream direction to minimize fish avoidance of gear.

For the population estimate of selected species, a mark-recapture study will be conducted over two days in a manner that is consistent with methodology described in Wills et al. (2006). All species will be identified, enumerated, and measured for length and weight, and selected species will be marked with a fin clip prior to release. The electrofishing survey will be conducted again on the second day to identify all the individuals that may be marked from the previous day's survey as part of the determination of the population estimate.

The goal is to return all fish alive to the system following collection and identification when possible. One representative of each species that is not identifiable in the field will be placed in a voucher jar containing 10% formalin for later identification. Each voucher jar will be labeled according to the sample location and date.

- Physical Habitat at Two Sites (¼ mile upstream and ¼ mile downstream of impoundment)

  Riparian and in-stream habitats will be qualitatively described for each station during the aquatic survey. A description of stream morphology included run/riffle/pool/shallow pool configurations, substrate, substrate embeddedness, in-stream cover, vegetation, flow stability, and bank stability. Stream habitat will be rated as excellent, good, marginal, or poor based on Great Lakes Environmental Assessment Section Procedure No. 51 (P51)(MDEQ, 2008) scores interpreted from ten habitat metrics.

  Habitat conditions, water quality, and stream dimensions will be documented during the aquatic survey. Photographs will be taken at each station to illustrate the conditions during the sampling event. Water temperature, dissolved oxygen, pH, and conductivity will be measured as part of the stream habitat evaluation. These water quality parameters will be measured using a YSI Professional Plus water quality meter.

- Macroinvertebrate Community at Two Sites (¼ mile upstream and ¼ mile downstream of impoundment)

Upon completion of the fish sampling of the Boyne River, macroinvertebrates will be collected according to the P51. Three-hundred macroinvertebrate samples will be collected from each of the two study reaches using D-framed kick nets and identify them to the lowest possible taxonomic level. Collected specimens will be stored in 250 mL plastic wide-mouth jars containing 70% ethanol, and will be identified using various taxonomic references (e.g. Merritt and Cummings, 2008., Bright, 2018).

The Boyne River macroinvertebrate data will be analyzed according to nine metrics identified in the P51 methodology. The sum of the macroinvertebrate scores can range from –9 to +9; and are graded as excellent, acceptable, or poor according to the summation of the metric scores.

The MNFI database will be used to check for occurrences of any rare mussel species. If there are any documented findings, or if the habitat is found to be suitable for inhabitation of mussel species, a field survey will be conducted using sampling techniques outlined by Dunn (2000). Each species will be identified, enumerated and photographed before being returned, in its proper orientation, to its suitable habitat. In general, coldwater streams typically do not have a high diversity or density of mussels.

- **Temperature Modeling Study** – Based upon anecdotal information provided by Boyne USA, the impoundment may be too shallow to stratify or to store any significant volume of cold water during summer months. Additionally, the dam currently operates, in part, as a bottom-draw structure. At this time, it is assumed that no modifications could be made to the dam or impoundment to alter the existing thermal regime of the river, downstream of the impoundment, and that a water temperature modeling study may be of little value. However, as more information becomes available, from other tasks completed on the impoundment, a determination will be made as to whether additional water temperature profiling may be of use. If determined necessary, temperature profiling of the impoundment will be completed in 12 locations, and used in conjunction with bathymetric data, to compute the volume of "cold" water available in the impoundment over the course of the warm season months (June 1 to September 30). This data will be used, in combination with downstream water temperature data, to analyze the potential for cold water spill during periods where spill may otherwise violate Water Quality Standards in the tailrace. We may also use the Stream Segment Temperature model (SSTEMP) as a means to evaluate stream temperature based and the influence of the impoundment's operation on stream temperature.

- **Nuisance Plant Surveys** – Survey of the impoundment will be completed using MDEQ's procedures for aquatic vegetation surveys (MDEQ, 2005). The impoundment will be broken into similarly-sized, individual assessment units and all plant species and densities within each unit will be documented, with primary focus on nuisance species such as Eurasian water milfoil, curly-leafed pondweed and starry stonewart. A meandering survey of the entire transmission corridor will be completed. Maps will be completed to illustrate locations and densities of nuisance species.

References

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Boyne River Hydroelectric Project- P-3409
Schedule of Environmental Studies
Public Sector Consultants/Streamside Ecological Services
June 6, 2018

Task	2018							2019											
	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Shoreline Erosion Inventory																			
Water Temperature Monitoring (Tailrace, Upstream and Downstream)																			
Dissolved Oxygen Monitoring																			
Water Temperature and Dissolved Oxygen Vertical Profiles in Impoundment																			
Aquatic Survey of the Impoundment																			
Impingement/Entrainment Evaluation																			
Aquatic Survey of the Boyne River																			
Temperature Modeling Study																			
Nuisance Plant Surveys																			
Data Analysis and Reporting							Draft Report												Final Report

BOYNE RIVER HYDROELECTRIC PROJECT
FERC PROJECT NO. 3409

RECREATIONAL RESOURCES STUDY PLAN

RECREATION STUDY CONSULTANT:
JMB Associates LLC
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1709 E Lake Mitchell Dr
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SECTION PAGE

1.0 DESCRIPTION OF ISSUE

Boyne USA Inc, the Licensee, owns and operates under a license issued by the Federal Energy Regulatory Commission (FERC) the Boyne River Hydroelectric Project (Project). The Project is located on the Boyne River in Charlevoix County, Michigan (Figure 1). Recreation is a recognized project purpose at FERC-licensed projects.

Under their current FERC license, the Licensee provides facilitated access to both the north and south side of the tailwater, from the hydro plant downstream to Dam Road, the nearest public road, a distance of approximately ¼ mile. These North and South Tailwater sites are primarily used for fishing, but also for walking / hiking / sightseeing activities. These are the only Project recreation facilities under the current Boyne River Hydro FERC license. There are no public roads that provide access to the Project reservoir or nearby upstream locations on the Boyne River.

An aerial view of the Boyne Hydro Project is illustrated in Figure 2. With the exception of the Project works associated with the powerhouse, plant intake and embankment, where public access is prohibited for public safety and project infrastructure security reasons, the upstream Project boundary corresponds with the normal maximum water elevation of the reservoir. Other surrounding property or the Boyne River upstream is not in the Project area.

FERC regulations require that the license application discuss existing and proposed recreational facilities and opportunities at the Project. The report must be prepared in consultation with local, state, and regional recreation agencies and planning commissions, the National Park Service, and any other state or Federal agency with managerial authority over any part of the project lands.

Figure 1. Project Location

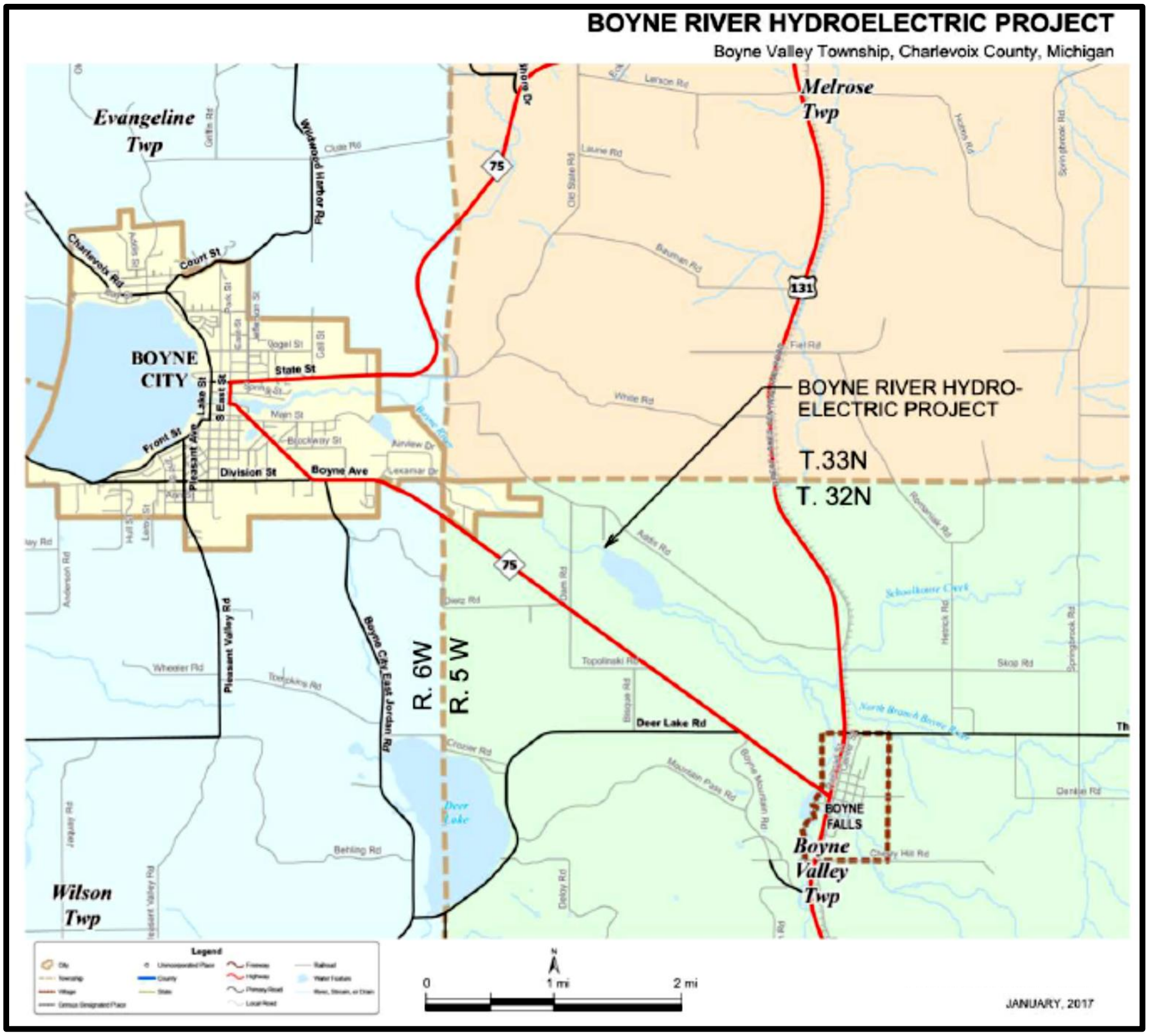
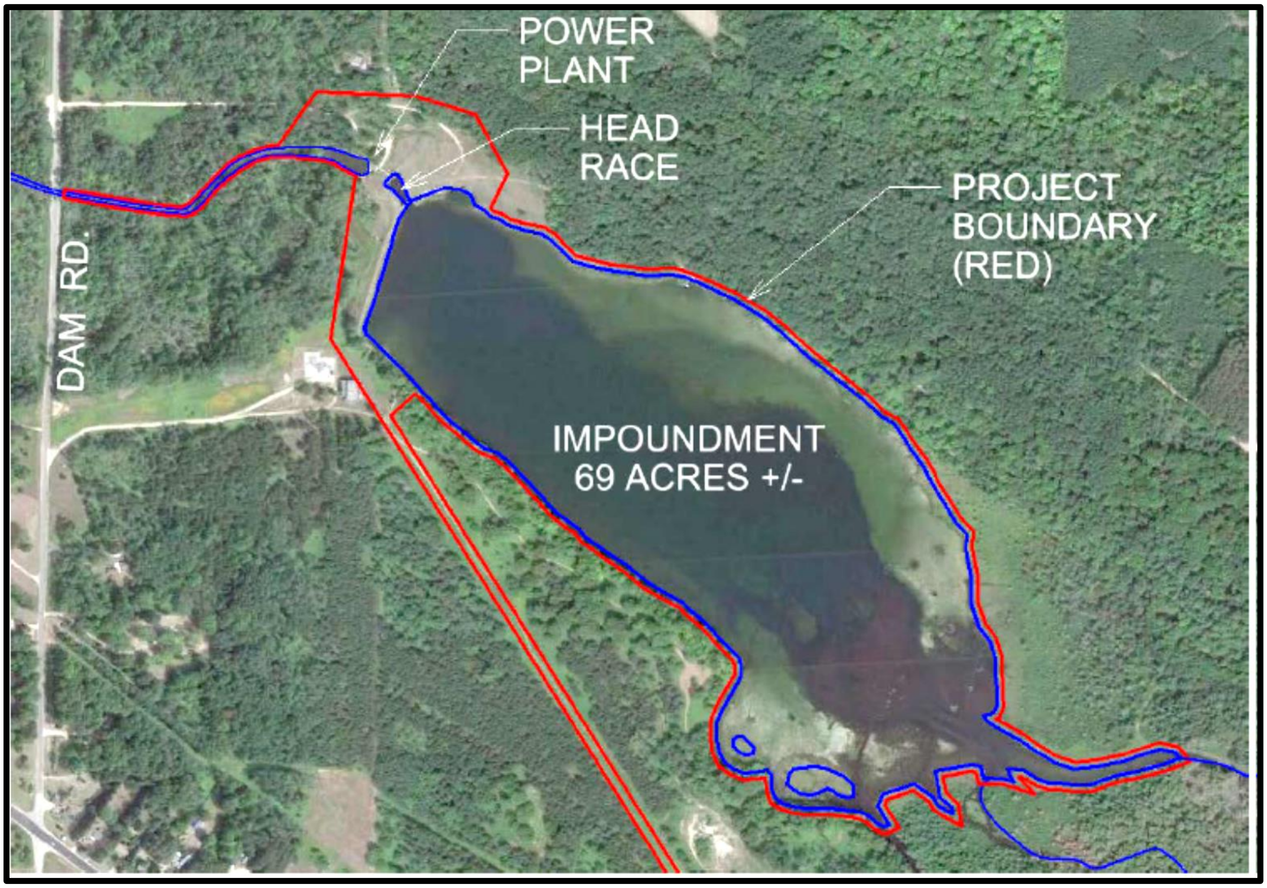


Figure 2. Project / Recreation Study Area



2.0 Project Effects

No Project effects on the recreation resource have been identified or are apparent. The Project's Run-Of-River mode of operation has been determined to be the most beneficial operational mode in terms of the downstream fishery resource where the public recreation access is available for anglers.

3.0 Relevant Existing Information

Recreational use data for the Project was most recently reported to the FERC in the required "Licensed Hydropower Development Recreation Report (Form 80), submitted to the FERC May 24, 2010. The Form 80 provides an estimate of recreation use as "recreation days" that occurs within the Project area. A recreation day is defined by FERC as each visit by a person to a Project development for recreational purposes during any portion of a 24-hour period. The Form 80 also includes a report of the Licensee's estimated annual costs and revenues.

The 2010 Form 80 Report for the Project reported use for the Tailwater Access sites, the only Project recreation facilities. The estimated total annual daytime use for the North and South Tailwater sites was 900 recreation days, and the total annual nighttime use was 100 recreation days. The peak weekend daytime average use was estimated at 40-50 recreation days, and the nighttime average was estimated at 5-10 recreation days. The 2010 Form 80 reported an annual cost of providing recreation access as being $15,000, with no recreation revenues received by the Licensee.

Boyne has been granted an extension of time by the FERC for submittal of the Form 80 Report that was due April 1, 2017. That current Form 80 Report is due August 31, 2018. Data that will be utilized for the Form 80 Report is being collected in conjunction with the relicensing recreation study effort.

4.0 NEED FOR RECREATION INFORMATION

The application for a new license will include a report of recreational resources, designed to provide:

- a description of existing recreational facilities at the project, indicating whether the facilities are available for public use;
- an estimate of existing and potential recreational use of the project area, in daytime and nighttime visits;
- a description of any measures or facilities recommended by the agencies consulted for the purpose of creating, preserving, or enhancing recreational opportunities at the Project and in its vicinity (including opportunities for the handicapped), and for the purpose of ensuring safety of the public in its use of Project lands and waters;
- a statement of the existing measures or facilities to be continued or maintained and the new measures or facilities proposed by the applicant for the purpose of creating, preserving, or enhancing recreational opportunities at the project and in its vicinity, and for the purpose of ensuring the safety of the public in its use of project lands and waters, including an explanation of why the applicant has rejected any measures or facilities recommended by an agency;
- identification of the entities responsible for implementing, constructing, operating, or maintaining any existing or proposed measures or facilities;
- a schedule showing the intervals following issuance of a license at which implementation of the measures or construction of any proposed facilities would be commenced and completed;
- an estimate of the costs of construction, operation, and maintenance of any proposed facilities, including a statement of the sources and extent of financing;

5.0 ADDITIONAL INFORMATION REQUEST

In comments submitted in response to the Boyne River Pre Application Document (PAD), additional recreation information was requested by the Michigan Department of Natural Resources (MDNR) and by the Michigan Hydro Relicensing Coalition (MHRC).

In their letter of August 31, 2017, MDNR recommended that the recreation study review the potential for expanding recreational access opportunities to include access to the impoundment for shore fishing, kayaking and a small boat launch. MDNR also recommends that the study evaluate current tailwater access parking.

As noted earlier, there is no public access available to the river upstream or to the Project reservoir. These locations are not served by any public roads, nor are there any publicly developed access points. Since there is no public access to those areas currently, the Licensee does not believe it is appropriate or productive to include them in the study. The Licensee would have to develop major public use infrastructure outside the Project boundary to make such recreational enhancements as shore fishing, kayaking and small boat launching available to the public. The Licensee does not believe that such development requirements would be consistent with the level of recreation access that is appropriate for this Project. The tailwater access parking will be inventoried and evaluated as part of the recreation study, as discussed further below.

In their letter of September 1, 2017, the MHRC recommends that the recreation study include an assessment of:

- Downstream tailwater access and parking area
- Public access to the Boyne River at Dam Road.
- Canoe/kayak portage at the hydroelectric dam.
- Upstream impoundment public access.

The Licensee will include an assessment of the North and South Tailwater Access and parking area, as well as public access to the Boyne River at Dam Road in the Recreation Study, as described further below. As noted above, since there are no public access locations upstream for launching canoes or kayaks, a portage would not serve a public access need. As noted in the response to the MDNR comments, reservoir access would involve major public infrastructure road development and providing access to private property that is not included in the Boyne River Project area.

The MHRC recommended that the Licensee file its Form 80 Recreation Report with the FERC. The Licensee expects to make the Form 80 filing by August 31, 20018, as discussed earlier. The MHRC also requested an evaluation of public access on the upper Boyne River. As acknowledged by the MHRC in their letter, this request lies outside the relicensing process and is not an appropriate subject for this Recreation Study.

6.0 PURPOSE OF STUDY AND USE OF RESULTS

The purpose of the Recreation Study is to compile existing data and develop additional information to support a new FERC license application for continued operation of the Project.

The primary goals of this study are to:

- Develop an inventory and condition assessment of the existing Project recreation facilities;
- Estimate the existing level of daytime and nighttime recreational use occurring at the Project;
- Assess the adequacy of Project recreation relative to applicable existing public recreation plans and goals; and
- Develop recommendations for Project recreation access for inclusion in the license application.

7.0 STUDY METHODOLOGY

7.1 Site Inventory and Condition Assessment

The Licensees will conduct a recreational site inventory and condition assessment detailing the existing North and South Tailwater Access recreation sites, to include:

- An overview of the general site conditions and access provided;
- A detailed description of the site amenities and their condition; and
- Photographs documenting the sites.

7.2 Recreational Use Observations

Project operations personnel, who visit the Project daily, will make recreational use observations throughout the 2018 recreation season, to include the number of vehicles observed, the number of users at the sites and the activity they are engaged in. The daily observations will delineate users observed at the North and South Tailwater Access locations, and will also include the name of the observer, the time of day and weather conditions at the time of the observation. The observations will be recorded on the form provided in Appendix A.

This methodology substantially exceeds the recreation use estimate required by the FERC Form 80, for which a Licensee is instructed that only three hours of effort is estimated by the FERC, including data collection, data compilation and reporting. These actual use observations together with the site inventory and analysis will present a clear picture of the recreational opportunity provided at the Tailwater Access.

7.3 Existing Recreation Plan Review

Existing public recreation plans will be reviewed to determine if they contain any specific goals and objectives that are applicable to the Boyne River Hydro and its associated recreation access. Plans to be reviewed include:

- The Michigan State Comprehensive Outdoor Recreation Plan
- Charlevoix County Recreation Plan 2015 – 2019
- Boyne Valley Community Recreation Plan 2014 – 2018, adopted by Boyne Valley Township and the Village of Boyne Falls

7.4 Data Analysis and Reporting

The information developed from the site inventory and daily recreational use observations will be compiled to present a clear understanding of the public recreational use at the Boyne River Project. This information coupled with a review of existing recreation plans that apply to the area will be used to complete the recreation portion of the license application; and to make recommendations for future Project recreation access.

The report for this study will include a recreation site inventory, including the location of recreation sites in relation to the Project boundary, the amenities provided at each site, the condition of the facility/amenities, photographs, use figures for each recreation site, and overall recreational use figures for the Project.

8.0 SCHEDULE

Field data collection for this study will take place from April 2018 through October 2018., and may also include some data taken prior to April 2018 by the Licensee as part of their Form 80 data collection effort. Analysis of the data will occur in fourth quarter of 2018 and a report filed in the first quarter of 2019.

9.0 SUMMARY AND LEVEL OF EFFORT

The Licensees believe the proposed level of effort as described above is sufficient to obtain current information on recreational usage and demand within the Project area, and from which recreation access recommendations under the new license can be developed.

APPENDIX A

BOYNE RIVER HYDRO PROJECT
RECREATION USE OBSERVATION FORM

BOYNE RIVER HYDRO PROJECT

RECREATION USE OBSERVATION FORM

Observer:____________________ Date / Time: ____________________

Weather Conditions: ______________________________________

Recreation Site: Tailwater Access Sites

Number of Vehicles: ____________________

Number of People / Activity Observed:

North Tailwater

Fishing ____________ Walking / Hiking ____________ Other ____________

South Tailwater

Fishing ____________ Walking / Hiking ____________ Other ____________

Comments:

BOYNE RIVER HYDROELECTRIC PROJECT
FERC PROJECT NO. 3409

ENGINEERING STUDY PLAN

PREPARED BY
J. E. Tiffany and Sons, LLC
1707 N. 39 Road
Manton, Michigan 49663
JamesETiffany@gmail.com
231-735-4546

June 5, 2018

INTRODUCTION

Boyne USA, Inc. (Boyne) is licensed by the Federal Energy Regulatory Commission (FERC) to operate and maintain the Boyne River Hydroelectric Project (FERC Project No. 3409). The existing 40-year license was issued on February 22, 1982. The current license expires on January 31, 2022. Boyne is currently working on the process of re-licensing the project.

As part of the consultation process, Boyne held a joint meeting with interested stakeholders on July 10, 2017. The consultation process allows a time frame of 60 days from the date of the joint meeting to submit comments and to request studies. Study requests were submitted by the Michigan Department of Natural Resources (MDNR) and by the Michigan Hydro Relicensing Coalition (MHRC) pertaining to engineering issues. Those requests and our approach to addressing them are considered in this document.

STUDY REQUESTS & RESULTING STUDY PLANS

MICHIGAN DEPARTMENT OF NATURAL RESOURCES STUDY REQUESTS

In their letter of August 31, 2017, the MDNR made the following recommendations and requests. A study plan description follows after each study request listed below:

1. Impoundment Water Surface Operating Range

The MDNR has made the following recommendation:

> *"The Department requests that an evaluation of the operating band be conducted. Currently the PAD indicates that the operates over a 0.82 foot operating band, from 0.24 feet below target (634.64 ft.) to 0.58 feet above target (635.46 ft.). This band is quite wide, and we recommend that an operating band of +/- 0.25 feet from the target elevation (634.88 ft.) be included in a new license. Narrowing the operating band will provide flows that closer follow inflows approximate outflows at all times. The elevation datum used to establish the impoundment elevations was not included in the PAD and should be included in the draft license application."*

In response to the request, a study will be undertaken to explore the feasibility of reducing the operating range. It is anticipated that the low water surface elevation will be similar to the current minimum. Elevations required to pass the flood events will dictate the maximum water surface elevation. Spillway rating curves will be developed that will provide the water surface elevations associated with passage of floods of various frequencies.

Extensive survey work will be undertaken in order to complete the exhibits required for the application. A datum will be associated with the exhibits. We will provide a formula for correlating the new datum with the datum that was previously used.

2. Bathymetric Survey

The MDNR has made the following request:

> *"The PAD did not include a detailed bathymetric map of the impoundment. In order to better understand the characteristics of the impoundment and how flows affect conditions within the impoundment a detailed bathymetric map should be prepared. It should have contour lines at a minimum of every 5 feet of depth. The PAD indicates the surface area, volume, maximum depth, but does not include mean depth. We are unclear how the volume was calculated without such a detailed bathymetric map."*

A complete bathymetric survey will be completed along with the other survey work that is necessary for the application. With the new survey, more detailed information about surface area, volume, maximum depth and mean depth can be provided, along with a detailed contour map.

3. Flow Duration Curves

The MDNR has made the following request:

> *"The PAD lacks monthly flow duration curves. Turbine and spillway rating curves should be developed for the project and the data used to construct flow duration curves from project operation records. These curves should be based on a minimum of 10 years of operational data. Estimated flow information will be required for temperature modeling for the project. This will allow a more thorough analysis of the annual hydrograph for the project."*

Turbine and spillway rating curves will be developed for the project. Once that work is complete, flow duration curves can be developed based on records of impoundment levels and power generation. Unfortunately, it will not be possible to base the flow duration curves on 10 years of operational data. For many years the main spillway gate passed a significant amount of water because of bad seals. There is no way to know the flow rate passing the spillway gate seals.

A new spillway gate was installed on November 4, 2016, thereby eliminating the un-measurable flow. Flow duration curves will be established based on data for the rest of 2016, all of 2017 and 2018.

4. Impingement/Entrainment Evaluation

The MDNR has made the following request:

> *"The PAD does not include a summary of the approach velocities or characteristics of the trash racks for the project. The Department requests an analysis of the flow characteristics of the power house such that the level of potential impact to aquatic resources can be evaluated. Utilization of the swimming speed and burst speed data for the various fish found in the impoundment and based on the size distribution and abundance, the potential for the number and types of fish that may be at risk for impingement or entrainment at the project can be estimated. This analysis will provide needed insight to potential mitigation for fish protection at the project."*

A study will be undertaken to determine the cross sectional flow area at the trash racks and the approach velocities. This information will be provided to the environmental consultants on the project, Public Sector Consultants. Please refer to their study methodology document for information about the impingement/entrainment evaluation.

MICHIGAN HYDRO RELICENSING COALITION STUDY REQUESTS

In their letter of September 1, 2017, the MHRC made the following study requests.

5. Stream Gauges for Run of the River Compliance Monitoring

The MHRC has made the following request:

> *"Boyne USA currently operates the Boyne hydroelectric project in a run-of-river mode (outflow = inflow). This is the preferred method of operation by the MHRC for hydroelectric projects in Michigan. However, the MHRC feels that such operations need sound compliance monitoring, Therefore, the MHRC requests that Boyne USA conduct an instream flow study to quantify the stage-discharge relationship. This should be done for both the inflow and outflow reaches of the Boyne River. A quantified stage discharge relationship for both upstream and downstream reaches would allow Boyne USA to utilize a system of staff gauges for compliance monitoring of the run-of-river operation."*

The FERC, in a document entitled *Hydropower Primer* defines "run of the river" as

> *"A run-of-river project is a type of hydropower project in which limited storage capacity is available and water is released at roughly the same rate as the natural flow of the river (https://energy.gov/eere/water/glossary-hydropower-terms)."*

It should be noted that the dam has a fixed crest overflow spillway with no method of reducing flow over the spillway such that water can be stored for later use in power generation.

Since the new spillway gate was installed on November 4, 2016, power has been generated almost continuously with only one or two instances where the generator shut down because of a low water level.

The following equation for flow in and out of the impoundment is useful for evaluating this situation:

inflow = turbine flow + spillway flow + storage in the impoundment

Assuming that turbine flow is essentially constant then:

change in Inflow = change in spillway flow + change in storage in the impoundment

During normal flows, and unless there is a rapid change in inflow (such as during a flood event), the storage effect in the impoundment is negligible. Therefore, the equation shows that there is a natural equilibrium that is maintained between inflow and outflow.

In summary, because of the relatively small size of the generating equipment, the fixed crest uncontrolled spillway and the relatively small size of the impoundment, the Boyne River Hydroelectric Project is truly a "run of the river" project, and as a result, an instream flow study to quantify the stage-discharge relationship and a system of staff gauges for compliance monitoring of the run-of-river operation are deemed to be unnecessary.

Michigan Hydro Relicensing Coalition
1620 High Street
Traverse City, MI 49684
June 20, 2018

Randall Sutton
Boyne USA, Inc.
1 Boyne Mountain Road
Boyne Falls, MI 49713

Re: Boyne River Hydroelectric Project P-3409

Dear Mr. Sutton:

The purpose of this letter is to provide comment and input from the Michigan Hydro Relicensing Coalition (MHRC) for the relicensing studies that Boyne USA has proposed as part of the relicensing of the Boyne River hydroelectric project (FERC P-3409). These studies were provided to the MHRC on June 8, 2018 via email correspondence from J.E. Tiffany and Sons, LLC on behalf of Boyne USA.

The MHRC provided recommendations for the relicensing studies to Boyne USA via correspondence dated September 1, 2017. The Michigan Department of Natural Resources did likewise on August 31, 2017. The following are specific comments and input by the MHRC on the planned relicensing studies.

Project Operations - Study Plan follows recommendations with these exceptions:

- No system of staff gauges are planned. The study plan states that staff gauges for compliance monitoring of the run-of-river operation are deemed to be unnecessary. The rationale is that relatively small size of the generating equipment, the fixed crest uncontrolled spillway, and the relatively small size of the impoundment make the project truly "run of the river". While this may be true, the question still remains of how Boyne will do quantifiable compliance monitoring of its planned run-of-river operations. The MHRC still prefers a staff gauge system established for compliance monitoring.

- Period of record for establishing the flow duration curves is less than the recommended 10 years. Boyne's explanation is acceptable given the issues described with the spillway gate that were corrected in 2016.

Shoreline Erosion - Study Plan follows recommendation.

Water Quality - Study Plan follows recommendations with the following comments being submitted.

- Riverine water quality - one of the main purposes of the monitoring data should be to see if the project is in compliance with State water quality standards for coldwater streams, Boyne River's designation. While terms such as "coldwater-transitional" and "warmwater" could potentially serve as descriptors of existing conditions based on the planned 2018 monitoring, ultimately the real purpose is an assessment of existing temperature and dissolved oxygen relative to the State water quality standards for a coldwater stream.

- Temperature modeling - Study Plan follows recommendation if decision is made to do the evaluation. Boyne USA has based the modeling evaluation on the following condition: as information becomes available from other impoundment tasks, a determination will be made as to whether additional water temperature profiling may be of use. MHRC requests to be consulted on the decision making process for the recommended impoundment temperature profile data collection that would be used for the modeling.

Aquatic Resources (Stream Fish Communities) - Study Plan follows recommendation with these exceptions:

- Only two sampling locations per MDNR recommendation, not four per MHRC recommendation (two each upstream and downstream, respectively). The rationale for the MHRC recommendation was to account for variability in the population parameters being estimated by increasing the sample size. MHRC prefers that four riverine stations be sampled as originally requested. Also, the MHRC requests to be part of the site selection process as originally requested.

- The upstream sampling site needs to be located a minimum of ¼ mile from normal high water mark of the impoundment as recommended by MDNR (as opposed to "one within ¼ mile upstream" as described in the study plan). The purpose of the upstream site is to characterize the Boyne River outside of project-influence conditions.

Aquatic Resources - Impoundment - Study Plan follows recommendations.

Aquatic Resources - Mussels (Riverine) - the decision to proceed with riverine mussel surveys should not be predicated on a MNFI database search for occurrences of rare mussel species. A query of the current MNFI database for Charlevoix County will yield no documented occurrences of any rare mussel species . However, the MNFI database is based on field inventories. A search of MNFI publications dating back to 1981 reveals that no mussel surveys have been done in the Boyne River (or the connected Lake Charlevoix). Given the connection with Lake Charlevoix, the Boyne River could provide suitable habitat for freshwater mussels, especially downstream of the project. Thus, an actual field survey should be implemented.

Impingement\Entrainment Evaluation - Study Plan follows recommendations.

Non-native Invasive Species (NNIS) - Study Plan follows the recommendation for NNIS plants, and all species encountered in the impoundment and riverine fish sampling protocols will be documented. However, no specific mention of nuisance mollusks (e.g., New Zealand mudsnail). These should also be in the assessment.

Recreation - The Study Plan does address an assessment of tailwater based recreation. However, it does not include an assessment of impoundment and upstream-related recreation opportunities. MHRC feels that this is a serious omission that needs to be addressed.

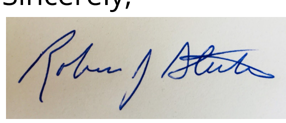
Federal Energy Regulatory Commission (FERC) policy requires it to give equal consideration to non-developmental resources, including recreation, in the licensing of hydroelectric projects (please refer to the reference given below). There may be public recreation opportunities associated with the impoundment, which is part of the hydroelectric project and within the FERC-established project boundaries.

> [Federal Energy Regulatory Commission. 1996. Recreation development at licensed hydropower projects. Division of Project Compliance and Administration, Office of Hydropower Licensing, Washington DC. 45pp.]

The recreation study plan states that since there are no public access locations upstream for launching canoes or kayaks, a portage would not serve a public access need. Reservoir access would involve major public infrastructure road development and providing access to private property that is not included in the Boyne River Project area. Boyne USA does not believe that such development requirements would be consistent with the level of recreation access that is appropriate for this Project. MHRC feels that this is a premature conclusion and does not agree with this rationale, especially for the impoundment. MHRC requests an assessment of impoundment recreation opportunities at a minimum.

Please contact MHRC if you have any questions regarding our comments on the planned relicensing studies. Thank you very much for providing the opportunity to do so as part of the FERC relicensing process for Boyne USA's project on the Boyne River.

Sincerely,



Robert J. Stuber
Michigan Hydro Relicensing Coalition
(231) 775-4321
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cc: Director of Office of Energy Projects, FERC
Kyle Kruger, MDNR
Scott Fisher, USFWS
Amira Oun, MDEQ
JE Tiffany and Sons, LLC

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES
LANSING

RICK SNYDER
GOVERNOR

KEITH CREAGH
DIRECTOR

June 28, 2018

James E. Tiffany, Owner
J.E. Tiffany and Sons. LLC
1707 N. 39 Road
Manton, MI 49663

RE: STUDY METHODOLOGIES – BOYNE RIVER HYDROELECTRIC PROJECT (FERC NO. 3409) ON THE BOYNE RIVER, MICHIGAN

Dear Mr. Tiffany,

The Michigan Department of Natural Resources (Department) has reviewed the proposes study methodologies for the relicensing of the Boyne Hydroelectric Project. The Department has also reviewed the response by the Michigan Hydro Relicensing Coalition (MHRC) that was provided to you via letter and filed with the Commission on June 19, 2018. Overall the proposals address the information requests provided during the initial scoping meeting in 2017. We do have some specific comments on the plans.

Project Operation\Engineering

The plan proposes to review the ability to operate the project in a tighter bandwidth. By doing so provided better compliance with run of river operation and protects shoreline areas. We believe the proposal addresses most of our recommendations.

Utilizing an uncontrolled spillway helps maintain run of river operation but does not guarantee compliance with operational bandwidths under normal flow conditions or flow conditions that can be accommodated by the operational gear at the project (generation flow and spillway gates). The plan suggests that staff gauges are unnecessary. We disagree, they are a way to monitor impoundment levels and provide a verification\backup to electronic level monitoring for the impoundment. In addition, a staff gauge marked with the operating band and placed in a location clearly visible to the public allows for interested parties to determine whether the impoundment is within the proper operating band.

Bathymetric Survey

The plan as proposed should provide the maps necessary for detailed evaluation.

Flow Duration Curves

The plan suggests that flow duration curves need to be constructed with a shorter than recommended time period. The given explanation for this deviation is acceptable.

Shoreline Erosion

The plan proposal is acceptable to the Department.

Water Temperature Monitoring

The plan as proposed is acceptable for monitoring temperatures. We would like to note that we concur with the MHRC's comments regarding the purpose of the temperature monitoring. The Boyne River is a cold water stream and the purpose is to verify the ability of the project to comply with the State Water Quality Standards for cold water stream. This data will also be necessary for the application to the Michigan Department of Environmental Quality (MDEQ) when the request for a 401 Water Quality Certification is submitted.

Dissolved Oxygen Monitoring – In Stream

The plan as proposed is acceptable to the Department for monitoring DO. As noted above, the Boyne River is a cold water stream and the monitoring is to observe the ability to comply with those standards. We note this data will also be important for developing the 401 Water Quality Certification.

Dissolved Oxygen Monitoring – Impoundment

The plan as proposed is acceptable to the Department.

Aquatic Survey of the Impoundment

The plan as proposed is acceptable to the Department.

Impingement\Entrainment

The plan proposal is acceptable to the Department.

Aquatic Survey – Riverine Habitats

The majority of the plan as proposed is acceptable to the Department. We have concerns regarding the location of the upstream sampling section. This reach should be clearly above the upstream influence of the impoundment. The proposal only to conduct a mussel survey downstream of the project if the Michigan Natural Features Inventory suggests that TES species are known the vicinity is unacceptable. A survey should be conducted downstream of the project.

The Department notes that the MHRC recommended two survey reaches be surveyed upstream and two reaches downstream. While we did not make that recommendation, we do believe that additional information is always useful when completing the environmental assessment that will be produced in conjunction with this relicensing effort.

Temperature Modeling Study

The Department recommends that this study be conducted. It will answer the questions regarding stratification and any potential mitigation measure that may be implemented. Historically, temperatures below this project have been shown to exceed the State Water Quality Standards for cold water streams. If the potential to mitigate temperatures exists, it should be evaluated. Otherwise the data may confirm there is no mitigation potential.

Nuisance Plant Surveys

The plan as proposed is acceptable to the Department.

Recreation Study

The Department disagrees with the intent of the recreation study to limit review the current as built recreation facilities. The license term will be a minimum of 30 years and therefore forward looking considerations need to be made. Access to the impoundment should be part of the recreation plan for the project and the Department expects that provisions to provide access to the impoundment will be included in any new license issued for the project.

The Department appreciates the opportunity to comment. If you have any questions or need clarification, please feel free to contact me at: Michigan Department of Natural Resources, Mio Field Office, 191 S. Mt. Tom Rd., Mio, MI 48647.

Sincerely,

Kyle Kruger
Senior Fisheries Biologist
Habitat Management Unit
Fisheries Division
(989) 826-3211 x 7073

cc Kimberly D. Bose, FERC, Washington
Robert Stuber, MHRC
Amira Oun, DEQ, Lansing

Gmail

James Tiffany <jamesetiffany@gmail.com>

Profile Data

James Tiffany <jamesetiffany@gmail.com> Fri, Jun 29, 2018 at 12:45 PM
To: krugerk@michigan.gov, stuberbob@gmail.com, jdschramm@oceana.net
Cc: Mark Coscarelli <mcoscarelli@publicsectorconsultants.com>, "Sutton, Randall" <rsutton@boynemountain.com>

Gents-

Please review the e-mail below and respond as appropriate.

Thanks!

Jim

James E. Tiffany, P.E.

J.E. Tiffany and Sons, LLC
Excellence in Engineering and Construction
1707 N. 39 Road
Manton, MI 49663
(231) 735-4546
www.jetiffanyandsons.com

[Quoted text hidden]

2 attachments

Draft_Water Temp and DO Profile Sites (1).jpg
1752K

DO and Temp Profiles.xlsx
17K


BOYNE USA - APPROXIMATE SAMPLING LOCATIONS
DO AND WATER TEMP PROFILES
Site B2
Site B1
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Site B1	45 11.632 N	84 56.912 W
Site B2	45 11.755 N	84 57.097 W

6/12/2018 11:30 AM mostly sunny, 88 F

Depth	Temp C	Temp F	%DO	DO (mg/L)	Cond	pH
0	18.8	65.8	129	11.92	387.8	8.44
1	17.9	64.2	124.4	11.79	380.5	8.43
2	17.4	63.3	122.3	11.71	375.8	8.4
3	17.4	63.3	119.9	11.47	376.8	8.37
4	16.7	62.1	114.4	11.04	373.2	8.31
5	16.1	61.0	110.1	10.88	370.7	8.24
6	14.5	58.1	109.5	11.15	366.5	8.25
7	14.2	57.6	107.1	11.06	364	8.24
8	14.1	57.4	104.4	10.75	362.2	8.22
8.5	14.1	57.4	103.5	10.69	363.2	8.18

6/12/2018 11:45 AM clear, 82 F

Depth	Temp C	Temp F	%DO	DO (mg/L)	Cond	pH
0	19.7	67.5	123	11.23	398.2	8.32
1	18.8	65.8	124.7	11.59	388.8	8.42
2	18.1	64.6	125.2	11.84	385.2	8.43
3	16.8	62.2	119.4	11.58	375.9	8.41
4	16.9	62.4	119.6	11.6	374.4	8.41
5	17.1	62.8	118.4	11.59	376.5	8.4
6	16	60.8	104.6	10.12	377.2	8.33
7	16.1	61.0	101.9	10.02	376.4	8.34
8	15.6	60.1	103.8	10.31	373.5	8.36
9	15.3	59.5	95.5	9.53	370.4	8.32
10	15	59.0	90.9	9.14	372.3	8.28
11	14.8	58.6	110.8	11.24	365.1	8.39
12	14.3	57.7	116.2	11.93	359.7	8.41
13	14.2	57.6	117.6	12.02	359.8	8.39
14	14	57.2	112.3	11.49	359	8.38
15	13.4	56.1	126.3	13.11	352.1	8.44
16	13	55.4	135.4	13.97	344.6	8.49
17	12.4	54.3	123.3	13.13	343.6	8.44
17.5	12.4	54.3	53.1	5.41	346.1	8.02

6/24/2018 4:25 PM mostly sunny, 88 F

Depth	Temp C	Temp F	%DO	DO (mg/L)	Cond	pH
0	20.5	68.9	143.5	12.88	400	8.16
1	20.5	68.9	143.5	12.92	400	8.15
2	19.5	67.1	142.2	12.96	397.3	8.12
3	17.4	63.3	133	12.86	383.1	8.17
4	15.9	60.6	133.4	13.07	378.3	8.17
5	15	59.0	140.8	14.62	363	8.28
6	14.8	58.6	143.1	14.48	362.5	8.3
7	14.7	58.5	143.5	14.56	361.6	8.31
8	14.5	58.1	147.2	14.96	358.8	8.34
9	14.4	57.9	145.6	14.76	357.6	8.34

6/24/2018 4:00 PM clear, 82 F

Depth	Temp C	Temp F	%DO	DO (mg/L)	Cond	pH
0	20.8	69.4	138	12.18	402.2	8.25
1	17.2	63.0	128.6	12.25	390.2	8.19
2	16.6	61.9	128.1	12.34	377.1	8.14
3	16.1	61.0	124.6	12.27	372.5	8.13
4	15.7	60.3	125	12.59	368.7	8.17
5	15.2	59.4	125.4	12.51	360	8.16
6	14.8	58.6	114.1	11.54	362.6	8.11
7	14.7	58.5	124.8	12.78	358.1	8.15
8	14.6	58.3	125	12.48	357.7	8.14
9	14.5	58.1	117	11.89	359.9	8.12
10	14.4	57.9	118.7	12.1	360.4	8.12
11	14.4	57.9	114.8	11.75	356.9	8.1
12	14.3	57.7	116.7	11.97	358.6	8.11
13	14.3	57.7	125	12.72	361.4	8.16
14	14.2	57.6	119.5	12.31	361.5	8.14
15	14.2	57.6	109.9	11.37	357.4	8.09
16	14.2	57.6	107.4	11	355.2	8.05
17	14.1	57.4	106.8	10.96	355	8.02
18	13.9	57.0	101.6	10.5	369.1	8.04

Gmail

James Tiffany <jamesetiffany@gmail.com>

Boyne River Hydro Project P-3409 Response to Study Methods Comments

James Tiffany <jamesetiffany@gmail.com> Fri, Jul 13, 2018 at 12:49 PM
To: krugerk@michigan.gov, Bob Stuber <stuberbob@gmail.com>
Cc: jdschramm@oceana.net, "Sutton, Randall" <rsutton@boynemountain.com>, "Grice, Ed" <egrice@boynemountain.com>, Mark Coscarelli <mcoscarelli@publicsectorconsultants.com>, Jim <jmbassoc@charter.net>

Gentlemen:

Please see the attached documents.

Sincerely,

Jim Tiffany

James E. Tiffany, P.E.

J.E. Tiffany and Sons, LLC
Excellence in Engineering and Construction
1707 N. 39 Road
Manton, MI 49663
(231) 735-4546
www.jetiffanyandsons.com

4 attachments

MDNR & MHRC-Study Methods Response Letter 7-12-18.pdf
40K

July 6 conference call summary .pdf
69K

Recreation Study Response to DNR & MHRC 7-12-18.pdf
22K

Boyne Hydro Engineering Study Plan Amended 7-3-18.pdf
177K

J.E. TIFFANY AND SONS, LLC

1707 N. 39 Road, Manton, Michigan 49663 Telephone:231-735-4546

July 12, 2018

Mr. Robert J. Stuber
Michigan Hydro Relicensing Coalition
1620 High Street
Traverse City, MI 49684

Mr. Kyle Kruger, Senior Fisheries Biologist
Habitat Management Unit, Fisheries Division
Michigan Department of Natural Resources
P.O. Box 30028
Lansing, Michigan 48909-7528

Re: FERC Project No. 3409 – Boyne River Hydroelectric Project - Response to Comments on Study Methodologies

Gentlemen:

This letter serves to transmit to you responses to comments that you submitted relative to the study methodologies that we provided on June 8, 2018.

The subjects discussed are environmental, recreational and engineering studies that will be undertaken throughout the remainder of this year.

Should you have any questions or comments, please do not hesitate to contact myself or Randall Sutton.

Sincerely,

J.E. Tiffany and Sons, LLC

James E. Tiffany

James E. Tiffany, P.E.
Owner

cc: Randall Sutton, Boyne USA
Ed Grice, Boyne USA
James D. Schramm, Esq., Michigan Hydro Relicensing Coalition

Enclosures

BOYNE RIVER HYDROELECTRIC PROJECT
FERC PROJECT NO. 3409

STUDY PLAN COMMENT RESPONSE – RECREATION RESOURCES

Michigan Hydro Relicensing Coalition
Recreation Study Comments:

The Study Plan does address an assessment of tailwater based recreation. However, it does not include an assessment of impoundment and upstream-related recreation opportunities. MHRC feels that this is a serious omission that needs to be addressed.

Federal Energy Regulatory Commission (FERC) policy requires it to give equal consideration to non-developmental resources, including recreation, in the licensing of hydroelectric projects (please refer to the reference given below). There may be public recreation opportunities associated with the impoundment, which is part of the hydroelectric project and within the FERC-established project boundaries.

[Federal Energy Regulatory Commission. 1996. Recreation development at licensed hydropower projects. Division of Project Compliance and Administration, Office of Hydropower Licensing, Washington DC. 45pp.]

The recreation study plan states that since there are no public access locations upstream for launching canoes or kayaks, a portage would not serve a public access need. Reservoir access would involve major public infrastructure road development and providing access to private property that is not included in the Boyne River Project area. Boyne USA does not believe that such development requirements would be consistent with the level of recreation access that is appropriate for this Project. MHRC feels that this is a premature conclusion and does not agree with this rationale, especially for the impoundment. MHRC requests an assessment of impoundment recreation opportunities at a minimum.

Comment Response
Boyne River Hydro (Boyne) recognizes the Federal Power Act (FPA) provisions for affording equal consideration to non-developmental resources in the licensing process, as noted in the MHRC comments.

Specifically, FPA Section 4(e) states *"…for any project, the Commission, in addition to the power and development purposes for which licenses are issued, shall give equal consideration to the purposes of energy conservation, the protection, mitigation of damage to, and enhancement of, fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality."* [FPA 16USC Chapter 12 §4(e)].

In applying that equal consideration of developmental and non-developmental purposes standard to the Boyne River Hydro, it must first be recognized that the developmental potential of the

Project is reflected in its one-quarter megawatt installed capacity. The developmental purposes of the Boyne River Hydro are in-fact very limited; and it is unlikely a new Project would be constructed on the same site today. The equal consideration standard must be applied at relicensing in that context. In providing facilitated access to both sides of the one-quarter mile stretch of the Boyne River below the Project, Boyne believes its recreational opportunities not only meet, but exceed the equal consideration standard.

Suitable infrastructure that would be needed to provide public access from Dam Road just to the 80-acre reservoir would include construction of 1,650 feet of road, a portion of which would involve construction through wetlands. An initial estimate for construction of a 20' wide gravel road, the minimum we believe would be needed, is $100 per lineal foot, or a total of $165,000. An additional $40,000 is estimated for providing minimal parking, a boat launch ramp and a skid pier. In addition, critical energy infrastructure and potentially hazardous structures that are fenced off from public intrusion under the current access provisions would require extensive additional fencing for public safety and asset protection once public access was introduced to that area, the cost of which is estimated to be $7,000 to $10,000. These estimates do not include design, engineering and permitting expenses. Overall, costs to provide public access to the reservoir would easily exceed $250,000 and this construction would serve no other Project purpose.

While these costs could be further refined in the Recreation Study, Boyne does not believe they represent a realistic approach to providing public recreation at the Project, would potentially render the Project uneconomic and would result in very limited public recreation benefits.

As was discussed in the Recreation Study Plan there are no public roads that provide access to the Project or the Boyne River upstream of the powerhouse. Boyne does not believe that major public road development solely for the purpose of providing public recreation access is consistent with relicensing standards and does not believe it warrants further study.

State of Michigan – Department of Natural Resources
Recreation Study Comments:

The Department disagrees with the intent of the recreation study to limit review the current as built recreation facilities. The license term will be a minimum of 30 years and therefore forward - looking considerations need to be made. Access to the impoundment should be part of the recreation plan for the project and the Department expects that provisions to provide access to the impoundment will be included in any new license issued for the project.

Comments Response:
Boyne believes that the review and development of additional detail for existing Project recreation facilities is the typical standard for relicensing Recreation Studies. We would note that additional provisions have been made in the Study Plan for review of applicable existing State and Local governmental agency recreation plans.

In making comments relative to the draft license application, the Department can make additional recreation development recommendations if it believes they are applicable at that time. However, as outlined above in our response to the MHRC comments, Boyne believes that development of suitable public access to the Project reservoir greatly exceeds the relicensing standards and Boyne does not believe it warrants further study.

PREPARED BY:
JMB Associates LLC
James R Bernier, Principal Consultant
1709 E Lake Mitchell Dr
Cadillac, MI 49601
jmbassoc@charter.net

PSC PUBLIC SECTOR CONSULTANTS

streamside ecological services

July 9, 2018

Summary of July 6, 2018 Conference call with the Michigan Department of Natural Resources, Michigan Hydro Relicensing Coalition, James Tiffany and Sons LLC, Streamside Ecological Services, and Public Sector Consultants and

Response to the Michigan Department of Natural Resources Letter dated June 28, 2018 Regarding the Boyne River Project P-3409, Relicensing Planned Studies

July 6, 2018 Conference Call Attendees:

Kyle Kruger, Michigan Department of Natural Resources (MDNR)
Bob Stuber, Michigan Hydro Relicensing Coalition (MHRC)
Jim Tiffany, James Tiffany and Sons LLC
Aaron Snell, Streamside Ecological Services
Doug Workman, Streamside Ecological Services
Submitted by Streamside Ecological Services and Public Sector Consultants

The purpose of the call was to review and discuss the fish sampling proposal as part of the biological sampling program for the Boyne relicensing process that was proposed by Streamside Ecological Services and reviewed by MDNR and MHRC. The original mussel survey that was proposed was also discussed and clarified.

Fish Sampling –
The primary purpose of the call was to discuss the fish sampling protocol. The MHRC had previously requested four fish sampling sites; Streamside Ecological Services had proposed two sampling sites, which would achieve the same result. In its initial reply to the MHRC, Streamside Ecological Services indicated that the sampling plan essentially complies with an increase in sample size by conducting a fish survey over a relatively large area (1,000 feet of stream). The consensus opinion among Streamside Ecological Services was that the current approach (2 sites) is better than carving the two large reaches into smaller reaches. Using larger reaches also does a better job of incorporating habitat variability, which would likely become a larger effect using more and smaller reaches. MHRC initially suggested expanding the reach size for four sampling sites, but given the additional costs the group agreed that the initial proposal is satisfactory.

Mussel Survey –
Streamside Ecological and PSC's original proposal indicated that a mussel survey would be conducted in the impoundment. MHRC requested that a mussel survey also be conducted downstream below the dam site. Parties agreed that a mussel survey would be conducted in both locations.

PSC PUBLIC SECTOR CONSULTANTS

streamside ecological services

Response to the Michigan Department of Natural Resources Letter dated June 28, 2018 Regarding the Boyne River Project P-3409, Relicensing Planned Studies

Streamside Ecological Services and Public Sector Consultants reviewed and discussed the MDNR response letter dated June 28, 2018 responding to the MDNR's review of the proposed study plan. It was agreed that the issues identified in the letter mirrored those submitted previously by the MHRC and that no additional written response was necessary.

BOYNE RIVER HYDROELECTRIC PROJECT
FERC PROJECT NO. 3409

ENGINEERING STUDY PLAN

PREPARED BY
J. E. Tiffany and Sons, LLC
1707 N. 39 Road
Manton, Michigan 49663
JamesETiffany@gmail.com
231-735-4546

June 5, 2018
Amended July 3, 2018

INTRODUCTION

Boyne USA, Inc. (Boyne) is licensed by the Federal Energy Regulatory Commission (FERC) to operate and maintain the Boyne River Hydroelectric Project (FERC Project No. 3409). The existing 40-year license was issued on February 22, 1982. The current license expires on January 31, 2022. Boyne is currently working on the process of re-licensing the project.

As part of the consultation process, Boyne held a joint meeting with interested stakeholders on July 10, 2017. The consultation process allows a time frame of 60 days from the date of the joint meeting to submit comments and to request studies. Study requests were submitted by the Michigan Department of Natural Resources (MDNR) and by the Michigan Hydro Relicensing Coalition (MHRC) pertaining to engineering issues. Those requests and our approach to addressing them are considered in this document.

STUDY REQUESTS & RESULTING STUDY PLANS

MICHIGAN DEPARTMENT OF NATURAL RESOURCES STUDY REQUESTS

In their letter of August 31, 2017, the MDNR made the following recommendations and requests. A study plan description follows after each study request listed below:

1. Impoundment Water Surface Operating Range

The MDNR has made the following recommendation:

> *"The Department requests that an evaluation of the operating band be conducted. Currently the PAD indicates that the operates over a 0.82 foot operating band, from 0.24 feet below target (634.64 ft.) to 0.58 feet above target (635.46 ft.). This band is quite wide, and we recommend that an operating band of +/- 0.25 feet from the target elevation (634.88 ft.) be included in a new license. Narrowing the operating band will provide flows that closer follow inflows approximate outflows at all times. The elevation datum used to establish the impoundment elevations was not included in the PAD and should be included in the draft license application."*

In response to the request, a study will be undertaken to explore the feasibility of reducing the operating range. It is anticipated that the low water surface elevation will be similar to the current minimum. Elevations required to pass the flood events will dictate the maximum water surface elevation. Spillway rating curves will be developed that will provide the water surface elevations associated with passage of floods of various frequencies.

Extensive survey work will be undertaken in order to complete the exhibits required for the application. A datum will be associated with the exhibits. We will provide a formula for correlating the new datum with the datum that was previously used.

2. Bathymetric Survey

The MDNR has made the following request:

> *"The PAD did not include a detailed bathymetric map of the impoundment. In order to better understand the characteristics of the impoundment and how flows affect conditions within the impoundment a detailed bathymetric map should be prepared. It should have contour lines at a minimum of every 5 feet of depth. The PAD indicates the surface area, volume, maximum depth, but does not include mean depth. We are unclear how the volume was calculated without such a detailed bathymetric map."*

A complete bathymetric survey will be completed along with the other survey work that is necessary for the application. With the new survey, more detailed information about surface area, volume, maximum depth and mean depth can be provided, along with a detailed contour map.

3. Flow Duration Curves

The MDNR has made the following request:

> *"The PAD lacks monthly flow duration curves. Turbine and spillway rating curves should be developed for the project and the data used to construct flow duration curves from project operation records. These curves should be based on a minimum of 10 years of operational data. Estimated flow information will be required for temperature modeling for the project. This will allow a more thorough analysis of the annual hydrograph for the project."*

Turbine and spillway rating curves will be developed for the project. Once that work is complete, flow duration curves can be developed based on records of impoundment levels and power generation. Unfortunately, it will not be possible to base the flow duration curves on 10 years of operational data. For many years the main spillway gate passed a significant amount of water because of bad seals. There is no way to know the flow rate passing the spillway gate seals.

A new spillway gate was installed on November 4, 2016, thereby eliminating the un-measurable flow. Flow duration curves will be established based on data for the rest of 2016, all of 2017 and 2018.

4. Impingement/Entrainment Evaluation

The MDNR has made the following request:

> *"The PAD does not include a summary of the approach velocities or characteristics of the trash racks for the project. The Department requests an analysis of the flow characteristics of the power house such that the level of potential impact to aquatic resources can be evaluated. Utilization of the swimming speed and burst speed data for the various fish found in the impoundment and based on the size distribution and abundance, the potential for the number and types of fish that may be at risk for impingement or entrainment at the project can be estimated. This analysis will provide needed insight to potential mitigation for fish protection at the project."*

A study will be undertaken to determine the cross sectional flow area at the trash racks and the approach velocities. This information will be provided to the environmental consultants on the project, Public Sector Consultants. Please refer to their study methodology document for information about the impingement/entrainment evaluation.

MDNR Follow-up Comment June 28, 2018

In a follow up letter provided to the licensee on June 28, 2018, the MDNR provided the following additional comment:

> *Utilizing an uncontrolled spillway helps maintain run of river operation but does not guarantee compliance with operational bandwidths under normal flow conditions or flow conditions that can be accommodated by the operational gear at the project (generation flow and spillway gates). The plan suggests that staff gauges are unnecessary. We disagree, they are a way to monitor impoundment levels and provide a verification\backup to electronic level monitoring for the impoundment. In addition, a staff gauge marked with the operating band and placed in a location clearly visible to the public allows for interested parties to determine whether the impoundment is within the proper operating band.*

Response:
Once the proper operating band has been established and accepted, a staff gauge will be provided for the impoundment that is marked with the operating band and placed in a clearly visible location.

MICHIGAN HYDRO RELICENSING COALITION STUDY REQUESTS

In their letter of September 1, 2017, the MHRC made the following study requests.

5. Stream Gauges for Run of the River Compliance Monitoring

The MHRC has made the following request:

> *"Boyne USA currently operates the Boyne hydroelectric project in a run-of-river mode (outflow = inflow). This is the preferred method of operation by the MHRC for hydroelectric projects in Michigan. However, the MHRC feels that such operations need sound compliance monitoring, Therefore, the MHRC requests that Boyne USA conduct an instream flow study to quantify the stage-discharge relationship. This should be done for both the inflow and outflow reaches of the Boyne River. A quantified stage discharge relationship for both upstream and downstream reaches would allow Boyne USA to utilize a system of staff gauges for compliance monitoring of the run-of-river operation."*

The FERC, in a document entitled *Hydropower Primer* defines "run of the river" as

> *"A run-of-river project is a type of hydropower project in which limited storage capacity is available and water is released at roughly the same rate as the natural flow of the river (https://energy.gov/eere/water/glossary-hydropower-terms)."*

It should be noted that the dam has a fixed crest overflow spillway with no method of reducing flow over the spillway such that water can be stored for later use in power generation.

Since the new spillway gate was installed on November 4, 2016, power has been generated almost continuously with only one or two instances where the generator shut down because of a low water level.

The following equation for flow in and out of the impoundment is useful for evaluating this situation:

inflow = turbine flow + spillway flow + storage in the impoundment

Assuming that turbine flow is essentially constant then:

change in Inflow = change in spillway flow + change in storage in the impoundment

During normal flows, and unless there is a rapid change in inflow (such as during a flood event), the storage effect in the impoundment is negligible. Therefore, the equation shows that there is a natural equilibrium that is maintained between inflow and outflow.

In summary, because of the relatively small size of the generating equipment, the fixed crest uncontrolled spillway and the relatively small size of the impoundment, the Boyne River

Hydroelectric Project is truly a "run of the river" project, and as a result, an instream flow study to quantify the stage-discharge relationship and a system of staff gauges for compliance monitoring of the run-of-river operation are deemed to be unnecessary.

Michigan Hydro Relicensing Coalition
1620 High Street
Traverse City, MI 49684
July 31, 2018

Randall Sutton
Boyne USA, Inc.
1 Boyne Mountain Road
Boyne Falls, MI 49713

Re: Boyne River Hydroelectric Project P-3409

Dear Mr. Sutton:

The purpose of this letter is to provide comment on Boyne USA's response to the input provided by the Michigan Hydro Relicensing Coalition (MHRC) and the Michigan Department of Natural Resources (MDNR) regarding the planned recreation study for the relicensing of the Boyne River hydroelectric project (FERC P-3409). This response was provided to the MHRC and MDNR on July 13, 2018 via email correspondence from J.E. Tiffany and Sons, LLC on behalf of Boyne USA.

The MHRC provided recommendations for the recreation Study on June 20, 2018. MHRC requested an assessment of impoundment recreation opportunities. MDNR provided its comments on the proposed recreation Study on June 27, 2018. MDNR requested that access to the impoundment be included in any new license for this project.

In its response to these recreation study plan recommendations, Boyne USA states there are no public roads that provide access to the Project or the Boyne River upstream of the powerhouse. Boyne believes that development of suitable public access to the Project reservoir greatly exceeds the relicensing standards and Boyne does not believe it warrants further study. In its response, Boyne USA lays out a scenario of intensive recreation development that is in its opinion, cost-prohibitive:

"Suitable infrastructure that would be needed to provide public access from Dam Road just to the 80-acre reservoir would include construction of 1,650 feet of road, a portion of which would involve construction through wetlands. An initial estimate for construction of a 20' wide gravel road, the minimum we believe would be needed, is $100 per lineal foot, or a total of $165,000. An additional $40,000 is estimated for providing minimal parking, a boat launch ramp and a skid pier. In addition, critical energy infrastructure and potentially hazardous structures that are fenced off from public intrusion under the current access provisions would require extensive additional fencing for public safety and asset protection once public access was introduced to that area, the cost of which is estimated to be $7,000 to $10,000. These estimates do not include design, engineering and permitting expenses. Overall, costs to provide public access to the reservoir would easily exceed $250,000 and this construction would serve no other Project purpose. While these costs could be further refined in the Recreation

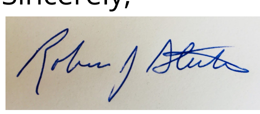
Study, Boyne does not believe they represent a realistic approach to providing public recreation at the Project, would potentially render the Project uneconomic and would result in very limited public recreation benefits."

As stated above, MHRC and MDNR simply requested that an assessment of impoundment recreation opportunities be conducted and public access to the impoundment be included in a new license. Neither organization requested the level of development that Boyne USA provided an analysis of in its July 12, 2018 response prepared by JMB Associates LLC (copy enclosed). In fact, the level of intensive development described is premature at this point and goes far beyond what the MHRC and MDNR requested. Development of facilities as described by JMB Associates LLC may very well be cost-prohibitive for this project. However, to come to the conclusion that further study is not warranted based on this intensive, high level development analysis is not acceptable to MHRC. There may very well be other options to provide public access to the impoundment at this FERC-licensed project that are not as burdensome to the licensee or the environment, and they should be explored.

Therefore, MHRC again requests that Boyne USA conduct an assessment of public recreation opportunities for the impoundment. This assessment should look at a range of development options from simple walk-in to the full blown high intensity of development described by JMB Associates LLC. MHRC believes that there are options that are likely to be more in balance with the generational capacity of the project. We hope that your upcoming FERC Form 80 recreation use information (as specified by FERC correspondence dated September 14, 2017, and due on August 31, 2018) be integrated into the Recreation relicensing study.

Please contact MHRC if you have any questions regarding our comments on the planned recreation studies as they related to public access for the impoundment.

Sincerely,



Robert J. Stuber
Michigan Hydro Relicensing Coalition
(231) 775-4321
stuberbob@gmail.com

cc: Director of Office of Energy Projects, FERC
Kyle Kruger, MDNR
Scott Hicks, USFWS
Amira Oun, MDEQ
JE Tiffany and Sons, LLC

Enclosure

RICK SNYDER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES
LANSING

KEITH CREAGH
DIRECTOR

August 2, 2018

Mr. James Tiffany
J. E. Tiffany and Sons, LLC
1707 N. 39 Road
Manton, MI 49663

RE: MICHIGAN DEPARTMENT OF NATURAL RESOURCES RESPONSE TO COMMENTS REGARDING POTENTIAL RECREATION DEVELOPMENT AT THE BOYNE RIVER HYDROPOWER PROJECT (FERC NO. 3409) ON THE BOYNE RIVER, MICHIGAN

Dear Mr. Tiffany,

The Michigan Department of Natural Resources (Department) has reviewed Boyne's response to our request for review of potential recreational development at the project prepared by JMB Associates, LLC. At this time the Department believes it is premature to discount review of recreation directed at the impoundment and declare it unnecessary or too costly. In addition, assumptions on the level of development are being presented that may not be appropriate representation of the level of development needed to fulfill recreation needs at the project.

The intention of our request was to review the potential for developing access to the project lands and waters, which includes both the tailrace and the impoundment. The response from Boyne does not accomplish this and dismisses impoundment recreation without full review or just cause.

The Commission has requested that Boyne complete their required Form 80 analysis. Though these reviews are simplistic, they are a starting point in looking at the recreation needs at the project. But we also note that they will be incomplete since access to the impoundment has not been available during the current license period.

The Department requests that the recreation facility need analysis be completed and a series of options provided to the Commission, agencies, NGOs, and public for review and discussion. This would be the best path forward in determining the level of development that will be required at the project.

The Department appreciates the opportunity to comment. If you have any questions or need any clarification, please feel free to contact me at: Michigan Department of Natural Resources, Mio Field Office, 191 S. Mt. Tom Rd., Mio, MI 48647.

Sincerely,

Kyle Kruger
Senior Fisheries Biologist
Habitat Management Unit
FISHERIES DIVISION
(989) 826-3211 x 7073

cc Kimberly Bose, FERC, DC
Amira Oun, DEQ, Lansing
Robert Stuber, MHRC, Traverse City

Appendix G STAGE 2 CONSULTATION

J.E. TIFFANY AND SONS, LLC

1707 N. 39 Road, Manton, Michigan 49663 Telephone:231-735-4546

October 4, 2019

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

Re: FERC Project No. 3409 – Boyne USA, Inc. – Boyne River Hydroelectric Project – Draft Application for Subsequent License Transmittal

Dear Secretary Bose:

Boyne USA, Inc. ("Boyne USA"), the licensee for the Boyne River Hydroelectric Project (FERC Project No. 3409) submits the attached Draft License Application for a subsequent license for the Project. The current Federal Energy Regulatory Commission (FERC) License for the Boyne River Dam expires on January 31, 2022.

By filing this Draft License Application with the Commission, Boyne USA is seeking comments from Commission staff, Federal and State resource agencies, Indian Tribes and other interested parties. The Commission's regulations require stakeholders to file all written comments on this Draft License Application with Boyne USA within 90 days of this letter.

The contents of the Draft License Application were prepared in accordance with 18 C.F.R. § 4.61, as applicable. Two volumes are contained herein and will be filed separately. One volume is suitable for public review and the other volume is comprised of Critical Energy Infrastructure Information (CEII) that is not available to the public. The content of each volume and their associated security designations is listed in the Draft Application Document Listing just after the cover sheets of the attached document.

Should you have any questions, please contact Randall Sutton at 231.549.6076 (email rsutton@boynemountain.com) or myself at 231.735.4546 (email James.E.Tiffany@gmail.com).

Sincerely,

J.E. Tiffany and Sons, LLC

James E. Tiffany

James E. Tiffany, P.E.
Project Principal

cc: Randall Sutton, Boyne USA
Ed Grice, Boyne USA
Stakeholders listed in the Initial Statement (documents provided on enclosed flash drive)

Gmail

James Tiffany <jamesetiffany@gmail.com>

Fwd: Boyne River Water Temperature Data

3 messages

Mark Coscarelli <mcoscarelli@publicsectorconsultants.com> Wed, Dec 11, 2019 at 11:03 AM
To: James Tiffany <jamesetiffany@gmail.com>

---------- Forwarded message ---------
From: **Bob Stuber** <stuberbob@gmail.com>
Date: Tue, Dec 10, 2019 at 4:01 PM
Subject: Boyne River Water Temperature Data
To: Mark Coscarelli <mcoscarelli@publicsectorconsultants.com>

Mark - I left you a voice message regarding the Boyne River downstream water temperature data that was collected in 2018. I am in the process of reviewing the draft project license application (including the Exhibit E Appendix A report prepared by PSC). The report states that the project is having an impact on water temperature below the dam (5.4F increase in July mean water temp between upstream and tailrace). Table 1 lists the minimum, mean, and max temps for both upstream and tailrace and Figure 7 graphically depicts the temperatures. However, it would be nice to see what percentage of the time between June 1 and Aug 31 that the daily mean exceeds 70F, and what percentage of the time the daily max exceeds 70F. This would help quantify the extent of the "impact on water temperature". Would it be possible to get this data? Please let me know. Thanks for your consideration and I hope all is well.

Bob Stuber

--
PSC
Mark Coscarelli
Senior Policy Fellow
Public Sector Consultants

Direct: 517-331-9444
Main: 517-484-4954
www.publicsectorconsultants.com

Mark Coscarelli <mcoscarelli@publicsectorconsultants.com> Tue, Dec 17, 2019 at 10:44 AM
To: Bob Stuber <stuberbob@gmail.com>
Cc: James Tiffany <jamesetiffany@gmail.com>, Snell <snell@streamsideeco.com>

Hi Bob, attached is the data file you've requested regarding the Boyne River and water temperature profiles. If you have any questions, or need additional information, please let me know.

Happy Holidays!

Mark
[Quoted text hidden]

Tailrace_Temp logger data - Copy.xlsb
1464K

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426
December 17, 2019

OFFICE OF ENERGY PROJECTS

Project No. 3409-031 – Michigan
Boyne River Hydroelectric Project
Boyne USA, Inc.

VIA FERC Service

Mr. Randall Sutton,
Boyne Mountain Resort Area Manager,
Boyne USA, Inc.
P.O. Box 19
Boyne Falls, MI 49713

Reference: Comments on the Draft License Application for the Boyne River Hydroelectric Project

Dear Mr. Sutton:

On October 4, 2019, Boyne USA, Inc. (Boyne USA), licensee for the Boyne River Hydroelectric Project No. 3409, filed a draft license application (DLA). Staff has reviewed the DLA and offer the comments outlined in Appendix A pursuant to 18 CFR § 16.8(c)(4). We recommend that Boyne USA incorporate the suggested modifications or provide the additional information in any final license application filed with the Commission.

If you have any questions, please contact Patrick Ely at patrick.ely@ferc.gov or (202) 502-8570.

Sincerely,

Janet Hutzel, Chief
Midwest Branch
Division of Hydropower Licensing

Enclosure: Appendix A

Appendix A

COMMENTS ON THE DRAFT LICENSE APPLICATION FOR THE BOYNE RIVER HYDROELECTRIC PROJECT NO. 3409-031

Commission staff has identified that the draft license application (DLA) did not contain some of the information that will be required by our regulations for a final license application (FLA) (sections 4.32, 4.61, and 16.8 of the Commission's regulations). In our comments, we note the areas of the DLA where more specific information will be needed for a complete FLA.

General Information

1. Section 4.32(a)(1) of the Commission's regulations requires that each license application identify every person, domestic corporation, municipality, citizen, association of citizens, or state that has or intends to obtain and maintain relevant property rights to construct, operate or maintain the project. In the FLA, please comply with the requirements of section 4.32(a)(1).

2. Section 4.32(a)(2) of the Commission's regulations requires that each license application identify and provide names and mailing addresses of: (1) every county in which any part of the project would be located; (2) every city, town, or local political subdivision in which any part of the project would be located; (3) every city, town, or local political subdivision that has a population of 5,000 or more persons located within 15 miles of the project; (4) every special purpose political subdivision (irrigation district, etc.) that owns, maintains, or uses any facilities that the project would use; (5) other interested or affected political entities; and (6) Indian tribes affected by the proposed project. In the FLA, please comply with the requirements of section 4.32(a)(2).

3. Section 4.32(a)(3)(i) of the Commission's regulations requires that an applicant notify, by certified mail, the filing of a license application to:

    a. Every property owner of record of any interest in the property within the bounds of the project, or in the case of the project without a specific boundary, each such owner of property which would underlie or be adjacent to any project works including any impoundments; and

    b. the entities identified in paragraph (a)(2) of section 4.32, as well as any other Federal, state, municipal or other local government agencies for which there is reason to believe would likely be interested in or affected by such application.

In the FLA, please comply with the requirements of section 4.32(a)(3)(i) and state that you have notified the parties listed above.

4. Section 4.32(a)(4) of the Commission's regulations requires the verification of application facts, under oath. In the FLA, please include a notarized document verifying application contents. The contents must include the applicant's name and address, and the state and county in which the application is executed.

5. Section 4.32(b)(6) of the Commission's regulations requires that an applicant publish twice a notice of its FLA, no later than 14 days after the filing date, in a daily or weekly newspaper of general circulation in each county in which the project is located. The notice must disclose the filing date of the application and briefly summarize it, including the applicant's name and address, the type of facility applied for, its proposed location, the places where information is available for inspection and reproduction, and the date by which any requests for additional scientific studies are due. The notice must also state that the Commission will publish subsequent notices soliciting public participation if the application is found acceptable for filing. Once the notices are published, please file with the Commission proof of the publications.

6. Section 4.32(c)(1) of the Commission's regulations requires that a license application contain a statement of whether or not the applicant will seek benefits under section 210 of the Public Utility Regulatory Policies Act of 1978. Please include this information in the FLA.

Initial Statement

7. On page 3 of the Initial Statement, it states that Boyne USA, Inc. (Boyne USA) will apply for a water quality certification with the state of Michigan in accordance with section 401 (a) of the Clean Water Act for the operation and maintenance of the hydropower facility. The DLA indicates that you plan to obtain a 401 WQC from the Michigan Department of Natural Resources. However, a 401 WQC from the state of Michigan will need to be obtained through the Michigan Department of Environment, Great Lakes, and Energy (Michigan EGLE).

Exhibit A

8. Section 4.61(c) of the Commission's regulations requires an Exhibit A that includes the sizes, capacities, and construction materials, as appropriate, of powerhouses, canals, intake facilities, transmission lines, and other appurtenant facilities. Exhibit A of your DLA does not provide all of the information (i.e., dimensions) that is required by section 4.61(c)(1)(viii) of the Commission's regulations to include the height of left and right embankments, the height and length of fixed crest spillway, the length of concrete discharge pipe, the dimensions of concrete stilling basin, the length of sluice gate discharge pipe, the length of steel penstocks, and dimensions of the emergency spillway area and forebay structure. In your final license application, please revise Exhibit A to include the required dimensions for the embankments, crest spillway, sluice gate discharge pipe, penstocks, emergency spillway, and forebay structure.

   In addition, Table 1of the DLA, titled "Basic Project Information", describes the fixed crest spillway to be a 35-foot-wide concrete fixed crest spillway topped with elevation adjustment boards. Prior FERC Dam Safety inspections have not observed the elevation adjustment boards on the fixed crested spillway. Please clarify whether the fix crest spillway is currently equipped with flash boards and provide a description of the history of the flash boards as well as its purpose, operation, size, and elevation. Also, please include in the project description section of the FLA, the project feature that has been referenced as the abandoned fish pond that forms the stilling basin for the auxiliary spillway.

9. Section 4.61(c)(8) of the Commission's regulations requires an Exhibit A that includes a single-line electrical diagram. The DLA references, but does not include, the required diagram. Please include a single-line electrical diagram in the FLA.

Exhibit E

General

10. Section 1, *Environmental Setting of the Project*, of the DLA refers to the results of various resource studies contained in appendices to the DLA. Section 4.61(d)(2)(i) of the Commission's regulations requires that a license application contain a description of the environmental setting of the project. Although summaries of previous studies are provided, no information is given regarding the studies conducted as part of this relicensing effort. Simply referring to study results contained in appendices to the DLA does not provide enough information in Exhibit E for an adequate understanding of the environmental setting of the

project. All relevant information contained in these referenced study reports must be summarized and integrated into the FLA's description of the environmental setting, including data, for each resource area, as required by the Commission's regulations. For example, in section 1.5, *Water Resources*, and 1.6, *Fish and Aquatic Resources*, previous studies are summarized, but summaries of the most recent studies are not presented. This section should fully describe existing conditions within the project area and incorporate the results of the studies presented in the appendices of the DLA.

Aquatic Resources

11. Section 1.5.3, *A Monthly Flow Duration Curve*, indicates that monthly flow duration curves have been developed from project operating records and are provided in Exhibit F. Although Appendix C, *Hydrologic and Hydraulic Report*, contains the referenced flow duration curves, Appendix C is currently not available to the public because it is included with Exhibit F, *Design Drawings and Supporting Basis of Design*, which contains Critical Energy Infrastructure Information (CEII). Therefore, in the FLA, please include a publicly available version of the *Hydrologic and Hydraulic Report*. Please edit the report, as necessary, to remove any CEII from public view.

12. Section 3*, Flow Duration Curves,* of Exhibit F, Appendix C, *Hydrologic and Hydraulic Report,* states that "Once the proper operating band has been established and accepted, a staff gauge will be provided for the impoundment that is marked with the operating band and placed in a clearly visible location." In the FLA, please clarify if you are proposing to install a staff gauge in the project reservoir. If so, please describe the proposed location and include a discussion of how this measure would protect or enhance the existing environment. Additionally, please include the capital and operation and maintenance costs associated with this or any other proposals (section 4.61(c)(1)(x) of the Commission's regulations).

13. Figures 9 and 10 of Appendix A, *Environmental Study Report*, of the DLA presents dissolved oxygen (DO) data for areas upstream and downstream of the project from June through September 2018. Although the methods section of the report states that the DO loggers at these locations also simultaneously recorded water temperatures, the water temperature data is not provided in the report. In the FLA, please provide the water temperature data that corresponds to the DO data shown in Figures 9 and 10.

14. Table 10 of Appendix A, *Environmental Study Report*, of the DLA presents approach velocities in front of the trashrack as well as velocities between the trashrack bars over a range of flows. This information is useful for determining the potential for entrainment and impingement at the project. However, characteristics about the trashrack (e.g., bar spacing, bar width) were not provided, nor were the methods on how these velocities were calculated or measured. Therefore, please provide a detailed description of these structures in the FLA. The descriptions should include: (1) the overall dimensions of all trash rack panels at the project; and (2) the number, width, and clear bar spacing of the individual bar racks of all trash rack panels at the project. Additionally, in the FLA, please provide a detailed description of how the velocities presented in Table 10 were determined.

Terrestrial Resources

15. Section 1.7, *Floodplains, Wetland, Riparian and Littoral Habitat*, of the DLA includes a Wetlands Inventory Map, but do not include an estimate of the acreage for each type of wetland found within the project boundary. In the FLA, please provide estimated acreage of each type of wetland at the project in written or tabular form, along with any other details describing the different wetland types at the project.

Threatened and Endangered Resources

16. Section 1.8, *Rare, Threatened and Endangered Resources,* of the DLA includes a list of state and/or federally listed species and a more detailed description of the species that are likely to be found within the vicinity of the project. However, there is no description of the current or proposed maintenance and operations actions that have to potential to affect these species and their habitats. In the FLA, please describe the known habitat for these species that is present within the vicinity and any maintenance and/or operation activities that could occur in this habitat and thereby potentially affect these species.

Recreation and Land Use

17. Section 1.96, *Non-Recreational Land Use and Management Within the Project Boundary*, of the DLA states that land use within the project boundary is private. However, it is unclear who owns these private lands or what the current use of these lands are at the project (e.g. agricultural, residential, etc.). Please provide a description of the ownership and existing use of the private lands identified within the project boundary in the FLA.

18. Section 1.9, *Recreation and Land Use*, of the DLA provides a discussion of recreation and land use adjacent to the project and in the region. However, there is no discussion of recreation use within the project boundary. Appendix B, *Recreation Resources Study Report*, states that Boyne USA provides facilitated access to both the north and south side of the tailwater, from the hydropower plant downstream to Dam Road. The *Recreation Resources Report* further states that the Pre-Application Document included an overview of existing recreation opportunities provided by Boyne USA at the project. Section 4.61(d)(2) of the Commission's regulations requires the FLA to include a section that discusses recreational uses at the project. Please provide a description of all recreation use, including formal and informal recreation sites, within and immediately adjacent to the project boundary, and identify who owns and manages each site and facility and whether the sites are inside, outside or partially within the project boundary. If a site is partially within the project boundary, please describe which amenities are inside and outside the project boundary.

19. Appendix B, *Recreation Resources Study Report*, states that an estimated $5,000 is spent annually to maintain the project tailwater access sites, including access trail maintenance, trash removal, fencing, signage, recreation use monitoring, and incidental recreation access related activities. However, in section 3.0, *Relevant Existing Information*, of the report it states that the Hydropower Development Recreation Report (Form 80) (included in Appendix B) estimated the annual cost to provide recreation access was $15,000. Further, in Exhibit A, *Estimated Annual Cost of the Project*, states that the annual cost to operate and maintain the project is $9,200. It is unclear why there is such a large discrepancy between the 2010 recreation cost estimate and the cost estimate provided in the DLA. It is also unclear if the $5,000 estimate to maintain the project tailwater access sites provided in the DLA is included in the $9,200 estimate. Please explain why the recreation cost estimate provided in the Form 80 differs from the recreation cost estimate provided in the DLA, and clarify whether or not the recreation cost estimate is included in the $9,200 annual cost estimate to operate and maintain the project in the FLA.

20. Section 1.10, *Aesthetic Resources*, of the DLA states that the project can be seen by people who access the project to fish downstream of the dam or by people who canoe or kayak through the area, portaging around the dam itself. Although fishing downstream of the dam is identified as a recreational use at the project in the *Recreation Resources Study Report* in Appendix B, there is no discussion of recreational boating (i.e. canoe or kayak) at the project or the need to portage around the dam. It is unclear from the DLA, the *Recreation Resources Study*

Report, and Form 80 how many boaters are accessing the project and where these boaters are putting in their boats and taking them out in the project area. Please provide a description of recreational boating use at the project, including the number of boaters who visit the project on an annual basis, identify where the nearest put-in and take-out boating sites are located in relation to the project boundary, and describe how boaters portage around the dam (e.g. formal trail, user-made path, boating take out and put-in locations upstream and downstream of the dam, etc.) in the FLA.

Cultural Resources

21. Section 1.11, *Cultural Resources*, of the DLA mentions that there are no sites on the National Register of Historic Places (historic properties) in the vicinity of the project and that no known archaeological subsurface testing has been conducted within the project boundary. However, there is no evidence in the DLA as to how this determination was made or if Boyne USA consulted with the Michigan State Historic Preservation Office (Michigan SHPO) or any federally recognized tribes that may have an interest in the project prior to making the determination.

    Section 4.61(d)(2) of the Commission's regulations requires the FLA to include a section that discusses the status of compliance with or consultation under the National Historic Preservation Act. Therefore, Boyne USA must consult with Michigan SHPO and federally recognized tribes that may have an interest in the project to first determine the area of potential effect (APE) of the project.[1] Then Boyne USA must consult with the parties to determine whether a cultural resource study is necessary for this project or if the project would have no effect on historic properties. Historic properties can include archaeological sites or the project itself. Please ensure the FLA contains a map and description of the APE. Also, please file the entire consultation record with Michigan SHPO or any federally recognized tribes that have an interest, as required by section 4.61(d)(2) of the Commission's regulations.

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[1] The Advisory Council on Historic Preservation defines an APE as the geographic area or areas in which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist (36 C.F.R. § 800.16(d)). An undertaking means "a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license, or approval." 36 C.F.R. § 800.16(y). Here, the undertaking is the potential issuance of a subsequent license for the project.

Exhibit F

22. Section 4.61(e) Exhibit F-Drawings of Project Works (see section 4.41 (g) of the Commission's regulations) requires, in part, an Exhibit F that includes: (1) drawings of all major structures (including plan, elevation, profiles and section views); (2) preliminary design or final Exhibit F drawings; and (3) a supporting design report that demonstrates that existing and proposed structures are safe and adequate to fulfill their stated functions. Review of Exhibit F drawings and the supporting design report indicates that the following information is lacking and must be included in the FLA and filed as CEII:

    1. References to justify the strength parameters for the embankment fill and foundation materials. Verification of the shear strength parameters selected for foundation materials with Standard Penetration blow counts (SPT-N) of 1. Also, include the geologic cross sections A through C marked in the plan view drawing Sheet 1 of Appendix A of the "Report on Geotechnical Evaluation" dated August 30, 2019.

    2. Seepage and stability analysis for the right embankment, and stability analysis for the spillway structure, and channel intake structure retaining the left and right embankment upstream slopes.

    3. Seepage and slope stability analyses for the following sections of the left embankment:

        i) Near the south abutment, where the embankment has no core wall.
        ii) At the location of boring SB#3, where a 14-foot-thick layer of very soft/loose sand mixed with organic material with SPT-N of 1 was encountered at 8 feet below the embankment crest.

    4. Design Drawings and Supporting Basis of Design Exhibit F, Appendix C; Hydrologic and Hydraulic Report refers to the Michigan EGLE watershed methodology and the results of the HEC-HMS model. The referenced reports are not included. Please provide the supporting calculations, reports, describing the rainfall depth and duration used in the analysis, Unit Hydrograph, reservoir rating curve, spillway rating curve, and tailwater rating curve.

    5. Section drawings of the auxiliary spillway, right embankment, emergency spillway, and profiles along the crest of the left and right embankment

Exhibit G

23. Section 4.61(f) of the Commission's regulations requires, in part, that an application includes an Exhibit G with a map or series of maps that complies with section 4.41(h) of the Commission's regulations to sufficiently, clearly, and legibly show the location of the project, relative locations and physical interrelationships of the principal project features, and a proposed project boundary that encloses all of the principal project features identified in Exhibit A. The DLA references, but does not include, the required Exhibit G drawing. Please include an Exhibit G drawing in the FLA.

Consultation

24. Under section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), 16 U.S.C. § 1456(3)(A), the Commission cannot issue a license for a project within or affecting a state's coastal zone unless the Coastal Zone Management agency concurs with the license applicant's certification of consistency with the state's CZMA program, or the agency's concurrence is conclusively presumed by its failure to act within 180 days of its receipt of the applicant's certification. The DLA does not provide any evidence of consultation concerning the project's consistency with the Michigan Coastal Management Program. To determine the effects of the project on Michigan's designated coastal zone, please complete the following for the FLA:

    a. consult with the Michigan Coastal Management Program on whether the project would affect the coastal zone and what steps you need to take, if any, to comply with the state's CZMA program;

    b. if the project would affect the Michigan's designated coastal zone, send coastal zone consistency certification to the Michigan Coastal Management Program, assuming the project would be consistent with the state's coastal zone management program; and

    c. file copies of the consistency certification with the Commission, indicating when the Michigan Coastal Management Program received them.

    Also, please file any correspondence the Michigan Coastal Management Program sends in response to your submitted coastal zone consistency certification.

Friends of the Boyne River
PO Box 186
Boyne City MI 49712
www.boyneriver.org

December 16, 2019

Randall Sutton, Area Manager
Boyne Mountain Resort, Boyne USA
P.O. Box 19
Boyne Falls, MI 49713

RE: Federal Energy Regulatory Commission Project No. 3409
Boyne USA, Inc. – Boyne River Hydroelectric Project

As a non-governmental agency stakeholder, Friends of the Boyne River (FoBR) was invited to comment on the draft application for the Subsequent License of a Boyne River hydroelectric dam. Our written comments follow.

FoBR's mission is to improve and conserve the environmental health and recreational quality of the Boyne River and its watershed. In keeping with this standard, we believe non-critical dams should be removed not renewed.

River dams were generally constructed 100 years ago as a way to produce energy. In 2016, the 114 year old Boyne River Hydro Dam malfunctioned to cause multiple erosion issues along with concerns about the impact on fish populations. Modern energy production looks to wind mills and solar power as more efficient means to harness clean energy. Dams are no longer being built, but instead are being removed. Michigan dam removal operations near us include the Boardman River in Traverse City and the Maple River near Pellston.

As we know, a river dam is a barrier that stops the flow of fish, aquatic species and microscopic organisms while creating a collection pond/reservoir of mucky silt. In April 2019, the Boyne Falls grist mill dam breach left a trail of silt for approximately seven miles. This silt contamination passed through the M-75 dam in the Village of Boyne Falls, on through the Boyne USA dam and finally out into Lake Charlevoix. The Boyne River, a Michigan Public Trust Waterway, was visibly cloudy for about two weeks. This kind of silt can cause serious damage to fish and aquatic insect habitat as well as future fish populations. Furthermore, the grist mill dam was a relatively small breach. When compared to what could happen in a larger impoundment breach, such as the M-75 dam or the Boyne USA dam, river damage might last for years.

Facts show that dams warm up the water. The temperature in the Boyne River is warmer below the Boyne USA dam than above it. With climate change already affecting river biology, any additional temperature increase adds a further threat to the river's ecological health.

In addition to operating the dam to stringent environmental regulations, Boyne USA invests a significant amount of time and money into license renewal. The end result maintains the dam's status quo of producing approximately 660 MWh of electricity annually. This amount of power generation appears small compared to the risk it places on a Public Trust Waterway.

FoBR's bottom line is the expectation for a Boyne River that is clean, thriving and dam free with open access to the public for future generations.

Respectfully,

Adam Kennedy

Adam Kennedy, President
231-330-2923

XC: Secretary Kimberly D. Bose, Federal Energy Regulatory Commission

United States Department of the Interior

FISH AND WILDLIFE SERVICE

2651 Coolidge Road, Suite 101
East Lansing, Michigan 48823-6360

IN REPLY REFER TO:

December 20, 2019

Mr. Randall Sutton
Boyne Mountain Resort Area Manager
Boyne USA, Inc.
P.O. Box 19
Boyne Falls, MI 49713

RE: Boyne River Hydroelectric Project (FERC Project No. 3409) Draft License Application

Dear Mr. Sutton:

The U.S. Fish and Wildlife Service (Service) appreciates the opportunity to review the draft license application for the Boyne River Hydroelectric Project. Generally the draft license application provides adequate information for the evaluation of environmental effects of the project. In addition to the draft license application, we reviewed comments prepared by the Michigan Department of Natural Resources (MDNR) and the Michigan Hydro Relicensing Coalition. As described below, we are providing several recommendations for the final license application.

The Service has a variety of roles in the Federal hydropower licensing and planning processes. Under specific circumstances, the Service has authority to issue recommendations, terms, conditions, and prescriptions to the Federal Energy Regulatory Commission (FERC) for inclusion in a hydropower FERC License pursuant to sections 18, 4(e), 10(j), and 10(a) of the Federal Power Act. 16 U.S.C. §§ 797(e); 803(a)(1). Additionally, FERC and the Service have responsibilities under the Fish and Wildlife Coordination Act (FWCA; 16 U.S.C. § 662) for consultation and full consideration of the effects of the project to fish and wildlife resources. Pursuant to the FWCA, FERC is to include conditions for the protection, mitigation, and enhancement of fish and wildlife. The FERC and the Service also have obligations under the U.S. Endangered Species Act (16 U.S.C. 1531 *et seq*.) to consider the project's effects to endangered and threatened species through an interagency consultation process.

Recommendations for the final license application:

Section 1.2 Current and Proposed Operation
Please ensure that the operation as run-of-river (ROR) is to +/- 0.25 feet from normal pool elevation (previously recommended by MDNR). This will provide more consistent ROR flows and better

protect the downstream reaches of the Boyne River. Currently the project appears to be proposed to operate with a range of +/- 0.3 feet of target elevations, which may be unnecessarily wide.

Please also include protocols and procedures to maintain ROR flows between the time the turbine shuts down and the operator can restore flows to the river. The application describes that when the low alarm point is reached, the turbine shuts down and an operator is called out, but it's not clear if the overflow section on the spillway or other approaches will be used to maintain ROR flows.

Section 1.5.3 Monthly Flow Duration Curve
Please include the flow duration curves in the license application. The application notes that flow duration curves have been developed for the project, but are not provided.

Section 1.5.6 Water Quality Data
Please include in the final license application a more thorough evaluation of options for temperature mitigation and identify the applicable strategies or mitigation that will be adopted to help address the biological impacts of water quality degradation currently resulting from the project. The water quality study shows that the impoundment does have a significant effect on stream temperatures for portions of the summer. The temperature data for the impoundment shows what appears to be stratification (a 10°F differential between the top of the impoundment and the bottom) suggesting there may be opportunities to reduce the downstream temperature impacts.

Section 1.5.7 Other Physical and Chemical Parameters
Please include in the final license application a more complete characterization of the fluvial geomorphological changes resulting from the project. For example, a comparison of the changes in channel dimensions (width x depth), bed material composition (coarsening or fining) and other signals of channel adjustments or instability (laterally and/or vertically) resulting from diminished sediment transport due to the upstream impoundments sequestering the natural bedload and suspended sediments. In the draft license application, in the upstream sampling location "significant accumulation of sediment and organic materials were noted." The degree of disruption of sediment transport by the impoundment is important to more fully describe in the final license application as this is important for evaluating the project's environmental effects. Sediment transport is significant for aquatic organisms as their distribution and abundance will be driven by a suite of related parameters including depth, substrate stability and penetrability, current velocity, temperature, nutrient availability, water quality, and refuge from predation.

Section 1.6. Fish and Aquatic Resources
Please use the MDNR sampling of the North Branch of the Boyne River in 2015 to represent the upstream project conditions in the final license application. Results of this sampling show a typical coldwater fish community (e.g., brook and brown trout, sculpins). The results of the upstream site fish community sampling for the draft license application appears to more significantly reflect the privately managed fish stocking that occurs at this site.

Please also note in the final license application that downstream of the project the fish community should be characterized as coolwater species generally with some coldwater anadromous fish (e.g., juvenile steelhead and salmon, spawning adults). As noted in the draft license application, the stocked trout downstream are not representative of the fish community supported by the current water quality. The upstream and downstream stocking may mask to some degree the dissimilarity in fish communities actually resulting from the operation of the project (e.g., MDNR 2015 sampling vs. downstream of the dam).

Please include in the final license application the specific information on how the average velocity over various flows was calculated to determine that turbine intake flows and fish swimming speed supports that fish in the impoundment can escape entrainment. Please also include the data to show the matrix of flows across the face of the trash racks.

Lastly, we recommend the final license application address the topic of providing for fish passage. Currently, the draft license application only notes that the dam blocks fish passage.

1.8. Rare, Threatened, and Endangered Species
For the discussion of the northern long-eared bat, it is not clear why the draft license application references a 2016 on-line account of a delay in the construction of the first phase of the Boyne Valley Trail. We recommend the final application discuss the potential for northern long-eared bat habitat to occur within the project area and for the species to be affected by project operations (e.g., cutting trees in or around the impoundment, transmission line maintenance, etc.). If potentially suitable habitat is present, we recommend the final application also describe the measures the applicant intends to use to avoid or minimize potential adverse effects to the northern long-eared bat (e.g., conduct tree removal activities outside of the northern long-eared bat pup season (June 1 to July 31) and/or the active season (April 1 to October 31)). Under section 7 of the ESA, a federal agency must consult with the Service if their action (e.g., licensing) may affect a listed species. The FERC may choose to complete section 7 consultation under the streamlined consultation process for this species by using the Determination Key that is available through our Information for Planning and Consultation website (https://ecos.fws.gov/ipac).

1.9. Recreation and Land Use
Supporting wildlife-based recreational opportunities is an important aspect of helping to offset the public impacts to fish and wildlife resources from a hydropower facility. The impacts to wildlife and fish habitat connectivity and the resulting reduced productivity for wildlife and fish resources can directly impact the public; those public impacts can be ameliorated to some degree by providing adequate public access and facilities to both the hydropower impoundment and areas immediately downstream of the hydropower facility.

We recommend that a parking area and appropriate facilities, be included in the project boundaries and part of the license. Based on the amount of public use described in the draft license application, it appears there should be parking for at least 30 vehicles, with at least 2 parking spaces that meet Americans with Disabilities Act standards. This parking area should also provide sanitary facilities.

We have reviewed FERC's comments submitted to Boyne on December 17, 2019. We note they included a number of data requests and the need for further details regarding aspects of the recreational facilities and project boundaries. This information will be critical for developing the final license application.

We appreciate the opportunity to review the draft license application. Please let me know if you have any questions or need additional information, my e-mail: Scott_Hicks@fws.gov and direct phone: (517) 351-6274.

Sincerely,

Scott Hicks
Field Supervisor

cc: Kyle Kruger, MDNR
Patrick Ertel, MDNR
Amira Oun, MDEQ
Robert Stuber, MHRC

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES
LANSING

GRETCHEN WHITMER
GOVERNOR

DANIEL EICHINGER
DIRECTOR

December 26, 2019

Mr. Randall Sutton
Boyne Mountain Resort Area Manager
Boyne USA, Inc.
P.O. Box 19
Boyne Falls, MI 49713

RE: COMMENTS BY THE MICHIGAN DEPARTMENT OF NATURAL RESOURCES FOR THE DRAFT LICENSE APPLICATION SUBMITTED FOR THE BOYNE RIVER HYDROPOWER PROJECT (FERC NO. 3409) ON THE BOYNE RIVER, MICHIGAN

Dear Mr. Sutton,

The Michigan Department of Natural Resources (Department) has reviewed the draft application for license (DLA) submitted by Boyne USA (Boyne) for relicensing the Boyne River Hydropower Project (project). Overall the Department found the application provided a good background for the project. The general geographic and socioeconomic summaries characterized the vicinity of the project well. We did have concerns regarding some of the fish community analysis, water quality monitoring result, and the recreation study conclusions. We have the following comments and request additional information be included in the final license application (FLA):

1. **Environmental Setting of the Project**

Section 1.2 Current and Proposed Operation:

We agree with the proposed operation as run-of-river (ROR) for the project. That will provide for the most appropriate hydrograph for the downstream reach of the river. In the description of the high and low alarm points, it appears that the project is proposed to operate with a range of +/- 0.3 feet around normal pool elevation (636.59 NAVD 88). We believe this range is too wide and the project should be operated with a maximum bandwidth of +/- 0.25 feet from target elevation. This will provide more consistent ROR flows and better protect the downstream reaches of the Boyne River. This section describes that when the low alarm point is reached, the turbine shuts down and an operator is called out. There does not appear to be any method to maintain ROR flows between the time the turbine shuts down and the operator can restore flows to the river. We note that there is an overflow section on the spillway, but we are unsure that during the periods when the turbine is shut down it will provide continued ROR flows to the tailrace.

Section 1.5.3 A Monthly Flow Duration Curve

The application notes that flow duration curves have been developed for the project, but have not been provided to the agencies or MHRC. They are listed as being included in Exhibit F, but Exhibit F has been listed as CEII and not provided. Please provide the flow duration curves and a copy of the hydrologic study for the project.

Section 1.5.8 Data with Respect to Existing Lake

The application listed average head at the project as 32.7 feet and the maximum depth of the impoundment as 19 feet. There is not a significant power canal present at the project. What is the reason for this differential?

2. Description of Expected Environmental Impacts from Proposed Construction or Changes in Operation

This section notes that the Department requested a reduced operating range for the impoundment to "0.25 feet or less." and indicates this is addressed in Exhibit F, however Exhibit F was not provided due to being listed as CEII.

Appendix A

The general characterizations for the community appear to be reasonable for the general character of the stream and size of the Boyne River and knowing the dam prevents fish below the dam from moving upstream past the impoundment. The Department has limited information regarding the upstream communities (the impoundment and river upstream of the impoundment) and therefore these surveys have provided additional important information to our understanding of the Boyne River system. The assemblage sampled downstream is consistent with Department records and observations. The fish sampled in the impoundment are as noted typical species for lacustrine environments in the northern Lower Peninsula. We too were intrigued that that bluegill were absent in the sampling for the impoundment fishery. However, we have no reason to suspect they were missed in the sampling. The upstream fluvial fish sampled do appear to be influenced by the stocking which is taking place on that reach of the river and details about the fish may not reflect what would be expected in the age/size structure if it were only naturally reproducing fish. The Department has some information from survey work further upstream on the North Branch of the Boyne River that may be a better representation for the expected fish assemblage. It may be useful information to be included in the FLA.

The water quality study shows that the impoundment does have a significant effect on stream temperatures for portions of the summer. There can be in excess of 5°F between the temperatures inflowing to the impoundment and in the tailrace. The data also shows that the impoundment affects the daily temperature variance and compresses that cycle in the tailrace causing especially higher night time temperatures than would be expected without the impoundment. The environmental study report indicates that given the small size of the impoundment, high turnover rate, and the withdrawl zone reaching the full depth of the impoundment, there is no potential for any temperature mitigation. We request that this conclusion be revisited. The temperature data for the impoundment shows what appears to be stratification. If the withdrawl zone did extend to the full depth of the impoundment, we believe we would not see the 10°F differential between the top of the impoundment and the bottom. There may be some recharge in the impoundment and the potential for some limited relief during the hottest portions of the summer. While the data collection ran into issues with dissolved oxygen (DO) monitoring at the upstream location, it appears that DO is not a major issue of concern at this project.

The effects on the water quality at the project is influencing the conditions downstream. It appears that natural reproduction of salmonids is limited. And the invertebrate community may be affected as well. The diversity shown in the Procedure 51 sampling showed slightly lower numbers downstream than upstream. While the charts show what the temperature trends were, the actual data was not provided. There is no comparison of how much of the time the project is actually out of compliance with temperature standards for coldwater streams. This data should be included with the FLA.

The DLA provides a summary of the velocities for the intakes and a review of potential impingement and turbine entrainment and mortality for fish present in the impoundment. While an average number over various flows is provided, there is no specific information on how that velocity was determined or the data showing the matrix of flows across the face of the trash racks over the full range of flows. This data should be provided in the FLA.

The inventory of terrestrial plant species along the transmission corridor reflects a number of introduced species that can be problematic. A proposal for vegetation management on project lands should be included in the FLA.

Recreation Resources Study Report (RRSR)

The RRSR for the Boyne Project summarized the currently available facilities and observed use at the project for facilities as they currently exist. The description for the parking in the RRSR includes lands outside of the project boundaries and therefore does not allow it to be included as part of the project's recreational development under the license and would be outside the preview of the Commission. Any facilities, including parking that need to be available as part of the project recreation facilities must be included in the project boundaries and part of the license. The RRSR indicates as many as 49 vehicles were observed in the area. The use at the project is clearly significant. Therefore, we restate our recommendation that a parking area should be provided as part of the recreation facilities for the project. There should be parking for at least 30 vehicles, with at least 2 parking spaces that meet ADA standards. This parking area should also provide sanitary facilities (vault toilet or porta-john).

The Department recommends access be provided to the impoundment. We have no objection to the facilities being small and rustic in nature. We suggest that at a minimum the impoundment access should include an ADA accessible shore fishing or fishing pier opportunity and at a minimum a canoe\kayak carry down launch site. Parking for at least 4 vehicles with 1 ADA compliant spot should be included.

The RRSR characterizes the impoundment fishery as minimal and only small warmwater fish that have little attraction for anglers and therefore discount the value of the opportunity that would be provided. We believe this characterization is incorrect and that there will be interest by the public to utilize such facilities.

The RRSR implies that the Charlevoix Count recreation plan does not include any plan or need for expansion of recreational opportunity. We disagree as it states under Goal 2, in the Charlevoix County 2015-2019 Recreation Plan, has one Objective: Improve access to recreation opportunities throughout the County. The first action listed under that objective is "Encourage the acquisition and development of recreation facilities in areas that are underserved." [This is found on page 54 of the plan]. It further states: "The publicly owned waterfront lands are being used for either recreational purposes, or transportation (road right-of-ways). Road end parcels, although small, help to meet the high demand for access to water bodies in the County. ***A number of access sites open to the public in the past are no longer available*** [emphasis added]. Care must be taken to ensure the availability of existing access sites in the future." [page 69]. We believe that Charlevoix County would value additional recreational opportunities.

The Department has also reviewed the Commission's comments submitted to Boyne on December 17, 2019. We note there are numerous data requests included in those comments and further details regarding aspects of the recreational facilities and project boundaries. This information will be critical for developing the FLA and comments on the FLA.

The Department appreciates the opportunity to provide comments on the draft license application for the Boyne Project. If you have any questions or need clarification, please feel free to contact me at: Michigan Department of Natural Resources, Mio Field Office, 191 S. Mt. Tom Rd., Mio, MI 48647.

Sincerely,

Kyle Kruger
Senior Fisheries Biologist
Habitat Management Unit
Fisheries division
(989) 826-3211 x 7073

cc Kimberly D. Bose, FERC
Bob Stuber, MHRC
Scott Hicks, USFWS
Amira Oun, EGLE
Patrick Ertel, MDNR

Michigan Hydro Relicensing Coalition
1620 High Street
Traverse City, MI 49684

Telephone (231) 775-4321

Randall Sutton
Boyne USA, Inc.
1 Boyne Mountain Road
Boyne Falls, MI 49713

December 27, 2019

Re: Boyne River Hydroelectric Project (FERC Project No. 3409) Draft License Application

Dear Mr. Sutton:

The Michigan Hydro Relicensing Coalition (MHRC) has reviewed the draft license application (DLA) for the Boyne USA hydroelectric project on the Boyne River. Generally, the DLA provides adequate information for the evaluation of environmental effects of the project. However, MHRC has some specific concerns related to the DLA that need to be addressed in the final license application (FLA). The biggest MHRC concerns relate to the project's effect on downstream water quality (temperature) and associated aquatic communities, and the project's proposed recreation management. These concerns are discussed in detail below.

- Water quality [temperature] - based on data presented in the DLA, the Boyne hydroelectric project is warming the water temperature of the downstream Boyne River. The midsummer mean water temperature upstream of the project was 62.4F, consistent with the "cold" classification given to it. However, the project warms the Boyne River significantly as the 2018 July average water temperatures were 5.4ºF warmer downstream of it. These warming trends are consistent with historical monitoring described in the DLA.

  Given that the Boyne River is a State designated trout stream (coldwater classification), it has an associated water quality standard of 68ºF maximum for the summer months. The DLA discloses that water temperatures exceed this benchmark below the project. Thus, it is erroneous to state that the fish community downstream of the project is meeting coldwater standards (DLA Exhibit E, Appendix A Environmental Study Report Table 15). In addition, the DLA does not quantify the amount of time that the project is out of compliance with this coldwater standard of 68ºF. This omission needs to be rectified in the FLA (e.g., occurrence of measurements above 68ºF expressed as a percentage of total number of measurements during June - August).

  > [**Note**: 2018 water temperature data from the tailrace was provided to the MHRC upon request in mid-December, 2019. Based on initial examination, it appears the tailrace water temperatures exceeded the benchmark 68ºF approximately 15-20 percent of the time between June 1 and August 31, 2018. However, this needs to be verified by the licensee and incorporated into the FLA.]

  The DLA also states that below the dam peak daily water temperature averages approximately 75°F in the summer months with a few days reaching 80°F for brief periods. It goes on to say that "the State has found that trout still seem to thrive above and below the dam despite the high summer temperatures. This is likely due to the excellent river habitat and much cooler nighttime temperatures." The MHRC disagrees with this characterization. It is the MHRC position that warming from the project has an adverse effects on the aquatic communities of the Boyne River. As described in the DLA, the Boyne River fish population shifts from an upstream coldwater community to a coolwater-warmwater community in the impoundment to a cool community below the hydro-electric project. As a result, the downstream trout population is impaired and heavily dependent on stocking to maintain it (certainly not "thriving"). The project is also affecting macroinvertebrates as the downstream community is less diverse than upstream. Finally, as pointed out in the DLA, physical habitat based on the Procedure 51 sampling is better upstream than downstream. These facts needs to be reflected in the FLA. It is also the position of the MHRC that the FLA needs to identify measures that offset and/or mitigate these adverse effects on water quality and aquatic communities. The potential measures should include re-examination of using colder hypolimnetic water from the impoundment. If demonstrated to not be feasible, other mitigation need to be proposed in the FLA.

- Fish communities - related to any analyses of the project's effect on water quality and associated fish communities, the MHRC has concerns with the upstream and downstream fish community characterizations.
  - Upstream - as stated in the DLA, the results of the upstream site fish community sampling are not comparable to other sites along the Boyne River. The numbers and sizes of trout are atypical, being influenced by the privately managed fish stocking that occurs at this site. As an alternative, the Michigan Department of Natural Resources (MDNR) sampled the North Branch of the Boyne River in 2015. Results of this sampling show a typical coldwater fish community (brook and brown trout, sculpins). MHRC recommends that this data be used to represent the upstream project conditions in the FLA.
  - Downstream - the FLA needs more emphasis on the fact that the trout component of the fish community is heavily dependent on stocking to maintain it. Without this stocking, it is likely that the fish community would be predominated by coolwater species and some coldwater anadromous fish (e.g., juvenile steelhead and salmon, and spawning adults).

- Recreation use and needs - FERC policy requires that it to give equal consideration to non-developmental resources, including recreation, in the licensing of hydroelectric projects. The Recreational Resources Study Report (RRSR; DLA Exhibit E, Appendix B Recreation Study Report) summarized the existing available facilities and current use at the project. In the DLA, Boyne USA proposes to carry the recreation status quo forward (no change to tailrace situation, no public access to impoundment). MHRC does not feel that this meets the intent of FERC policy for public recreation opportunities.

  The RRSR implies that the Charlevoix Count recreation plan does not include any plan or need for expansion of recreational opportunity. The MHRC respectfully disagrees as the Charlevoix County 2015-2019 plan has a stated objective to improve access to recreation opportunities throughout the county. MHRC feels that the public (including Charlevoix County) would be best served through additional recreational opportunities such as moving beyond the status quo at the Boyne hydroelectric project. Comments specific to respective tailrace and impoundment areas are given below.

- Tailrace (downstream) - the RRSR description for parking includes lands outside of the project boundaries and therefore does not allow it to be included as part of the project's recreational development under the license (thus, not subject to the purview of FERC). Any facilities that need to be available as part of the project recreation facilities must be included in the project boundaries and part of the license. Therefore, the FLA should include proposed changes to project boundaries to include recreation facilities that are deemed necessary for the public good over the next 40 years. The RRSR describes as many as 49 vehicles observed in the area downstream of the project, a significant level of use. MHRC is in agreement with the MDNR recommendation that the FLA should include a parking area off of Dam Road as part of the recreation facilities for the project. Per the recommendations of the MDNR (and U.S. Fish and Wildlife Service), this area should accommodate at least 30 vehicles, with at least two parking spaces meeting ADA standards. Also given the level of use documented in DLA, this downstream parking area needs to provide sanitary facilities (vault toilet or porta-john).

- Impoundment - it is the position of the MHRC that the FLA provide public access to the impoundment. MHRC feels that the cost of developing public access that is described in the RRSR represents intensive, high level development ("major public use infrastructure"). This goes beyond the expectations of the MHRC. MHRC concurs with MDNR that any facilities developed as part of the FLA for public access should be small and rustic in nature. The MHRC also concurs with the MDNR recommendation that the access should include an ADA accessible shore fishing or fishing pier opportunity, and simply a carry-down launch site to accommodate small watercraft (canoe\kayak\small boat). Parking for at least four vehicles with one ADA compliant spot should be included. The FLA should include proposed changes to project boundaries that are necessary to include these recreation facilities for the public good over the next 40 years.

  The RRSR also characterizes the impoundment fishery as minimal with only small warmwater fish that have little attraction for anglers, therefore discounting the value of the opportunity that would be provided. The MHRC finds this to be in direct contrast to how the impoundment ("Kircher Pond") is described at the Boyne Outfitters' website: "At the end of the Preserve is 80 acre Kircher Pond. ***With its fantastic warmwater opportunities for scrappy smallmouth bass and voracious northern pike, you have some of the best private water in the Midwest.***" [emphasis added; https://www.boyneoutfitters.com/guide-trips/everett-kircher-preserve]. The

MHRC feels that if it can be touted as worthy of significant expenditure to access (e.g., $600 per day), it is certainly merits access to the general public.

The MHRC feels that maintaining the status quo for the impoundment as described in the DLA RRSR represents what is essentially privatization of recreation opportunities at a publicly FERC-licensed hydroelectric project. Therefore, it is the MHRC position that the FLA needs to provide public access at the impoundment to best serve the public interest, rather than continuing to limit access to this resource for the private commercial gain of Boyne USA (through Boyne Outfitters).

Finally, MHRC has reviewed the FERC's comments on the DLA submitted to Boyne USA on December 17, 2019. MHRC notes there are a number of data requests included in those comments and further details regarding aspects of the recreational facilities and project boundaries. This information will be critical for developing the FLA.

In addition to our comments on water quality and recreation management, MHRC offer the following recommendations for the FLA regarding project operations, shoreline erosion, temperature modeling, impingement, and non-native invasive species.

- Operations - the DLA states that run-of-river operation would be based on maintenance of the impoundment headwater at a defined, fixed level. However, the operating band of -0.3 feet to +0.52 feet around this fixed is larger than the +/- 0.25 ft recommended by MDNR. The +/- 0.25 ft operating band needs to be adopted in the FLA and made a requirement of the new license to meet the intent of "run-of-river".

- Shoreline erosion - treatment of the erosion site in the impoundment (Exhibit E, Appendix A Environmental Study Report Figure 6) was not identified. Stabilization recommendations should be developed for the FLA.

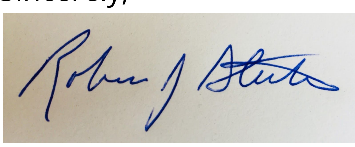
- Impoundment bathymetry and temperature modeling - MHRC questions the DLA conclusion that the volume of cold water in the impoundment is insufficient to provide a source of cooling water for downstream waters. The temperature data for the impoundment shows what appears to be stratification (cool water in the hypolimnion). If the withdrawal zone for flows through the project did extend to the full depth of the impoundment, the 10°F differential between the surface of the impoundment and the bottom probably would not be occurring. There may be some re-charge in the impoundment and the potential for some relief during the hottest portions of the summer. MHRC requests that the conclusion that there is insufficient cold water in the impoundment to mitigate downstream warming be re-examined in the FLA.

- Turbine entrainment and impingement - the DLA stated that analysis of turbine intake flow data and fish swimming speed concluded that fish species found in the impoundment can escape entrainment. However, while an average velocity over various flows is provided, there is no specific information on how that velocity was determined or the data showing the matrix of flows across the face of the trash racks. MHRC concurs with MDNR that this information should be provided in the FLA.

- Non-native invasive species (NNIS) - narrowleaf cattail is the only non-native aquatic plant species that was documented to occur in the impoundment; the species is considered to be quite invasive. Recommendations for management should be developed for the FLA. Also, the majority of terrestrial plant species found in the transmission corridor are introduced and it would be desirable to see some management proposed in the FLA to address those that are considered to be invasive.

Thank you for providing the MHRC the opportunity to review the DLA and provide recommendations for the FLA. In summary, the biggest MHRC concerns relate to the project's adverse effect on downstream water quality and associated aquatic communities, and the project's public recreation management and opportunities. It is the position of the MHRC that Boyne USA needs to address these adverse project effects and that the status quo recreation situation is not acceptable. Please contact me if you have any questions.

Sincerely,



Robert J. Stuber, Executive Director
Michigan Hydro Relicensing Coalition
stuberbob@gmail.com

cc: Kimberly D. Bose (FERC)
Kyle Kruger, Patrick Ertel (MDNR)
Scott Hicks (USFWS)
Amira Oun (MEGLE)
Adam Kennedy (Friends of the Boyne River)
JE Tiffany and Sons, LLC

Gmail

James Tiffany <jamesetiffany@gmail.com>

Boyne River fish data

3 messages

snell@streamsideeco.com <snell@streamsideeco.com> Mon, Jan 20, 2020 at 11:18 AM
Reply-To: snell@streamsideeco.com
To: KRUGERK@michigan.gov, "Hettinger, Heather (DNR)" <HettingerH@michigan.gov>
Cc: jamesetiffany@gmail.com, Mark Coscarelli <mcoscarelli@pscinc.com>

Hi Kyle,
I'm working on the Boyne River hydro re-licensing project. You sent a letter (December 26, 2019), to Mr. Randall Sutton at Boyne USA, indicating that DNR has some information from fisheries survey work on the North Branch of the Boyne River. I'm hoping that I can get a copy of that survey report for inclusion in our work.
Thanks,
Aaron

Aaron Snell
Streamside Ecological Services, Inc.
(616) 238-7372

Kruger, Kyle (DNR) <KRUGERK@michigan.gov> Tue, Jan 21, 2020 at 7:08 AM
To: "snell@streamsideeco.com" <snell@streamsideeco.com>, "Hettinger, Heather (DNR)" <HettingerH@michigan.gov>
Cc: "jamesetiffany@gmail.com" <jamesetiffany@gmail.com>, Mark Coscarelli <mcoscarelli@pscinc.com>, "Hettinger, Heather (DNR)" <HettingerH@michigan.gov>, "Heintzelman, Scott (DNR)" <HeintzelmanS@michigan.gov>, Bob Stuber <stuberbob@gmail.com>, "Ertel, Patrick (DNR)" <ErtelP@michigan.gov>

Hi Aaron,

I believe we can provide that. I’ve cc’d Heather Hettinger who works on those waters and hopefully she can send you that data.

Heather, please see below. Thanks.

Any questions, let me know.

KYle

[Quoted text hidden]

Hettinger, Heather (DNR) <HettingerH@michigan.gov> Tue, Jan 21, 2020 at 9:03 AM
To: "Kruger, Kyle (DNR)" <KRUGERK@michigan.gov>, "snell@streamsideeco.com" <snell@streamsideeco.com>
Cc: "jamesetiffany@gmail.com" <jamesetiffany@gmail.com>, Mark Coscarelli <mcoscarelli@pscinc.com>, "Heintzelman, Scott (DNR)" <HeintzelmanS@michigan.gov>, Bob Stuber <stuberbob@gmail.com>, "Ertel, Patrick (DNR)" <ErtelP@michigan.gov>

Aaron,

Attached are the two most recent surveys for the North Branch of the Boyne. One is from 2015 which I conducted, and the other is from 2007 at a different location which another biologist conducted. We also have a number of much older surveys where the data is not digitized, but the two I have attached are going to be the most relevant.

Let me know if you have any questions-

Heather

Heather Hettinger
Fisheries Management Biologist
Central Lake Michigan Mgt. Unit- Traverse City Field Office
231.922.6056
hettingerh@michigan.gov

Far and away the best prize that life has to offer is the chance to work hard at something worth doing...
~Theodore Roosevelt

[Quoted text hidden]

2 attachments

North Branch Boyne River 2007.pdf
1206K

North Branch Boyne River 2015.pdf
1197K

January 29, 2020

Mr. James Tiffany
J.E. Tiffany and Sons, LLC
1707 N. 39 Road
Manton, MI 49663

Dear Jim,

This memo serves to document two recent telephone conversations with staff of the Michigan Department of Natural Resources and the Michigan Hydro Relicensing Coalition to address question related to the draft FERC license application. Those contact are as follows:

1. Thursday, January 23, 2020—two members of the project team, Mark Coscarelli and Aaron Snell, participated in a 45-minute conference call with Mr. Kyle Kruger, Senior Fisheries Biologist, Michigan Department of Natural Resources (DNR), and Mr. Bob Stuber, Michigan Hydro Relicensing Coalition to discuss Michigan's 401 Water Quality Certifications and the project's effects to downstream temperatures related to a threshold of 68 degrees.

   The project team had suggested that the draft application remain unchanged on this topic, which utilized a comparison value of 67.1 F, derived from the classification system set up by Zorn (2009) and used in the water withdrawal assessment tool. Project team stated that its understanding that the Part 4 Water Quality Standard for water temperature was only for point source discharges. DNR said that they consider dams to be a point source, and that is how they are viewed in the 401 certification process. There is recent case law, in the City of Tacoma, WA, to support their position. So, we agreed that we would use the Part 4 WQS, as now described in our updated report. That is, the water temperature cannot exceed 68 F during the summer months, unless the "input" temperature, in our case the Upstream site, exceeds 68 F. In that case, the dam cannot cause a warming of the water that measures more than 2 degrees F.

2. Thursday, January 23, 2020—two members of the project team, Mark Coscarelli and Aaron Snell, participated in a 30-minute conference call with Mr. Gary Whelan, Program Manager, Michigan Department of

Natural Resources, to discuss Michigan's 401 Water Quality Certifications and the project's effects to downstream temperatures related to a threshold of 68 degrees, which is outlined in the above discussion and was further clarified by Mr. Whelan.

If you have any questions, or need additional information, please contact me at 517-331-9444.

Sincerely,

Mark Coscarelli
Senior Fellow

Enclosure

Gmail

James Tiffany <jamesetiffany@gmail.com>

Boyne River Hydroelectric Project

1 message

James Tiffany <jamesetiffany@gmail.com> Mon, Jan 6, 2020 at 3:28 PM
To: wuycheckr@michigan.gov

Ronda-

We are preparing a subsequent license application for submittal to the Federal Energy Regulatory Commission (FERC) for the Boyne River Hydroelectric Project (FERC No. 3409), located on the Boyne River in Boyne Valley Township near Boyne Falls, Michigan. The project is considered a Minor Water Power Project, being less than 5 Megawatts. I have attached a map showing the location of the project.

The FERC has asked us to determine the effects of the project on Michigan's designated coastal zone by consulting with the Michigan Coastal Management Program on whether the project would affect the coastal zone and what steps we need to take, if any, to comply with the state's CZMA program.

Please provide us with your determination as to whether to project affects the coastal zone as delineated by your agency. If you have any questions or need any additional information from me, please do not hesitate to contact me.

Sincerely,

Jim Tiffany

James E. Tiffany, P.E.
J.E. Tiffany and Sons, LLC
Excellence in Engineering and Construction
1707 N. 39 Road
Manton, MI 49663
(231) 735-4546
www.jetiffanyandsons.com

County Map-Fig 2.1.pdf
669K

BOYNE RIVER HYDROELECTRIC PROJECT

Boyne Valley Township, Charlevoix County, Michigan

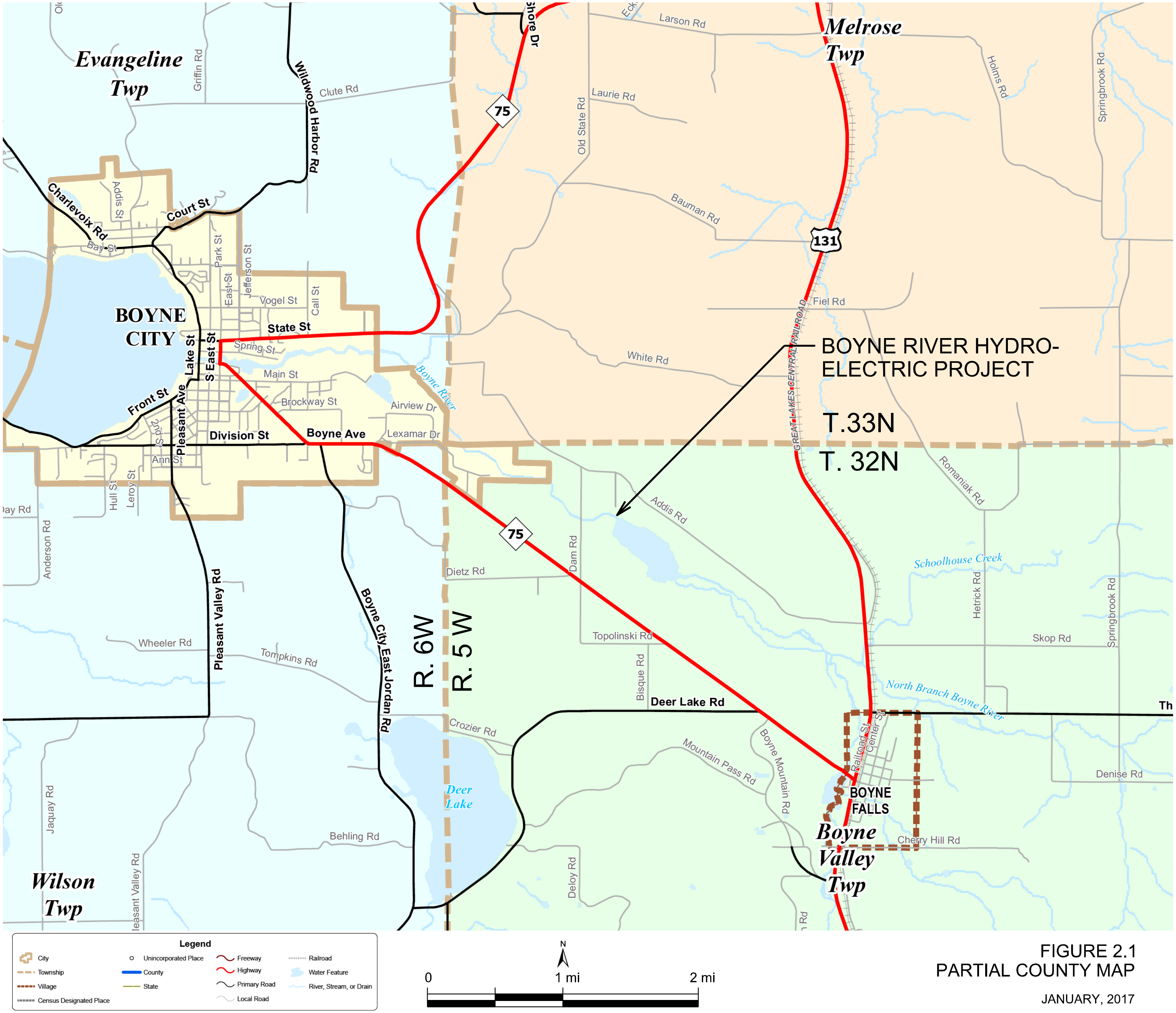


FIGURE 2.1
PARTIAL COUNTY MAP

JANUARY, 2017

STATE OF MICHIGAN

DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY

LANSING

GRETCHEN WHITMER
GOVERNOR

EGLE

LIESL EICHLER CLARK
DIRECTOR

January 27, 2020

James Tiffany
J.E. Tiffany and Sons, LLC
1707 N. 39 Road
Manton, MI 49663

Dear Mr. Tiffany:

SUBJECT: Federal Consistency Determination, Proposed Licensure for Boyne River Hydroelectric Project (FERC No. 3409), Boyne Valley Township, Charlevoix County

Staff of the Water Resources Division has reviewed this phase of the project for consistency with Michigan's Coastal Management Program (MCMP), as required by Section 307 of the Coastal Zone Management Act, PL 92-583, as amended (CZMA). Thank you for providing the opportunity to review this proposed activity.

Our review indicates that this project is located outside of Michigan's coastal management boundary. No adverse impacts to coastal resources are anticipated from this proposed activity as described in the information you forwarded to our office. Therefore, this phase of the project is consistent with MCMP.

This consistency determination does not waive the need for permits that may be required under other federal, state or local statutes. Please call me if you have any questions regarding this review.

Sincerely,

Chris Antieau
Field Operations Support Section
Water Resources Division
517-290-5732

ORIGINAL

MICHIGAN ECONOMIC
DEVELOPMENT CORPORATION

February 21, 2020

ORIGINAL

2020 MAR -6 P 4:51

KIMBERLY BOSE
FEDERAL ENERGY REGULATORY COMMISSION
888 FIRST STREET NE ROOM 1A
WASHINGTON DC 20426

RE: ER20-399 Boyne River Hydroelectric Project Application for New License, Sec. 5, 8, 9, 16, T32N, R5W, Boyne Valley Township, Charlevoix County (FERC)

P-3409

Dear Ms. Bose:

Under the authority of Section 106 of the National Historic Preservation Act of 1966, as amended, we have reviewed the above-cited undertaking at the location noted above. Based on the information provided for our review, it is the opinion of the State Historic Preservation Officer (SHPO) that **no historic properties are affected** within the area of potential effects of this undertaking.

This letter evidences the FERC's compliance with 36 CFR § 800.4 "Identification of historic properties," and the fulfillment of the FERC's responsibility to notify the SHPO, as a consulting party in the Section 106 process, under 36 CFR § 800.4(d)(1) "No historic properties affected." **If the scope of work changes in any way, or if artifacts or bones are discovered, please notify this office immediately.**

We remind you that federal agency officials or their delegated authorities are required to involve the public in a manner that reflects the nature and complexity of the undertaking and its effects on historic properties per 36 CFR § 800.2(d). The National Historic Preservation Act also requires that federal agencies consult with any Indian tribe and/or Tribal Historic Preservation Officer (THPO) that attach religious and cultural significance to historic properties that may be affected by the agency's undertakings per 36 CFR § 800.2(c)(2)(ii).

The State Historic Preservation Office is not the office of record for this undertaking. You are therefore asked to maintain a copy of this letter with your environmental review record for this undertaking.

If you have any questions, please contact Brian Grennell, Cultural Resource Management Coordinator, at 517-335-2721 or by email at GrennellB@michigan.gov. **Please reference our project number in all communication with this office regarding this undertaking.** Thank you for this opportunity to review and comment, and for your cooperation.

Sincerely,

Brian G. Gren

Brian G. Grennell
Cultural Resource Management Coordinator

for Brian D. Conway
State Historic Preservation Officer

BGG:SAT:irp

Copy: James Tiffany, J.E. Tiffany and Sons LLC

STATE HISTORIC PRESERVATION OFFICE

300 North Washington Square | Lansing, MI 48913 | 888.522.0103