EXHIBIT E

GREEN LAKE PROJECT (P7189)

APPENDIX C – STUDIES

APPENDIX C – STUDY REPORTS AND ADDITIONAL DATA

The reports in this Appendix are filed with the Federal Energy Regulatory Commission (FERC) and available on their website at:

https://elibrary.ferc.gov/eLibrary/search under Docket Number P-7189-014

STUDY REPORTS

Appendix C contains the following study reports:

Additional Study data was requested by MDEP and NMFS – the following data is included at the end of this appendix:

Ms. Kimberly D. Bose, Secretary
February 11, 2021

VIA E-FILING
Ms. Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N. E.
Washington, DC 20426

RE: Green Lake Hydroelectric Project (FERC No. 7189)
Initial Study Report

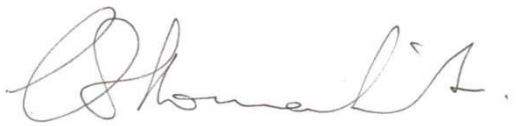
Dear Secretary Bose:

In accordance with 18 CFR § 5.15(c), the Licensee for the Green Lake Hydroelectric Project, Green Lake Water Power Company (GLWP), submits the Initial Study Report (ISR) for the relicensing of the Green Lake Hydroelectric Project (Project). The ISR includes the results of the studies completed in the first study season as well as a status update for those studies that are not yet completed.

The report was submitted on February 9, 2021. It is being resubmitted to fix some formatting errors, and to include littoral zone drawdown volume results.

Consistent with requirements under 18 CFR § 5.15, and in accordance with the Green Lake Project Process Plan and Schedule, within 15 days following the filing of this Initial Study Report (ISR) (i.e., by February 24, 2021) GLWP will hold an online meeting with relicensing participants and FERC staff to discuss the 2020 study results and status. Within 15 days following the ISR meeting, GLWP will file a meeting summary, which will include any proposed modifications to the Revised Study Plan as needed.

If you have any questions regarding the ISR, please contact me by email at caroline@greenlakewaterpower.com or by phone at (425) 553-6718



Sincerely,
Caroline Kleinschmidt
Relicensing Coordinator
Green Lake Water Power Co.

Enclosure
GLWP Initial Study Report
cc: Distribution List

Green Lake Project 7189 ISR Distribution List February 9, 2021

Federal Energy Regulatory Commission

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GREEN LAKE WATER POWER CO.

INITIAL STUDY REPORT
FOR THE GREEN LAKE HYDROELECTRIC PROJECT
(FERC NO. 7189)

Prepared by:

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February 2021

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GREEN LAKE HYDROELECTRIC PROJECT
FERC NO. 7189
INITIAL STUDY REPORT

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1.0 OVERVIEW

Green Lake Water Power Co. (Licensee) is in the process of relicensing the existing 500 Kilowatt (KW) Green Lake Hydroelectric Project (Project) with the Federal Energy Regulatory Commission (FERC). The Project (FERC P-7189) is located on Green Lake and Reeds Brook in Hancock County, Maine. The Licensee is not currently proposing any changes to the Project as part of the relicensing.

The Licensee is using FERC's Integrated Licensing Process (ILP) as established in regulations issued by FERC July 23, 2003 (Final Rule, Order No. 2002) and found at Title 18 CFR, Part 5. The Licensee filed a Pre-Application Document (PAD) and Notice of Intent (NOI) to seek a new license for the Project on March 31, 2019. The PAD provides a complete description of the Project, including its structures, operations, and potentially affected resources.

GLWP proposed several studies to be done during the 2020 and 2021 field seasons. Significant progress has been made despite the summer being very dry. For reference, the turbine was only run during the following times in the study period:

Turbine Operation During Study Period

Start Running	Lake Level	Shut Down	Lake Level	Comments
Fall 2019	Full	4-Jun-20	6.45	Summer
11-Sep-20	5.50	23-Sep-20	4.45	Fall Drawdown
10-Oct-20	4.19	18-Oct-20	4.19	Fall Drawdown
29-Nov-20	5.04			Winter 2020/2021

Table 1-1 – Turbine Operation During Study Period

1.1 Process and Schedule

1.1.1 FERC Determination and Study Plan Modification

Consistent with requirements under 18 CFR § 5.15, and in accordance with the Green Lake Project Process Plan and Schedule, within 15 days following the filing of this Initial Study Report (ISR) (i.e., by February 24, 2021) GLWP will hold meeting with relicensing participants and FERC staff to discuss the 2020 study results and status. Within 15 days following the ISR meeting, GLWP will file a meeting summary, which will include any proposed modifications to the Revised Study Plan as needed.

FERC staff, or any relicensing participant, may file a disagreement concerning GLWP's meeting summary within 30 days of its issuance. This filing must set forth the basis of any disagreement with the material content of the meeting summary and propose any necessary alternative modifications to ongoing studies or new studies. GLWP will then have 30 days to respond to the disagreements and possibly propose revised study modifications or new studies. Within 30 days of the GLWP's response, any remaining disagreements will be resolved by FERC, and the Revised Study Plan will be modified, if necessary.

Any proposal to modify an ongoing study must demonstrate that the study was not conducted as described in the Revised Study Plan, as approved, was conducted under anomalous environmental conditions, or that environmental conditions have changed in a material way since the Study Plan's approval. The proposal must also explain why the study's objectives cannot be met via the approved methods and why the proposal for modification was not made earlier, or that significant new information has become available that affects the study.

If no disagreements concerning GLWP's meeting summary and proposal, if any, to modify the approved Revised Study Plan are filed within 30 days, GLWP's revised study plan will be considered approved.

1.1.2 Study Reporting Timeline through Updated Study Report Meeting

To the extent that there are any modifications to the Revised Study Plan, GLWP will conduct any remaining studies, or a second phase of existing studies, in 2021.

An Updated Study Report (USR), if applicable, must be filed with FERC no later than February 9, 2022 in accordance with the Process Plan and Schedule to provide updated study information.

1.1.3 Summary List of Studies

This ISR includes the results of the relicensing studies (as identified in the Revised Study Plan) that have been completed to date. In addition, the ISR also contains a status update for those studies that have not yet been completed.

List of approved studies and additional data requested:

- 1 – Water Quality
- 1-1 – Impoundment Trophic State Study
- 1-2 – Impoundment Habitat Study
- 1-3 – FERC's Impoundment Temperature Study
- 1-4 – Downstream BMI Study
- 1-5 – Downstream Temperature and Dissolved Oxygen Study

- 2 – Aquatic Habitat Cross-Section and In-Stream Flow Study

- 3 – Eel Passage Survey

- 4-1 – Architectural Survey
- 4-2 – Erosion Survey

- 5 – FERC's additional data
- 5-1 – Loon counts and nests
- 5-2 – Impoundment Levels
- 5-3 – Docks and Beaches

2.0 INITIAL STUDY REPORTS

2.1 Study #1 – Water Quality – Encompasses Data Requested from the Maine Department of Environmental Protection (MDEP), United States National Marine Fisheries Service (US NMFS), United States Fish and Wildlife Service (US FWS) and FERC to determine current impoundment and downstream water quality.

Photo 2-1 – On Green Lake to gather samples

The objectives of the suite of water quality studies, including impoundment trophic state, impoundment aquatic habitat, temperature and dissolved oxygen, and benthic macroinvertebrate, are to collect contemporary water quality data in Green Lake and Reeds Brook upstream and downstream of the Green Lake dam to determine whether the Project waters meet MDEP's water quality standards and maintain the structure and function of the resident benthic macroinvertebrate community.

2.1.1 Impoundment Trophic State Study 1-1:

Sampling was done in Green Lake (the impoundment), twice each month for five months from June 17, 2020 through October 19, 2020, with samples being taken from the locations called Station #1 (in the North end) and Station #2 (in the South end), as specified by MDEP and per the protocols laid out in MDEP's *Sampling Protocol for Hydropower Studies* (September 2019).

Each sampling event consisted of collecting the Secchi data, the DO and Temperature information by meter, and collecting water samples for analysis. An extended set of water samples was collected from both sites at the end of August.

The samples were all kept 'on ice' until they were delivered to the lab in Augusta (HETL) where they were consistently checked in within the ± 2 °C window.

From the DO/T profiles collected during the lake sampling, the lake was stratified during much of the summer. See graphs at 2.1.1.1

The average of the Secchi disk readings for Station #1 over the 10 events was 8.68. The average of the Secchi disk readings for Station #2 over the 10 events was 8.11. The combined average of all Secchi disk readings for both stations was 8.40 m, or 27.54 ft.

The equipment used consisted of:

1. 1 large food grade Rubbermaid container.
2. 1 10 meter epilimnetic core sample tube per MDEP specs.
3. 1 YSI Prosolo ODOT meter
4. 1 ProSolo 50 meter cable and DO/T probe.
5. 1 ProSolo 4 meter cable and DO/T probe.
6. 1 Secchi disk with viewer
7. 1 portable 12v electric fridge
8. 1 Kemmerer water sampler
9. 2 five liter, heavy duty, food safe HDPE bottles
10. Multiple set of sample bottles as supplied by HETL
11. Multiple fiberglass tape measures with metric scale on one side.

Pictures of the equipment can be seen in the Equipment Picture section (2.1.1.2)

DO & Temperature monitoring graphs for each week at each station are after these tables.

This table shows the depth the water samples were taken, the lab results for the water samples and the Secchi disk readings for Station #1for all 10 weeks.

Date	Time	Depth (m)	Alkalinity (mg/L)	Chlorophyll A (mg/L)	Color (PCU)	pH	Total Phosphorus (ug/L)	Secchi Disk (m)
17-Jun	3:00 PM	9	4	0.002	16	6.9	17	7.99
30-Jun	3:50 PM	7	4	0.002	15	7.1	11	7.70

15-Jul	3:36 PM	7	4	0.002	13	6.9	6	8.80
29-Jul	11:38 AM	7	5	0.003	13	6.9	5	7.90
12-Aug	11:59 AM	8	4	0.002	13	6.9	12	9.05
^ 26-Aug	11:57 AM	7	5	0.002	12	7.0	5	9.90
9-Sep	1:22 PM	10	5	0.002	11	6.9	4	9.17
21-Sep	12:10 PM	10	5	0.002	12	6.9	4	9.71
5-Oct	12:35 PM	10	5	0.002	11	7.0	4	9.22
19-Oct	1:01 PM	10	5	0.002	12	6.8	3	7.38
	Average	**8.5**	**4.6**	**0.002**	**12.8**	**6.93**	**7.1**	**8.68**
	Median	**8.5**	**5.0**	**0.002**	**12.5**	**6.90**	**5.00**	**8.93**
	Minimum	**7.0**	**4.0**	**0.002**	**11.0**	**6.80**	**3.00**	**7.38**
	Maximum	**10.0**	**5.0**	**0.003**	**16.0**	**7.10**	**17.00**	**9.90**

Table 2-1 – Station #1 – Base Water Samples and Secchi Disk data

^ The samples did not get to HETL within 24 hours due to weather conditions as described in section 2.1.1.1 above. They arrived within 48 hours.

This table shows the depth the water samples were taken, the lab results for the water samples and the Secchi disk readings for Station #2

Date	Time	Depth (m)	Alkalinity (mg/L)	Chlorophyll A (mg/L)	Color (PCU)	pH	Total Phosphorus (ug/L)	Secchi Disk (m)
17-Jun	5:35 PM	7	4	0.002	18	6.9	5	7.05
30-Jun	5:40 PM	7	4	0.002	15	7.0	5	7.49
15-Jul	5:14 PM	7	4	0.002	16	6.9	4	7.73
29-Jul	1:28 PM	8	5	0.003	13	6.9	4	8.85
12-Aug	2:23 PM	8	4	0.002	13	6.9	5	8.59
27-Aug	7:08 PM	10	4	0.002	11	7.0	4	8.22
9-Sep	2:55 PM	9	5	0.002	11	6.9	5	9.43
21-Sep	2:01 PM	10	4	0.002	11	6.9	4	8.83
5-Oct	2:25 PM	10	5	0.002	10	7.0	4	8.57
19-Oct	2:37 PM	10	5	0.002	10	6.8	4	6.34
	Average	**8.6**	**4.4**	**0.002**	**12.8**	**6.92**	**4.4**	**8.11**
	Median	**8.5**	**4.0**	**0.002**	**12.0**	**6.90**	**4.0**	**8.40**
	Minimum	**7.0**	**4.0**	**0.002**	**10.0**	**6.80**	**4.0**	**6.34**
	Maximum	**10.0**	**5.0**	**0.003**	**18.0**	**7.00**	**5.0**	**9.43**

Table 2-2 – Station #2 – Base Water Samples and Secchi Disk data

2.1.1.1 Weekly DO & Temp graphs

Note: these graphs may not be what you are used to, the depth scale is the X axis.

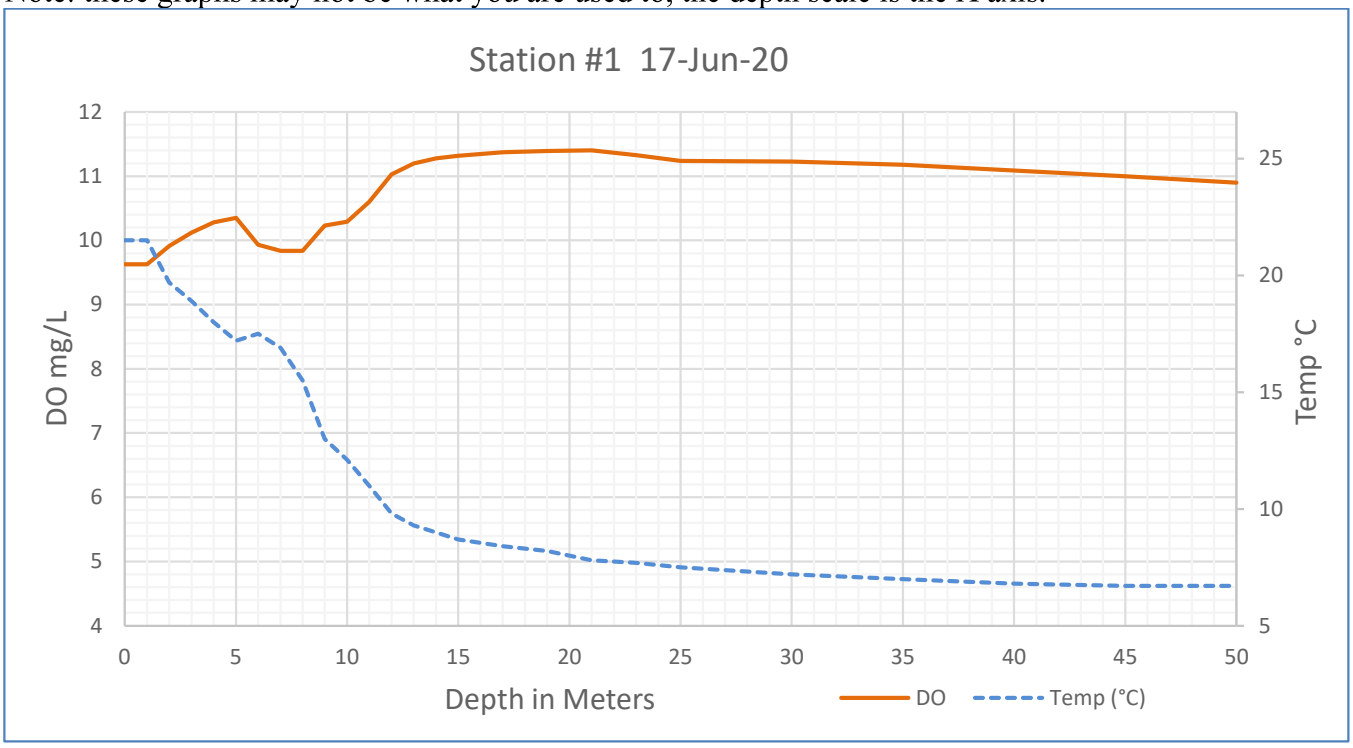


Figure 2-1 – Station #1 17-Jun-20 DO & Temp

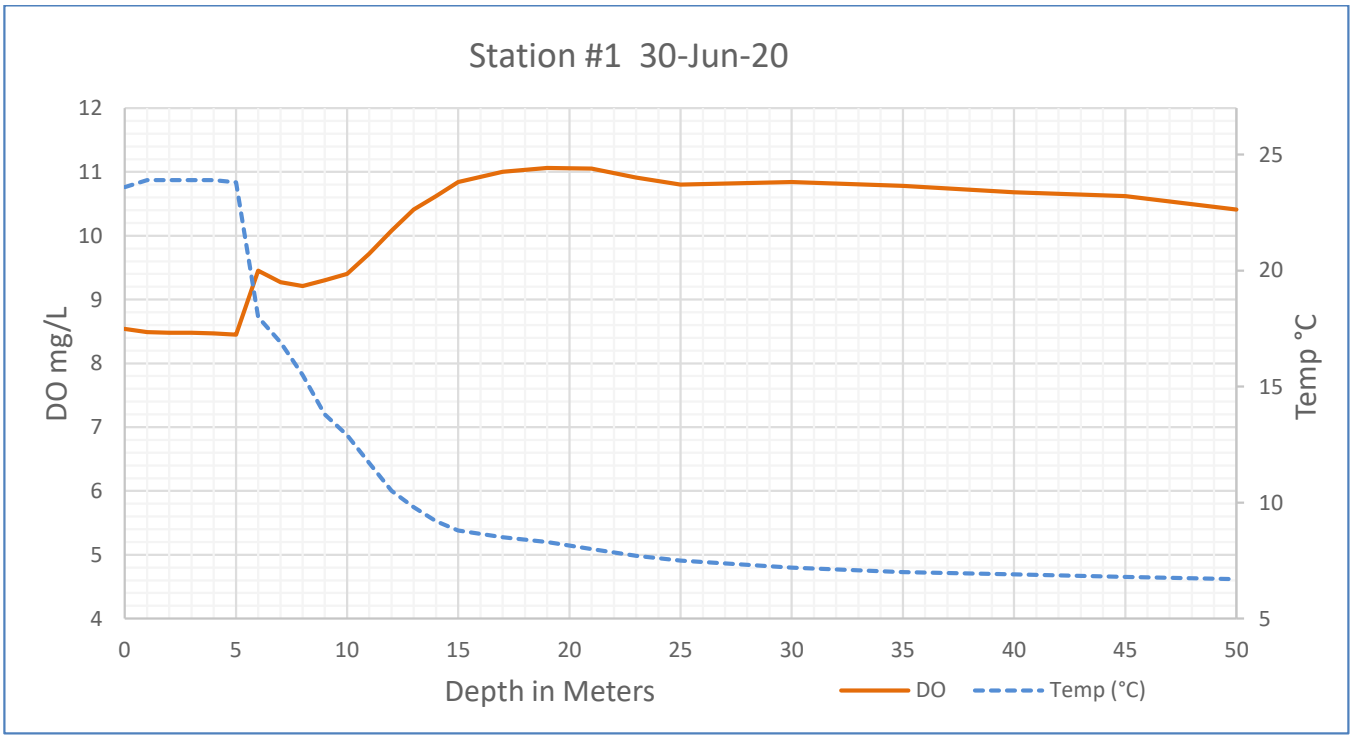


Figure 2-2 – Station #1 30-Jun-20 DO & Temp

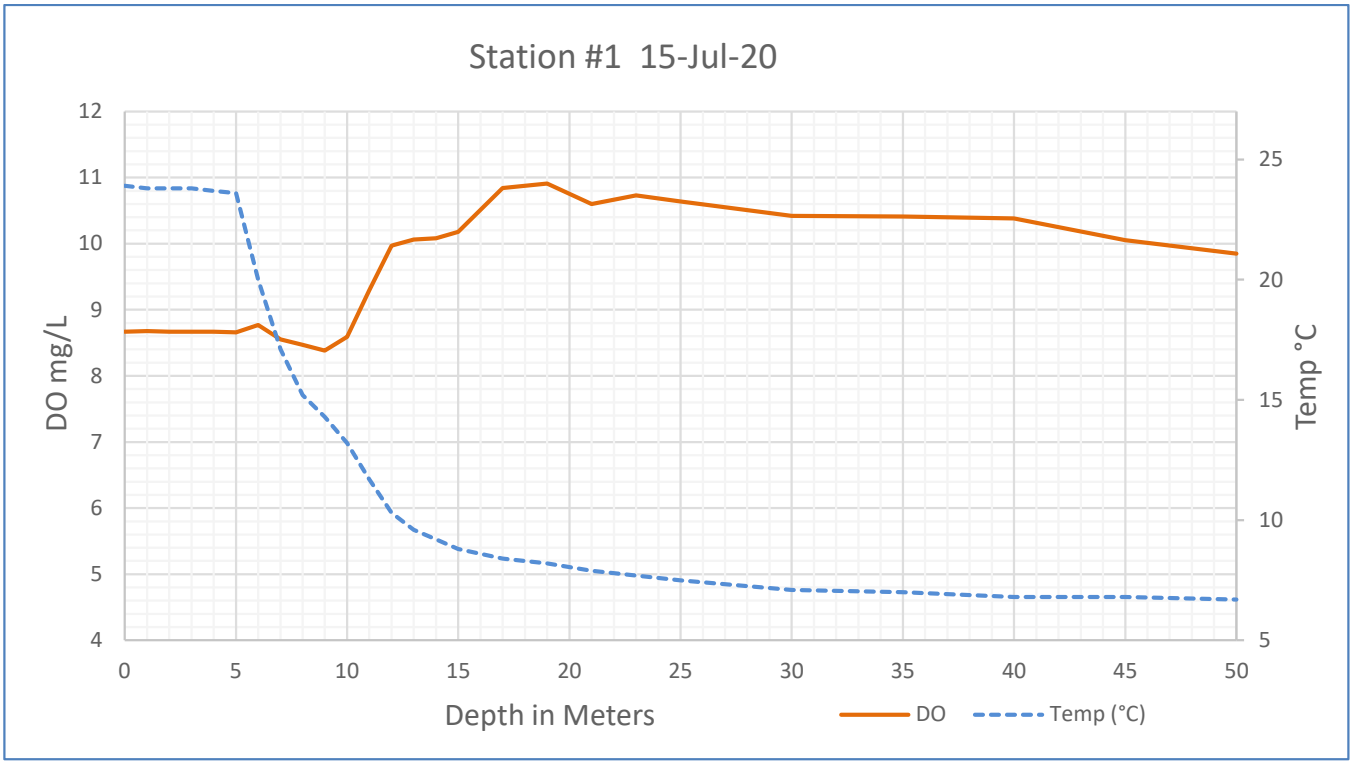


Figure 2-3 – Station #1 15-Jul-20 DO & Temp

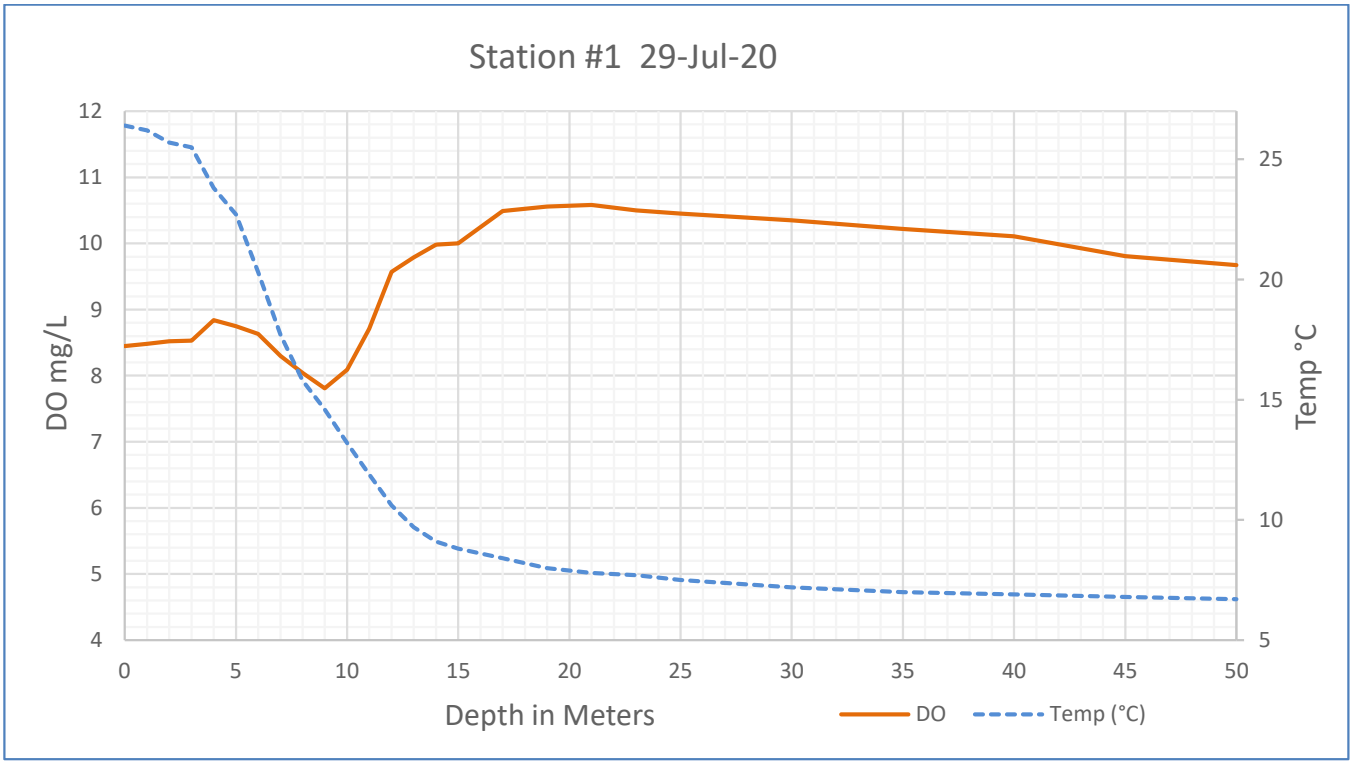


Figure 2-4 – Station #1 29-Jul-20 DO & Temp

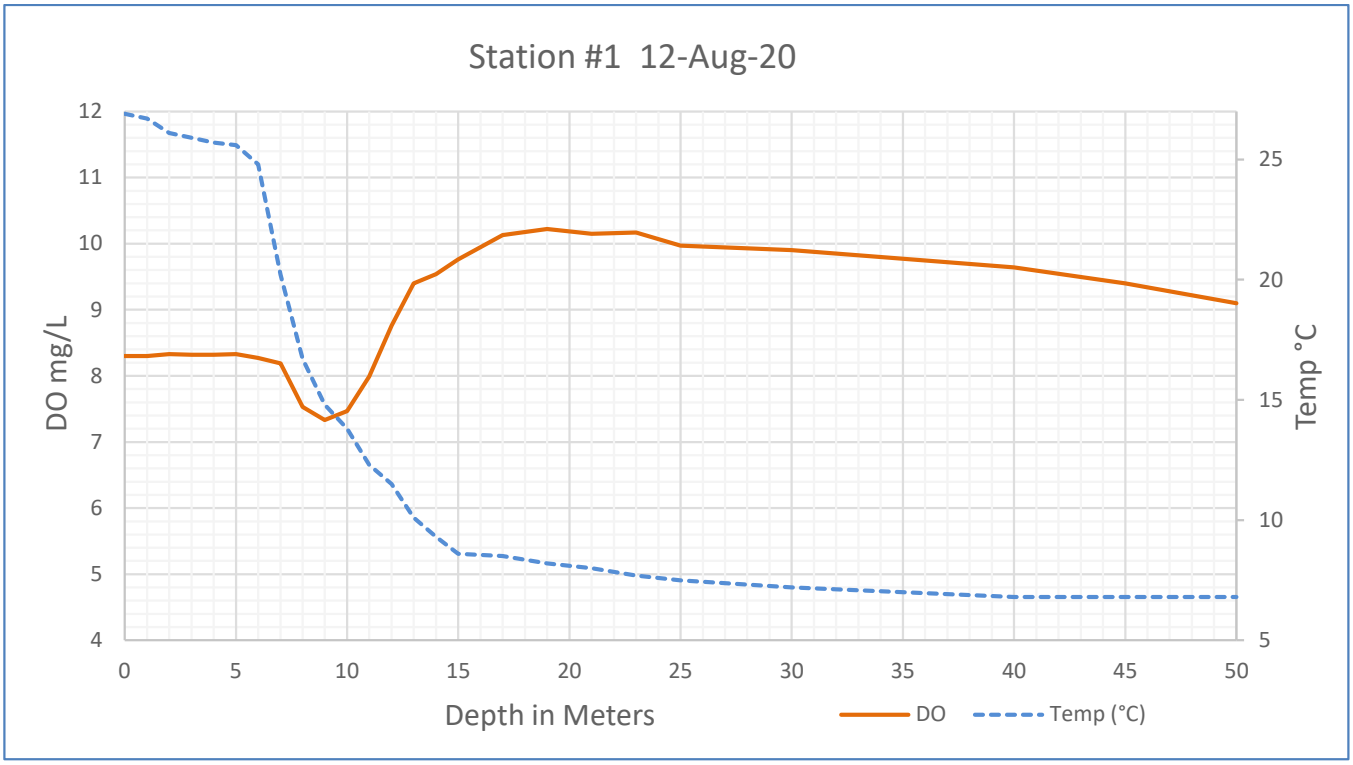


Figure 2-5 - Station #1 12-Aug-20 DO & Temp

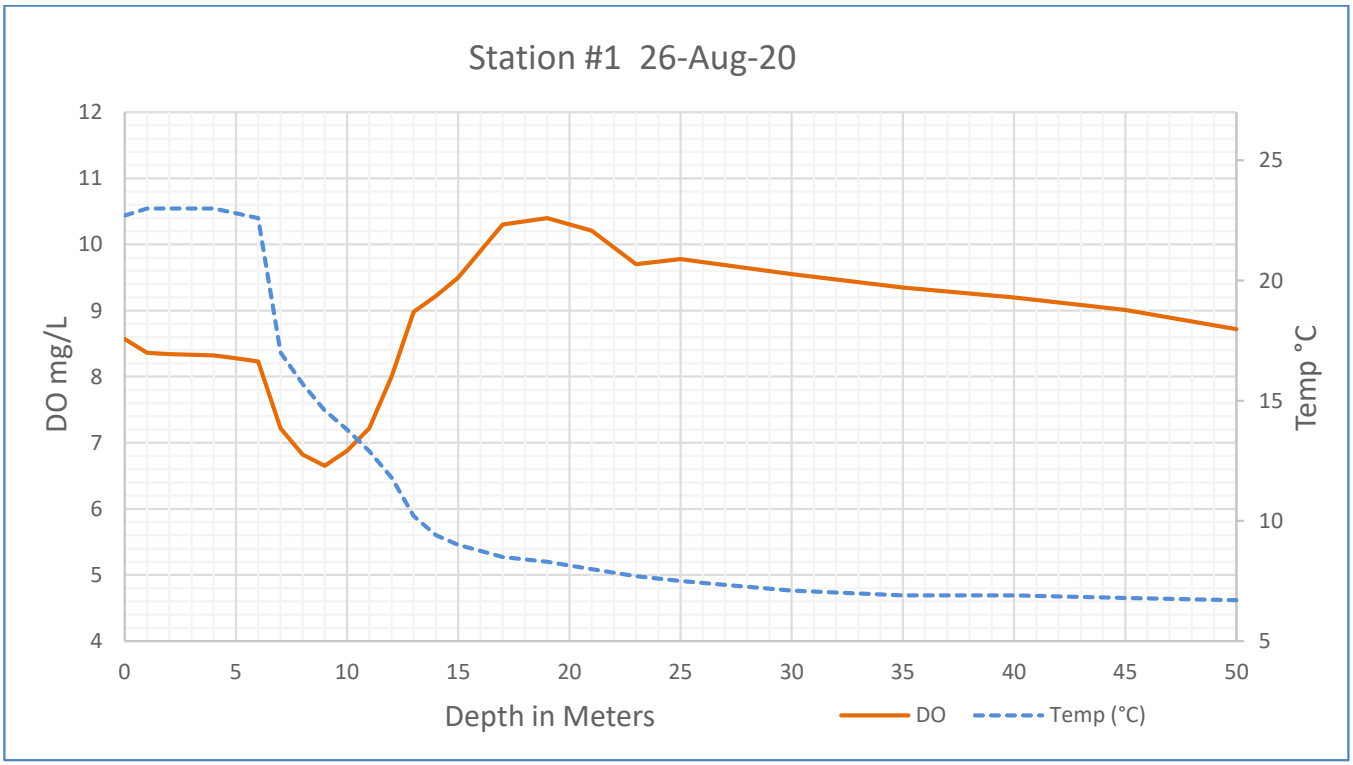


Figure 2-6 – Station #1 26-Aug-20 DO & Temp

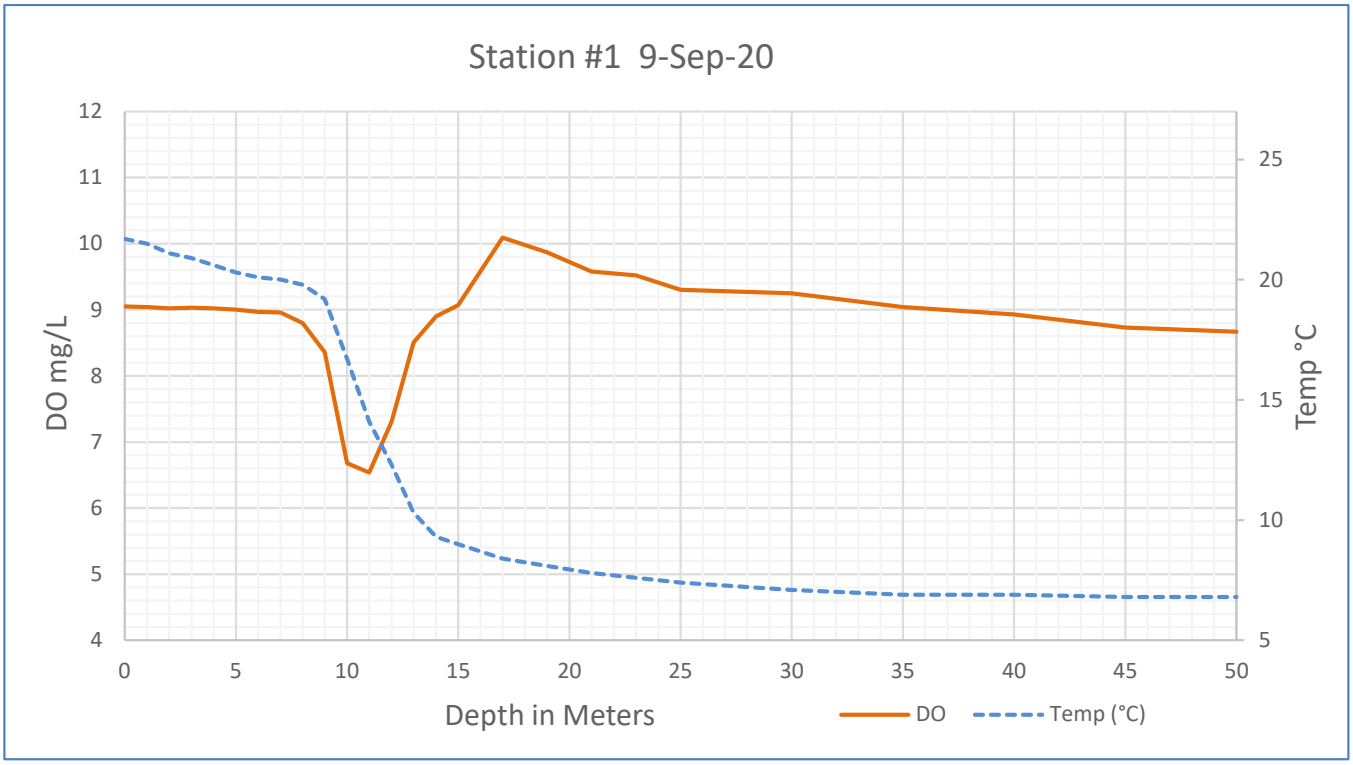


Figure 2-7 – Station #1 9-Sep-20 DO & Temp

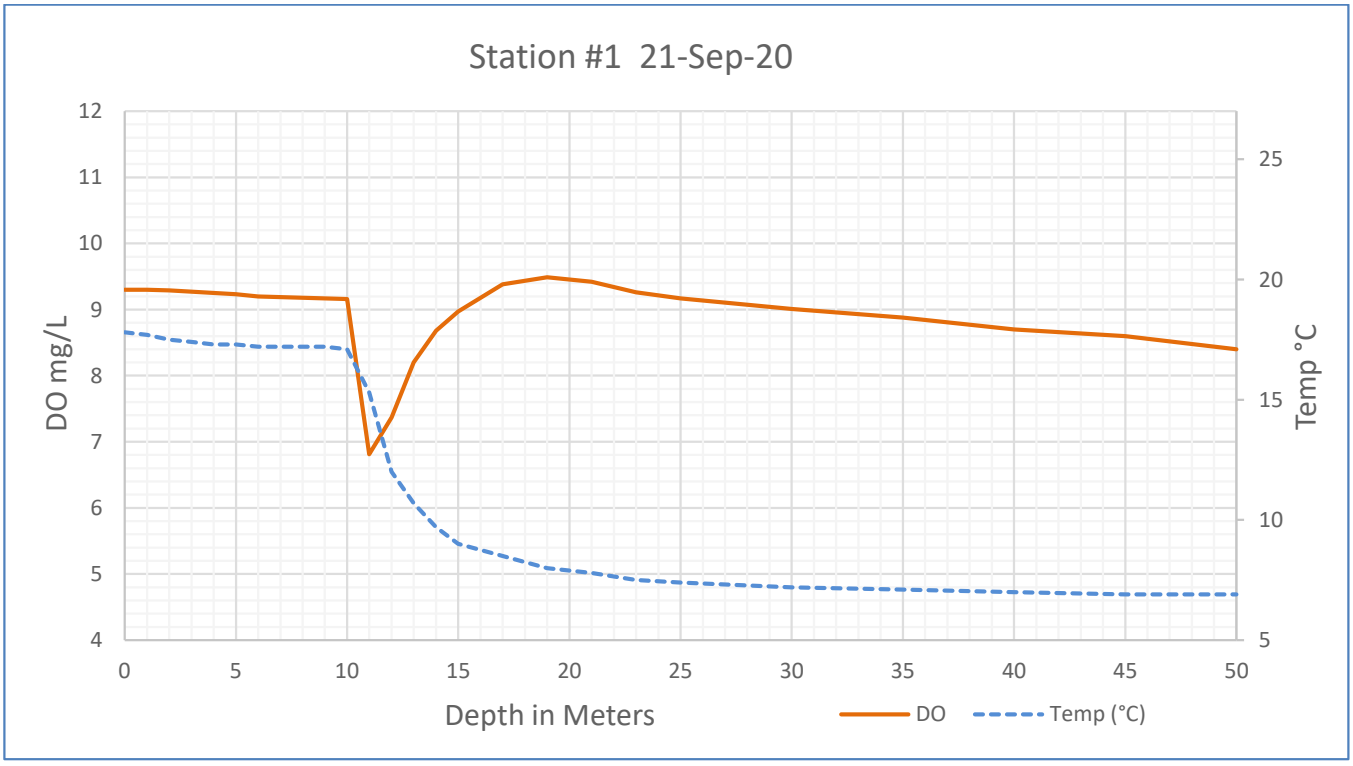


Figure 2-8 – Station #1 21-Sep-20 DO & Temp

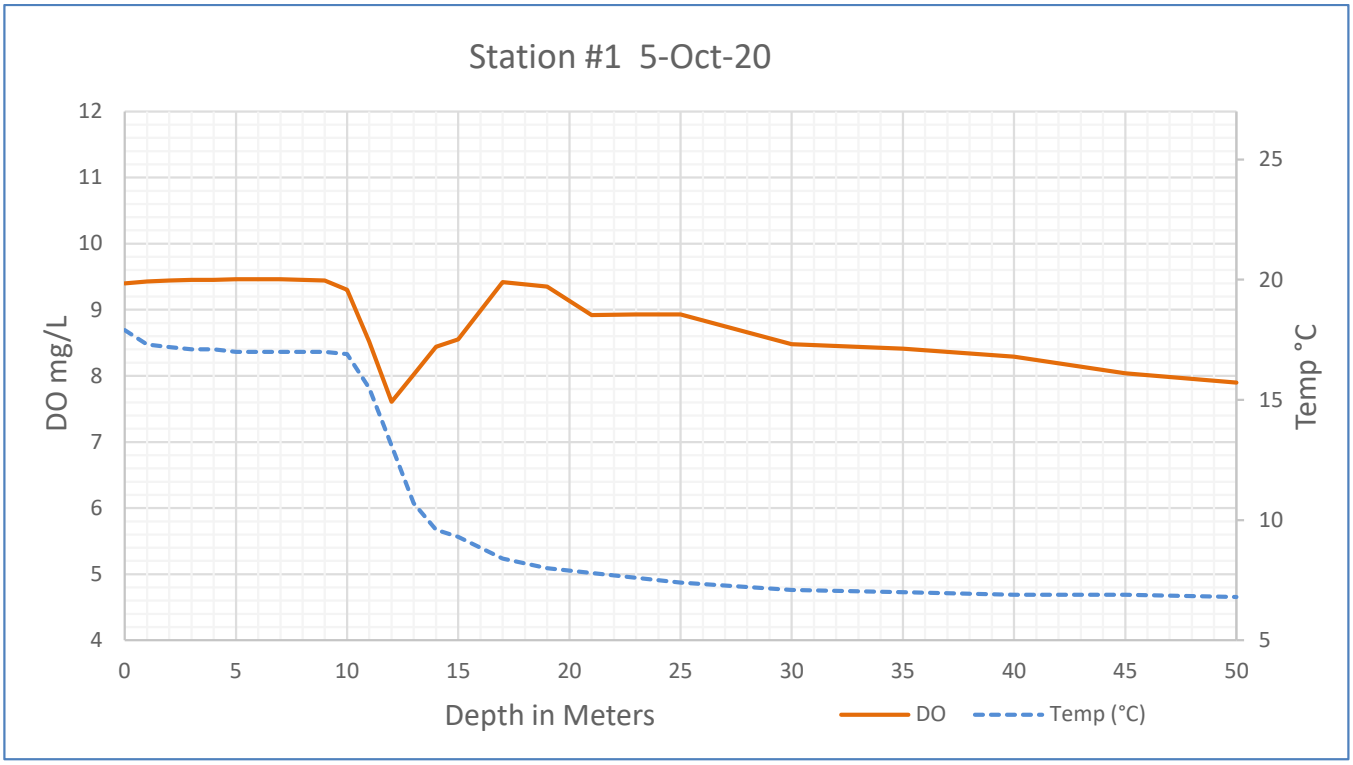


Figure 2-9 – Station #1 5-Oct-20 DO & Temp

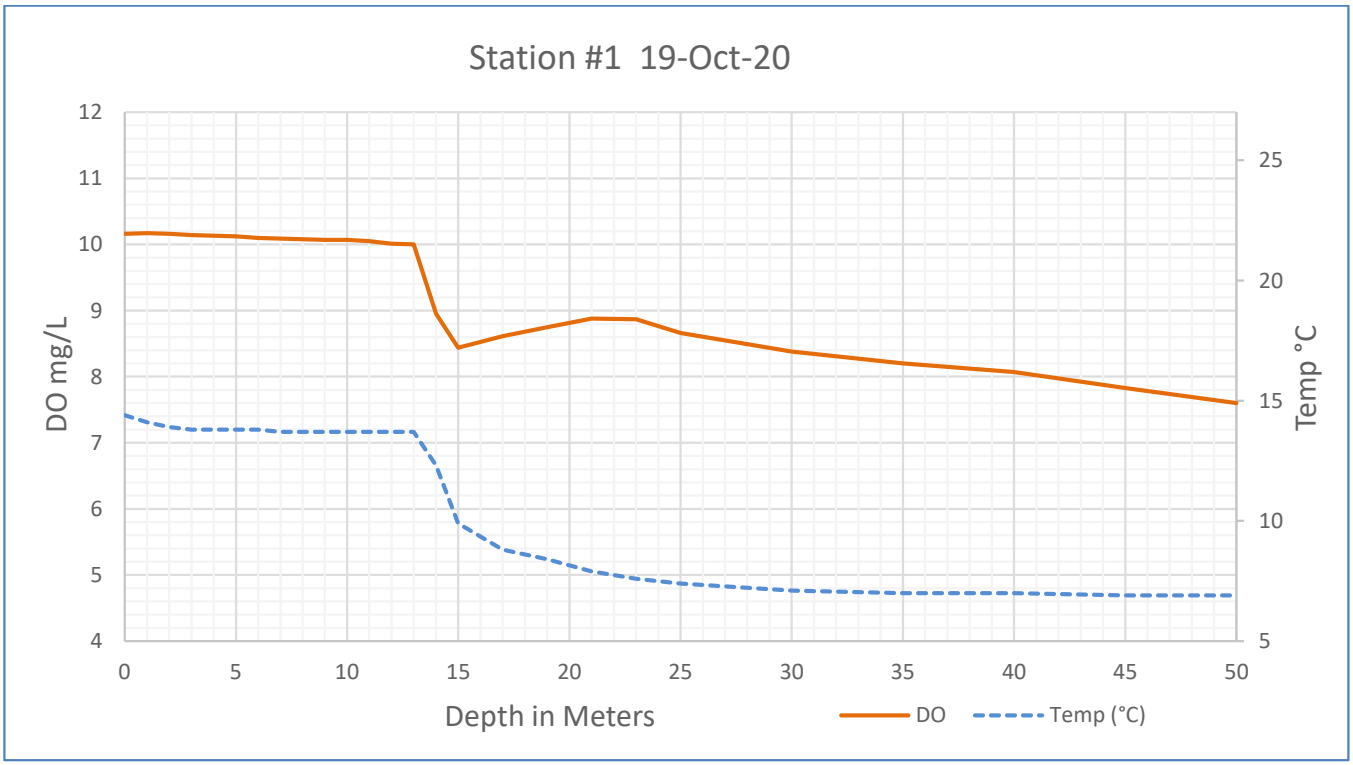


Figure 2-10 – Station #1 19-Oct-20 DO & Temp

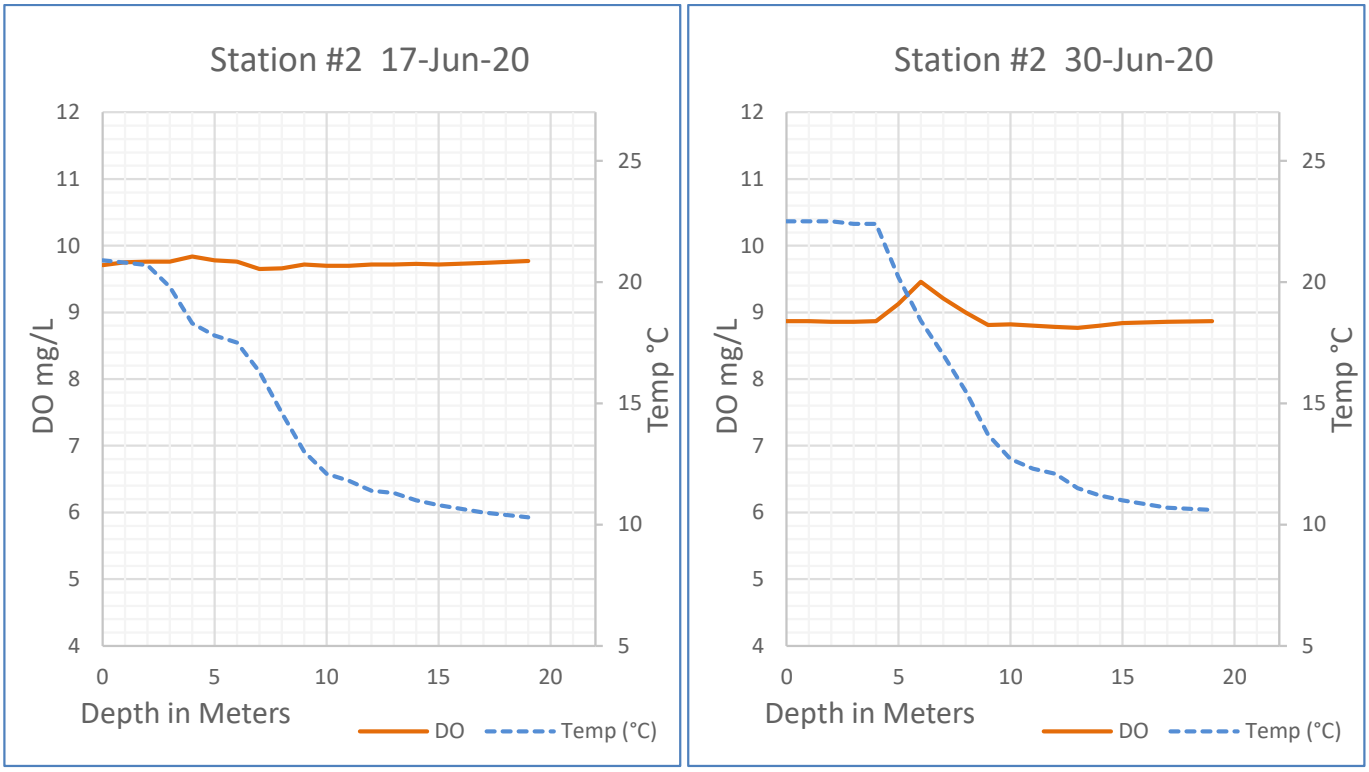


Figure 2-11 – Station #2 17-Jun-20 & 30-Jun-20 DO & Temp

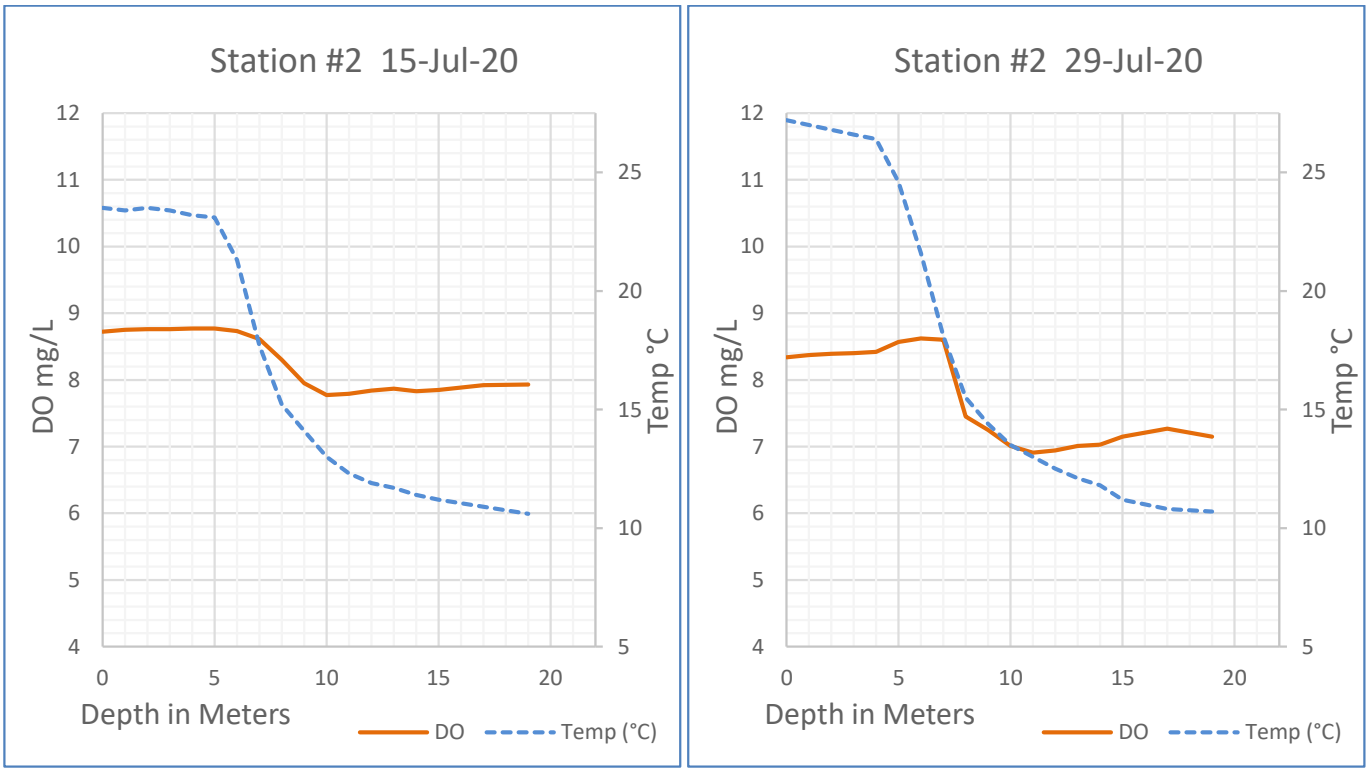


Figure 2-12 – Station #2 15-Jul-20 & 29-Jul-20 DO & Temp

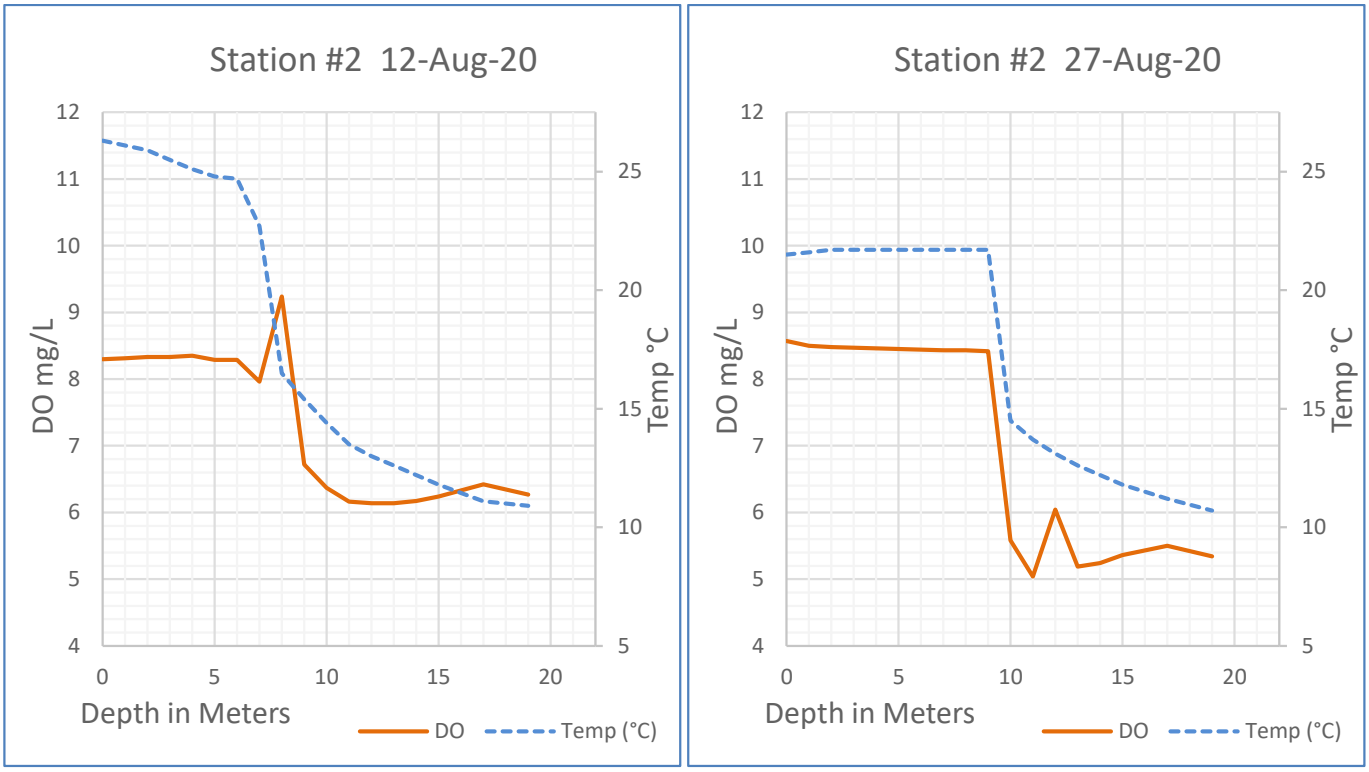


Figure 2-13 – Station #2 12-Aug-20 & 27-Aug-20 DO & Temp

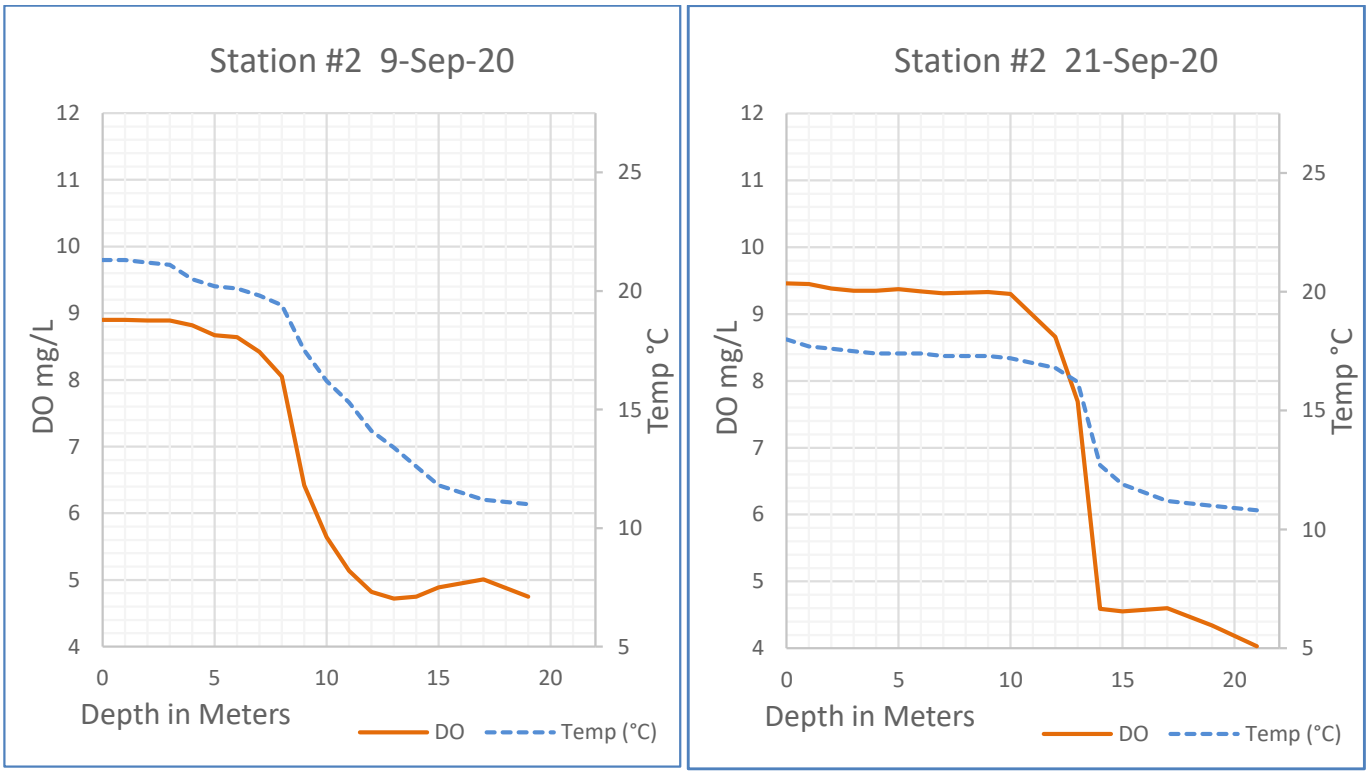


Figure 2-14 – Station #2 9-Sep-20 & 21-Sep-20 DO & Temp

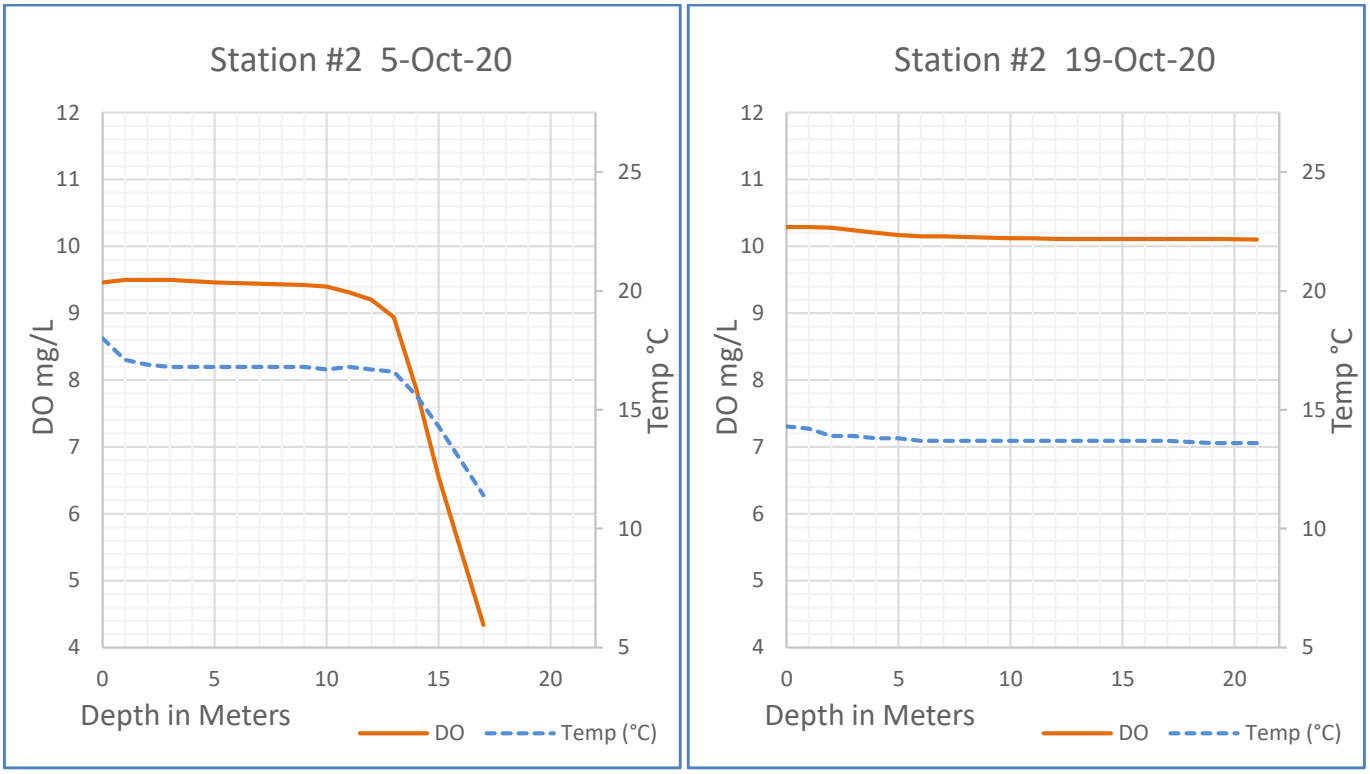


Figure 2-15 – Station #2 5-Oct-20 & 19-Oct-20 DO & Temp

In late August the extended samples were collected from both Station #1 and Station #2 – due to the high winds it was impossible to anchor at Station #2 after the samples had been collected from Station #1 – on the same day. The choices were either to gather the samples from Station #2 the following day, or to throw out the Station #1 samples and do a full new set after acquiring more sample bottles from HETL. After coordinating with MDEP it was decided to do the first option. This delayed the transport of the Station #1 set by 24 hours. The samples were kept at 4 °C ± 2 °C overnight.

	26-Aug-20	27-Aug-20
	Station #1	Station #2
Chain of Custody:	2007522-01	2015255-01
Conductivity uMHOS/cm	30	29.8
Silicon mg/L	1.2	1.2
Aluminum mg/L	0.024	0.017
Calcium mg/L	1.7	1.2
Iron mg/L	<0.05	<0.05
Magnesium mg/L	0.43	0.32
Potassium mg/L	0.29	0.19
Sodium mg/L	2.6	1.9
Sulfate mg/L	2	2
Chloride mg/L	4	
Nitrate Nitrogen mg/L	0.01	0.01

Chain of Custody:	2007522-02	2015255-02
Metals: Aluminum mg/L	0.016	0.015
Chain of Custody:	2007522-03	2015255-03
Dissolved Organic Carbon mg/L	3.5	3.5
Chain of Custody:	2007522-04	2015255-04
Phosphorus Total ug/L	5	8
2nd Phosphorus sample depth	14 meters	10 meters
Chain of Custody:	2007522-05	2015255-05
Phosphorus Total ug/L	7	13
3rd Phosphorus sample depth	50 meters	18 meters

Table 2-3 – Late August extended water sample results

2.1.1.2 Equipment Pictures

Photo 2-2 – 1 large food grade Rubbermaid container

Photo 2-3 – The container with the hose & 5 liter bottles

Photo 2-4 – 10 meter epilimnetic core sample tube per MDEP specs

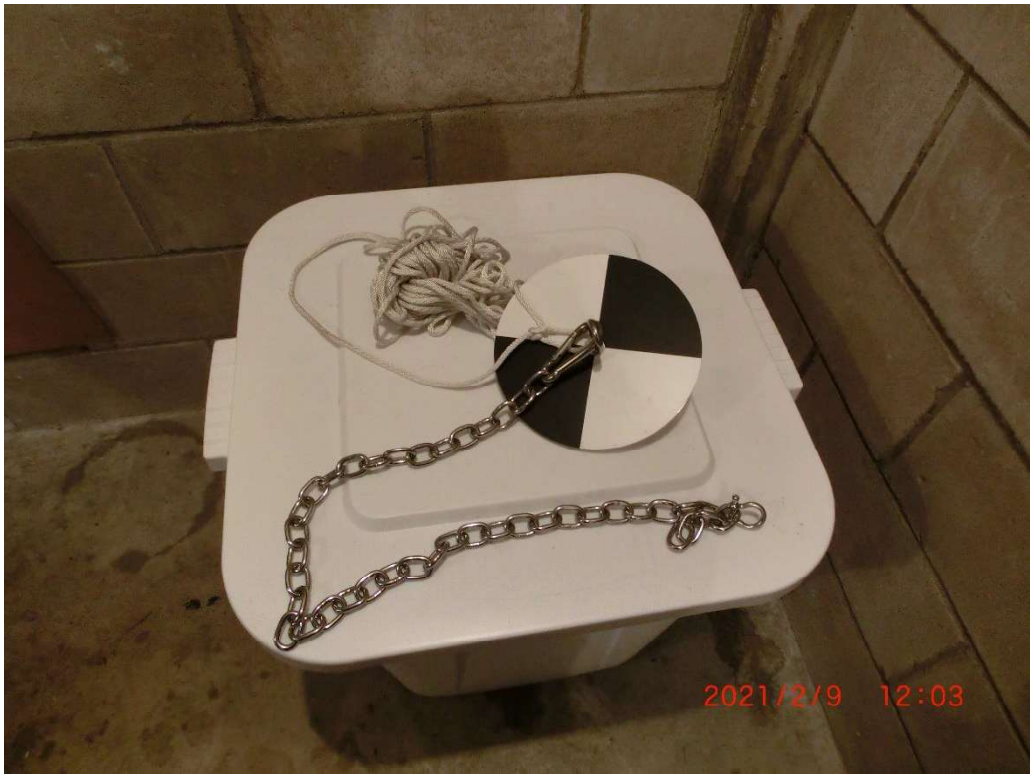


Photo 2-5 – Secchi disk

Photo 2-6 – 5 liter, heavy duty, food safe HDPE bottles

Photo 2-7 – Kemmerer water sampler

Photo 2-8 – ProSolo 50 meter cable with tape measure attached

Photo 2-9 – YSI Prosolo ODOT meter with 4 meter cable & DO/T probe

Photo 2-10 – Multiple fiberglass tape measures with metric scale on one sides

Photo 2-11 – Secchi disk viewer

2.1.1.3 Variances from FERC-approved Study Plan and Proposed Modifications

The collection of the more extensive set of water samples in the late summer was impacted by the weather. The high winds made it impossible to anchor at Station #2 after the samples had been collected from Station #1. The choices were either to gather the samples from Station #2 the following day, or to throw out the Station #1 samples and do a full new set after acquiring more sample bottles from HETL. After coordinating with MDEP it was decided to do the first option. This delayed the transport of the Station #1 set by 24 hours. This is noted on the results. With this exception, the study plan and schedule did not vary from the FERC-approved study plan.

2.1.1.4 References

MDEP – *Sampling Protocol for Hydropower Studies* (September 2019).
MDEP – Instruction Manual for Baseline Water Quality Sampling by Webster Pearsall (12/22/1997)

2.1.2 Impoundment Habitat Study 1-2:

From MDEP *DEP SAMPLING PROTOCOL FOR HYDROPOWER STUDIES*:

"Habitat Study
For lakes, ponds, and riverine impoundments, determination of attainment of the designated use 'habitat for fish and other equatic life' will be determined as follows. Uising the depth of twice the mean summer Secchi disk transparency, determined from the Trophic State Study or historic DEP data, as the bottom of the littoral zone, the volume and surface area dewatered by the drawdown will be calculated to determine if at least 75% of the littoral zone remains watered at all times. Alternatively, studies of fish and other aquatic life communities..."

The Green Lake Trophic State Study conducted by GLWP during the summer of 2020 determined that the mean Secchi disk reading was 27.5 feet, giving a value of 55 feet for the bottom of the littoral zone. Using this value, and the maximum drawdown value of 3.2 ft, GLWP determined that the amount of the littoral zone area that is dewatered by the maximum drawdown is 14.4% and the volume drawdown is a maximum of 13.3%

2.1.2.1 Methodology

Navionics Plus East bathymetric data, on a Raymarine Axiom 9 RV chartplotter/depth-sounder, was used for this study. The combination of the bathymetric data for Green Lake and the Axiom chartplotter allowed setting white for the color of water deeper than a specified value and blue for shallower water. Setting the deep water threshold to 55 feet, and a medium contour density (which resulted in 6 ft contour intervals) resulted in the basic map image used for the littoral zone drawdown analysis. The complete map was captured as a mosaic composed of multiple screen captures at a constant scale to allow sufficient detail for the analysis.

2.1.2.1.1 Littoral Drawdown Area

This small, enlarged part of the image shows the level of detail available during the analysis:

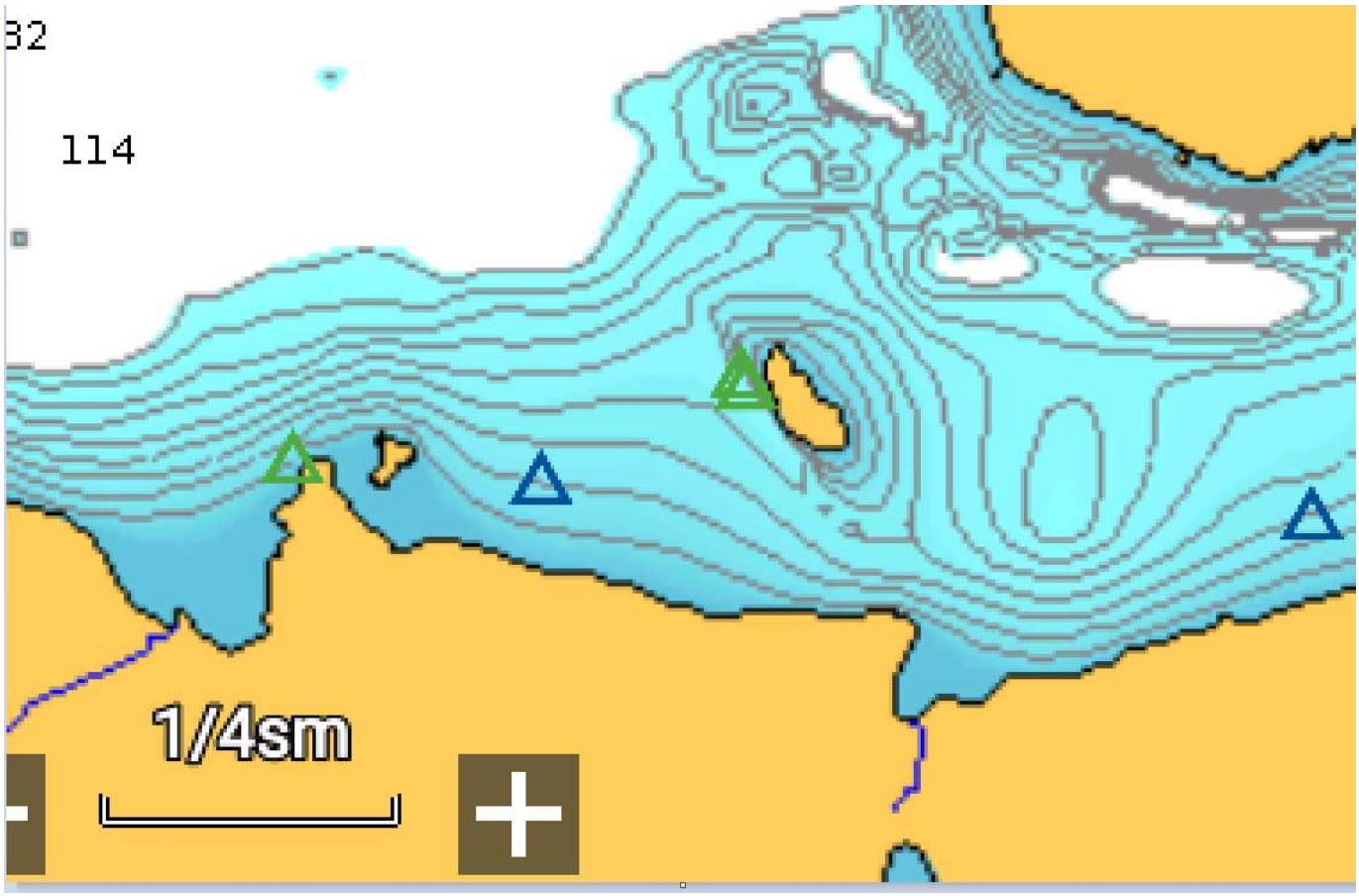


Figure 2-16 – Map image shows the level of detail available during the analysis

The complete basic map is shown in the following image of Green Lake:

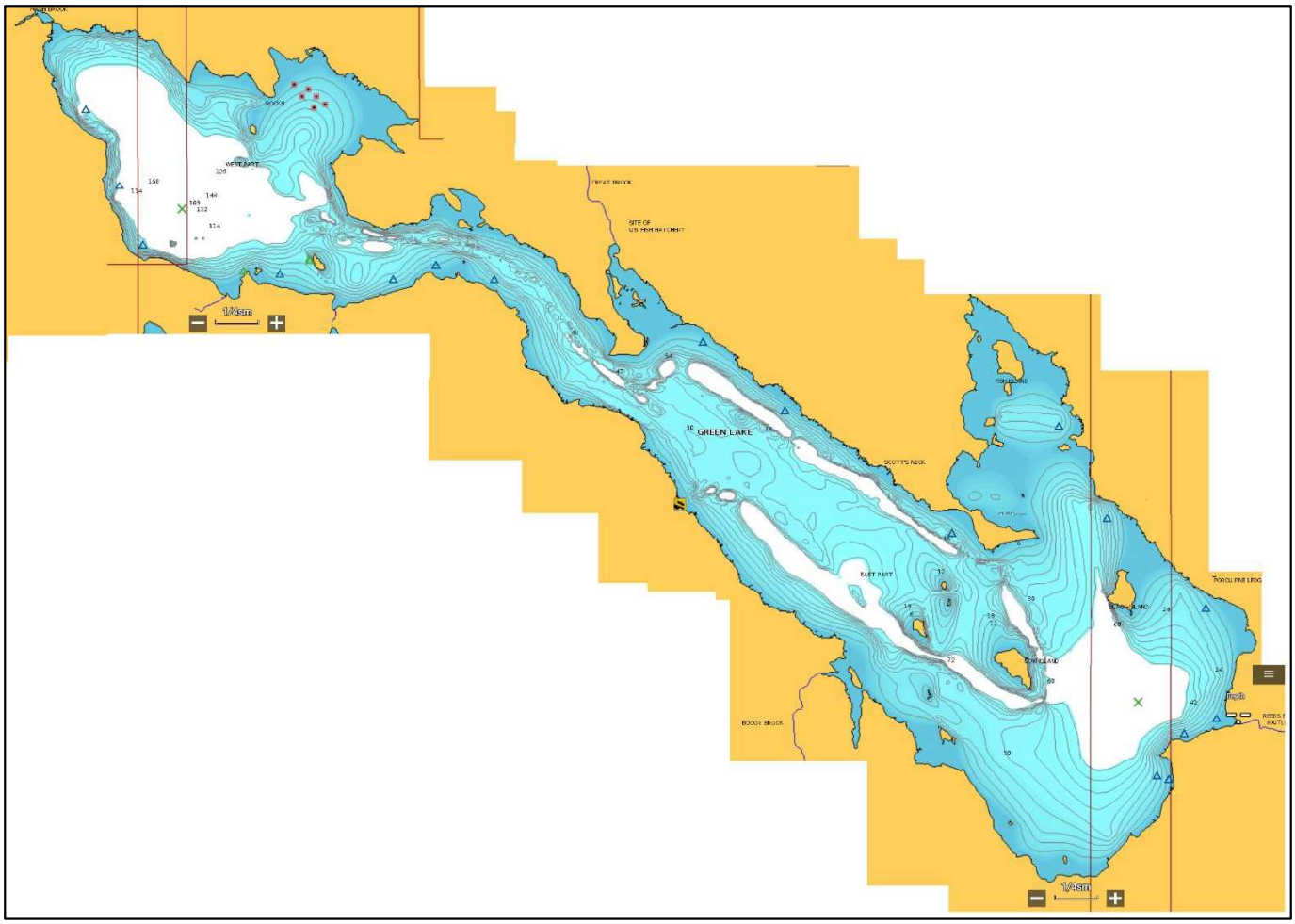


Figure 2-17 – The complete basic map of Green Lake

This map was converted to a PDF file and then processed using Adobe Acrobat Reader DC. Adobe Acrobat Reader DC allows measuring distances, circumferences, and enclosed areas on a PDF file. The scale of the PDF map can be specified, so calibration of the distances used in the calculations is possible. The "1/4sm" scale in the image was used for an initial scale factor, though it was discovered to be slightly off, and was corrected—details are below in the Accuracy sub-section.

The perimeter of the lake and of each island were traced, specifying "Area" as the measurement. The lake area was specified as one category for export and the island areas were specified as another category. This allowed subtracting the area of the islands from the overall area of the lake:

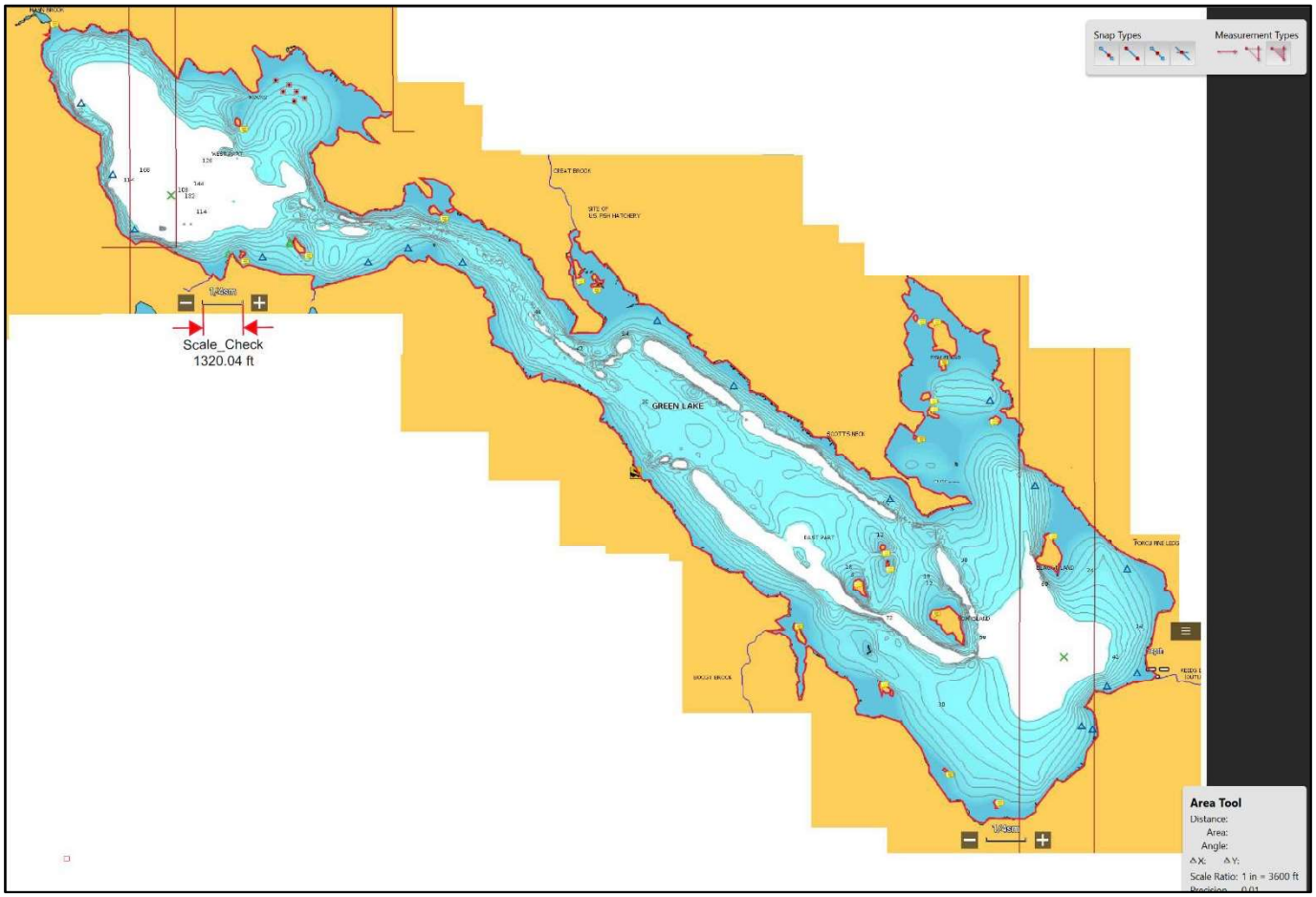


Figure 2-18 – Lake and island perimeters

The limit of the littoral zone was traced:

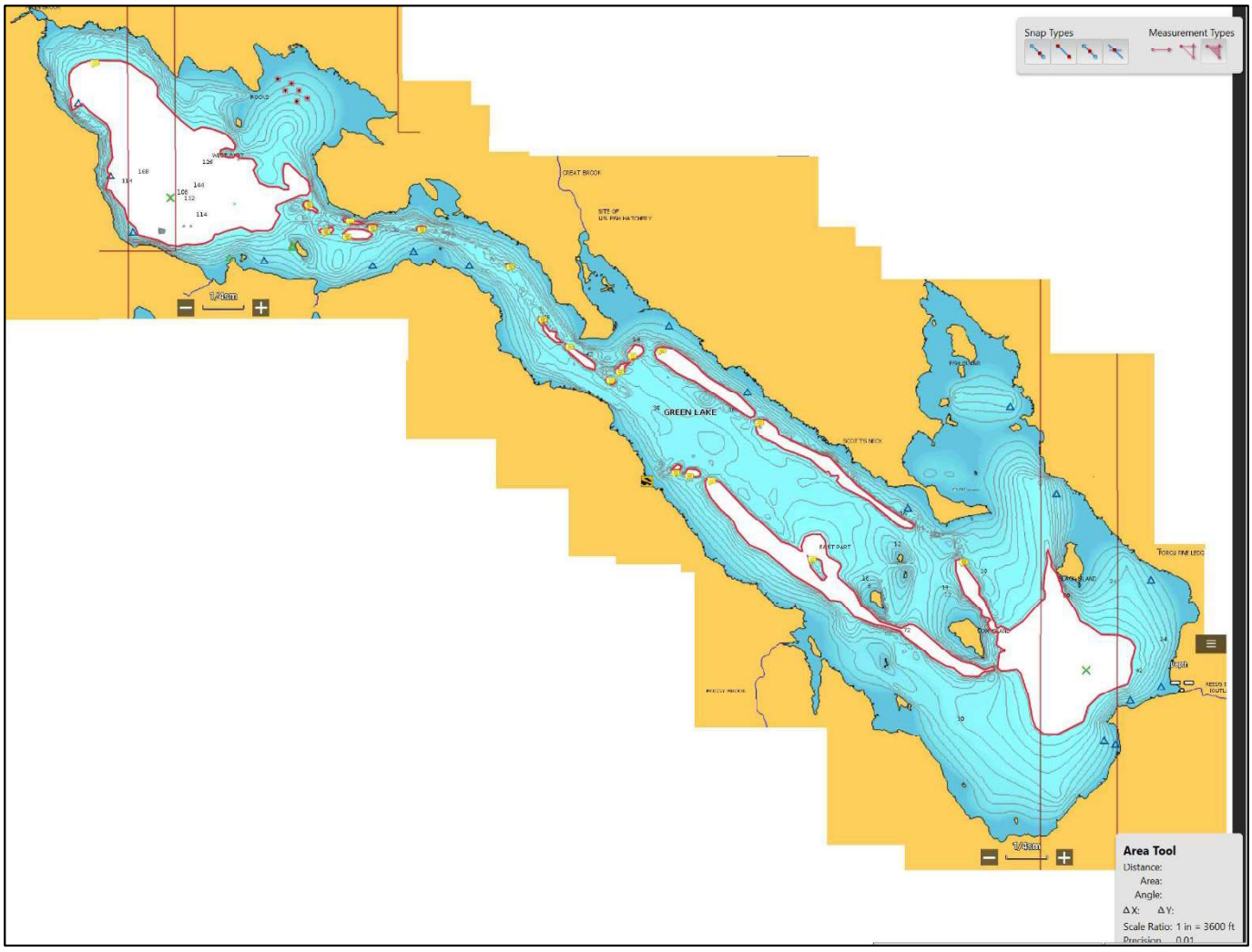


Figure 2-19 – Littoral zone limit

The limit of the drawdown was traced. One half the distance from the shore to the first contour line (at 6 ft depth) was used for this. Islands were traced this way as well so their drawdown zones could be included. This gave a very conservative (overly large) area for the drawdown zone (see Accuracy below):

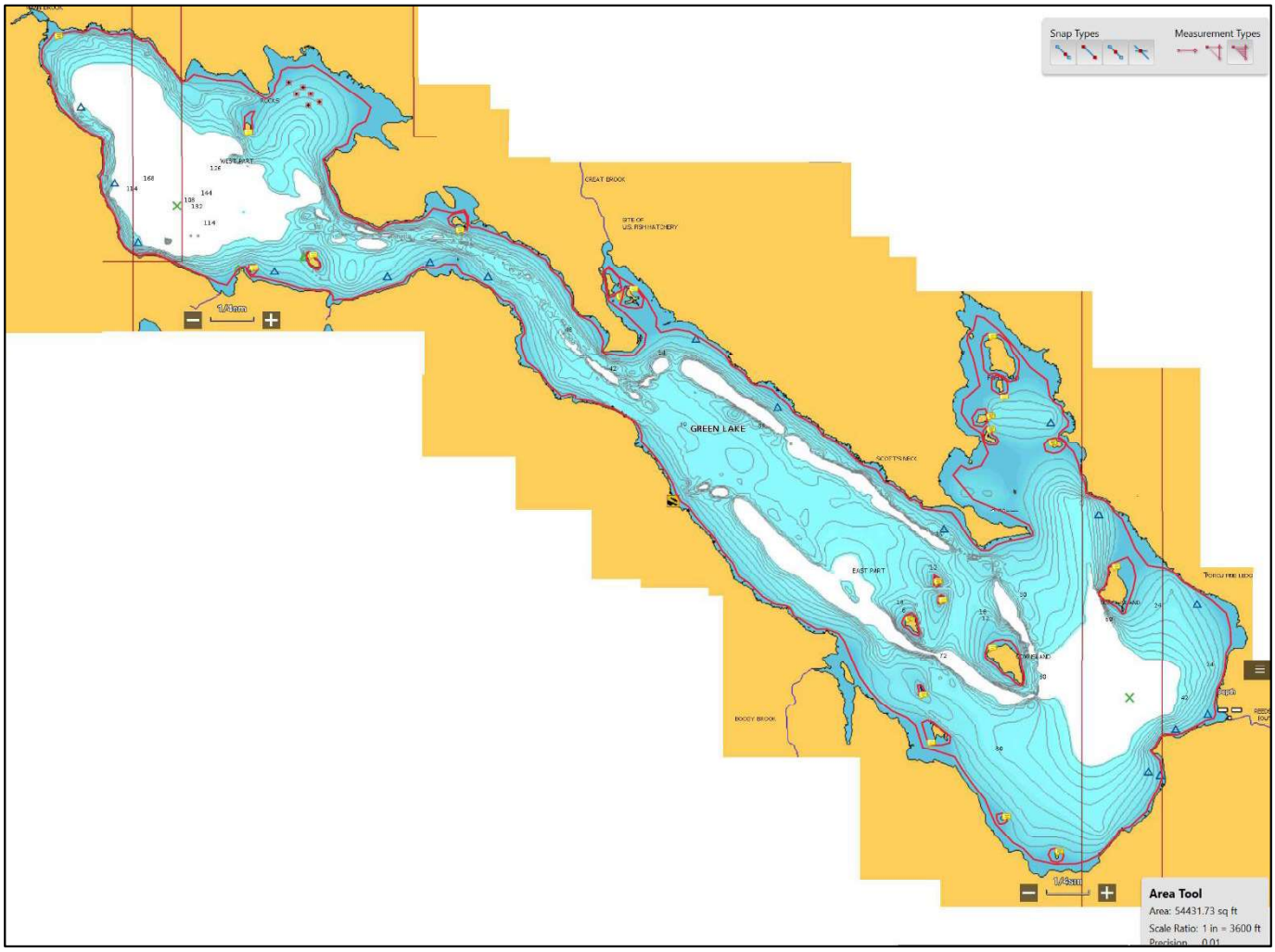


Figure 2-20 – Drawdown limit

The areas measured were processed in a spreadsheet. The sums of the areas rolled up as follows:

GL Gross Area	3167.54	ac
Islands Area	40.34	ac
Net Area	3127.20	ac
Littoral Exclusion	608.77	ac
Littoral Zone Area	2518.43	ac
Inside Perimeter Draw	2851.24	ac
Perimeter Draw	316.30	ac
Gross Island Draw	86.89	ac
Island Draw	46.55	ac
Total Draw Area	362.85	ac
Littoral Draw Fraction	0.14	
Area Drawdown Percentage	14.41%	

Figure 2-21 – Littoral Drawdown Area

2.1.2.1.2 Littoral Drawdown Volume

To calculate the volume drawdown, the 6 ft contour lines from a depth of 6 feet to 54 ft were traced in Adobe Acrobat Reader DC to measure areas. Areas were identified as adding or subtracting from the area at that depth depending on whether the area surrounded was shallower water than the contour line or deeper water. The Navionics Plus bathymetric map on the Axiom 9 RV were consulted during the tracing of the contour lines to make this determination. All areas calculated by Adobe Acrobat were scale corrected as explained in the Accuracy section below.

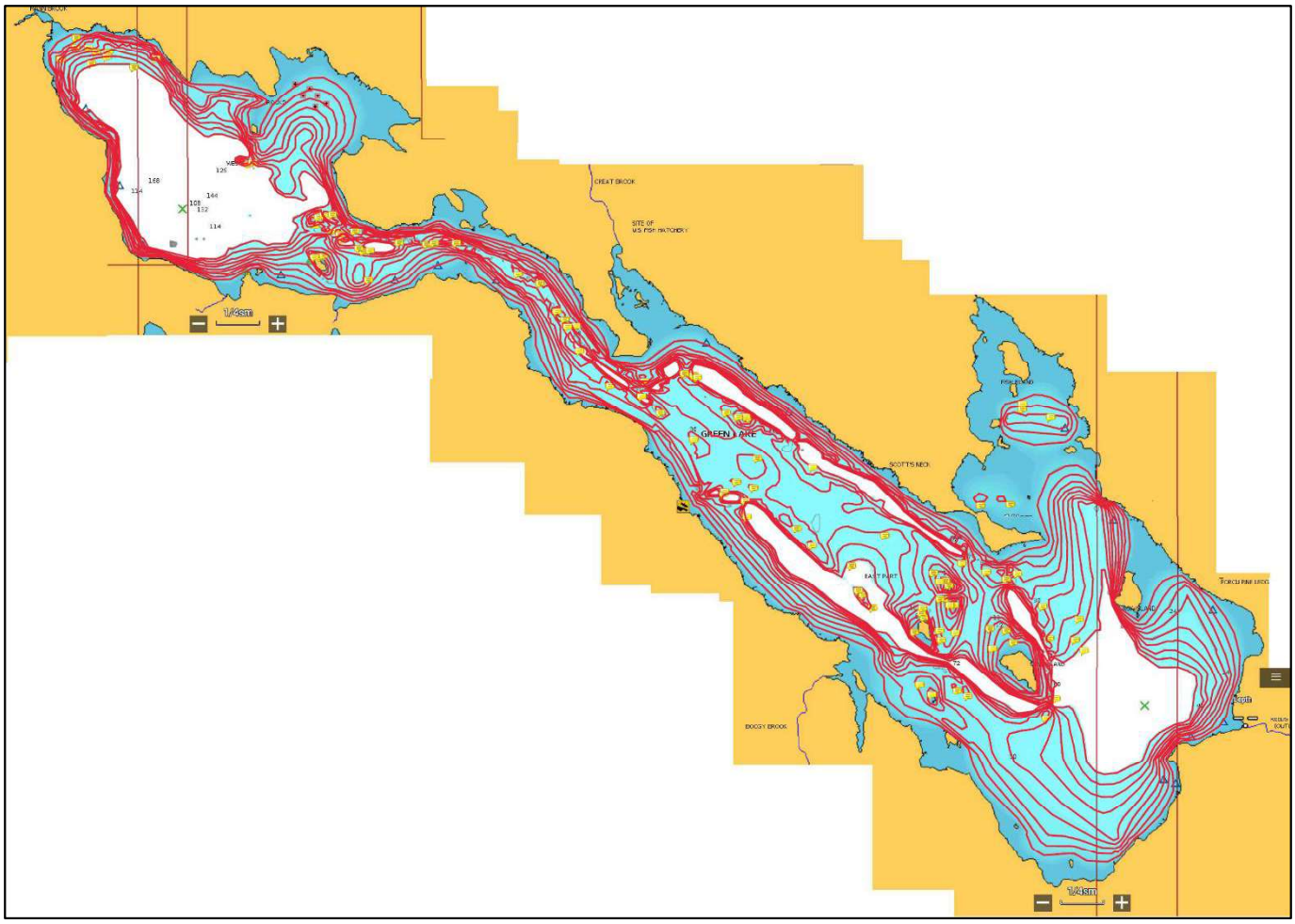


Figure 2-22 – Green Lake Contours Traced

Each contour line was visualized to represent a horizontal slice of water in the lake, 6 ft in depth, centered on the contour line. The top and bottom "slices" had depths of 5.8 ft and 4 ft respectively. The volumes of the slices were calculated and added up to get the total volume of the lake from 3.2 ft to 55 ft. The volume of the "littoral exclusion zone" (the area of the lake deeper than 55 feet) below the depth of 3.2 was then calculated and subtracted from the total volume to give the total volume of the littoral zone. The littoral drawdown volume was calculated from total littoral area and drawdown area using a depth of 3.2 feet. The drawdown volume was added to the littoral volume below 3.2 ft depth to get the total littoral zone volume. The littoral drawdown volume was then divide by total littoral zone volume to get the volume drawdown percentage.

This table contains the results:

Volume of lake from 3.2 ft depth to 55 ft	80471.11	ac-ft
Volume outside littoral zone from 3.2-55 ft	31534.21	ac-ft
Littoral zone 3.2-55 ft volume	48936.91	ac-ft
Littoral draw	7478.42	ac-ft
Total Littoral Zone Volume	56415.33	ac-ft
Drawdown Fraction	0.1326	
Volume Drawdown	13.26%	

Figure 2-23 – Littoral Drawdown Volume

2.1.2.2 Accuracy

The inial area of Green Lake calculated using the Navionics Plus scale was 5436 ac. The lake is believed to have an area of about 3000 ac, so the scale was checked against USGS maps:

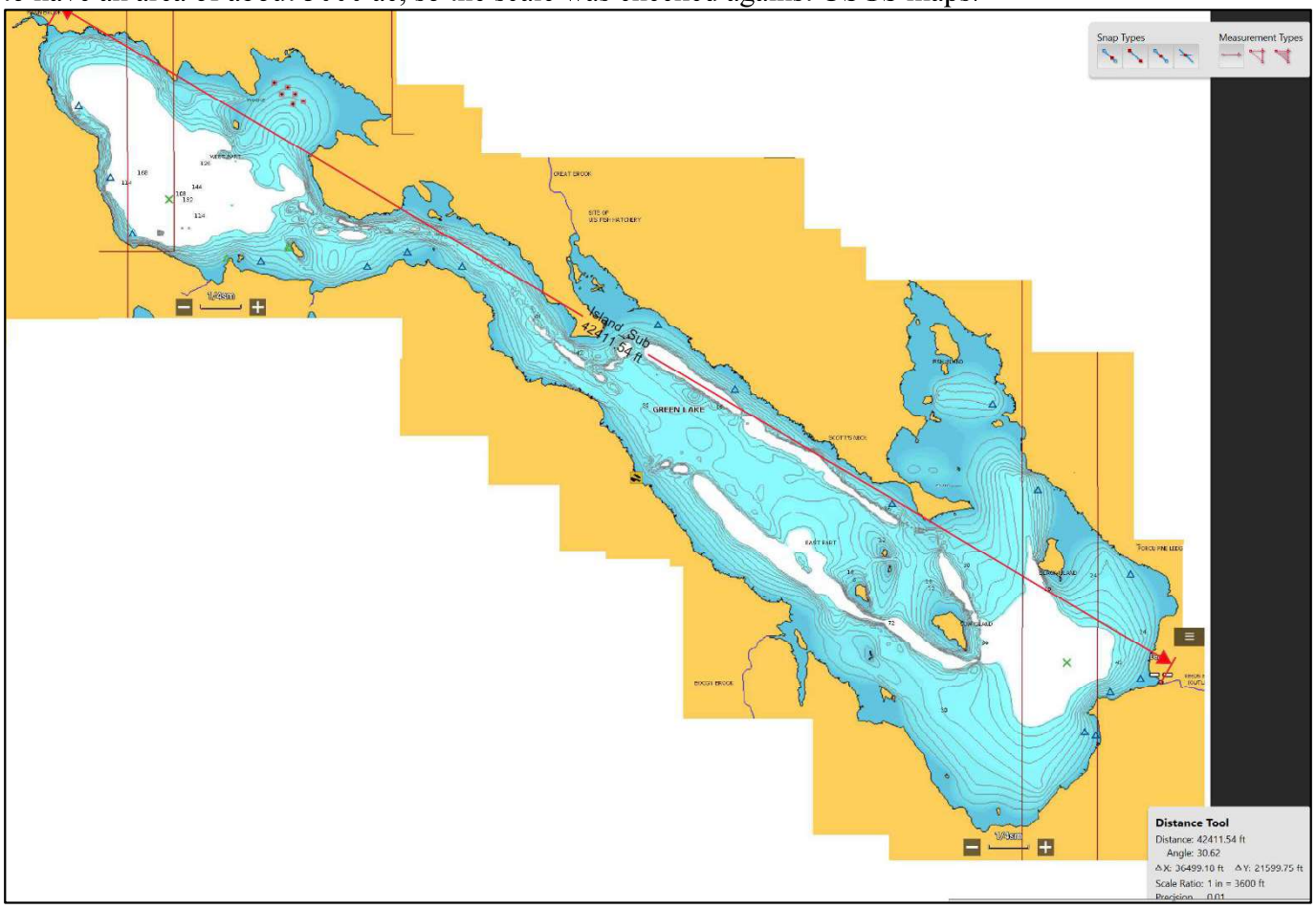


Figure 2-24 – Green Lake Length Navionics

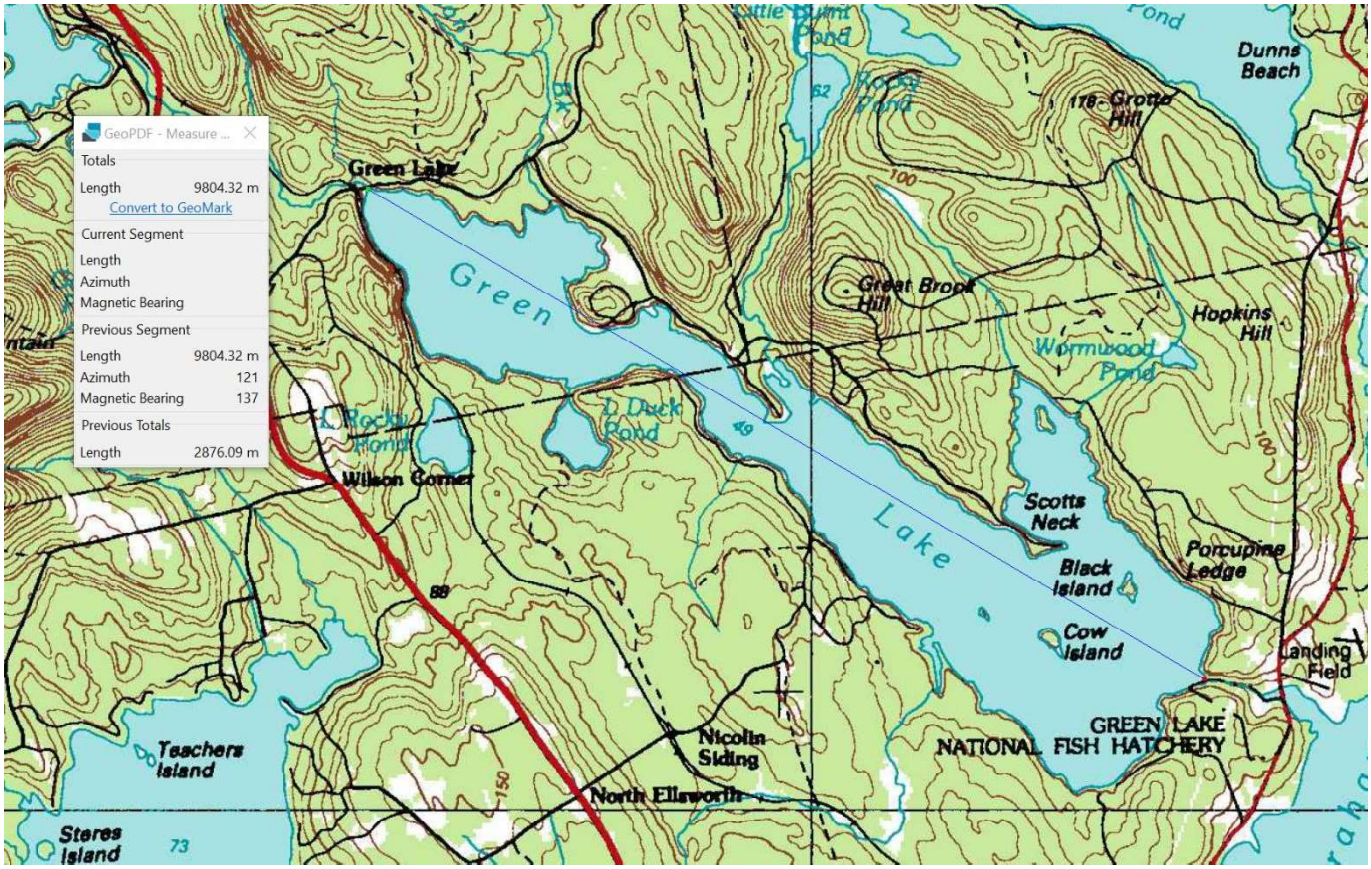


Figure 2-25 – Green Lake Length USGS

The Navionics Plus chart scale mapped the length of Green Lake as 42,411 ft. The USGS map measured the lake at 9804 m, or 32,166 ft. This results in a distance scale inaccuracy of about 1.32. Squaring this number results in an area correction factor of 1.738. Applying this to the measured area of Green Lake results in an area of 3127 ac, close to the rough 3000 ac value. These corrections have been applied to the numbers reported above. While ratios of distances and areas will not be affected, the magnitude of the values involved is more realistic after the correction.

During our summer work on the lake we gained quite a bit of experience on the lake areas and depths. We found the Navionics Plus bathymetry data to be very good except in shallow water. This is expected since their bathymetry data is largely gathered from depth-sounder readings of boaters. Boaters tend to stay away from areas of the lake that might be shallow or rocky unless they want to fish close to rocks. This results in Navionics marking areas of the lake as very shallow (2 ft or less) that we know from experience are not. The cove near the dam, for example, is marked as shallower than it actually is.

Because the Navionics Plus bathymetric data marks a wider region around the circumference of the lake as 0-6 ft in depth, this would result in our measurement of littoral zone drawdown area being larger than it actually is. The littoral area drawdown percentage calculated would therefore be larger than the actual drawdown – we have calculated a conservatively large value.

2.1.2.3 Variances from FERC-approved Study Plan and Proposed Modifications

The study plan did not vary from the FERC-approved study plan.

2.1.3 Impoundment Temperature Study 1-3:

Green Lake contains one of the 14 remaining arctic char populations in the contiguous U.S. The Maine Department of Inland Fisheries and Wildlife (Maine DIFW) lists arctic char as a species of special concern, and considers the Green Lake population to be at low abundance (Frost, 2001). Arctic char spawn in areas between 1.5 and 6 feet deep when the water temperature reaches 50 °F in the fall (Frost, 2001). The exact spawning period for arctic char in Green Lake is unknown. Maine DIFW states that arctic char spawning occurs between October 20 and November 7 in Flood's Pond, which is located approximately 6.5 miles north of Green Lake.

Given the possible spawning sites for artic char, loggers were deployed from August 31, 2020 to December 1, 2020 with the goal of determining when the temperature of the lake goes below 50 °F

Figure 2-26 – Possible Arctic Char Spawning Sites – Map provided by MDIFW

Two data loggers were deployed in two separate locations on August 31, 2020. The Loggers were located at location 2 and 4 on the map above. The other sites proved unsafe to access with our boat.

The devices were placed such that they would stay within the 18" to 6' deep range required throughout the allowed lake level range.

Photo 2-12 – Logger 1 at location 4

One additional logger was placed at each of the sites on September 9, 2020 to ensure the data would be captured if a logger failed or was moved or otherwise tampered with.

Loggers 1 and 3 were placed in location 4 on the map above. Loggers 2 and 4 were placed in location 2.

A fifth logger was set up and installed in the lake near the dam on October 7, 2020. The purpose of this logger was to determine any correlation between the temperature at the potential spawning locations and at the dam.

Over the three month period, that the loggers were in the lake, the water temperature went from 68 °F up through 73 °F and then down to 44 °F. The loggers show that the water temperature in Green Lake reached 50 °F initially in the evening of November 2, 2020, then went back above 50 °F and finally went below, and stayed below, 50 °F on November 13, 2020

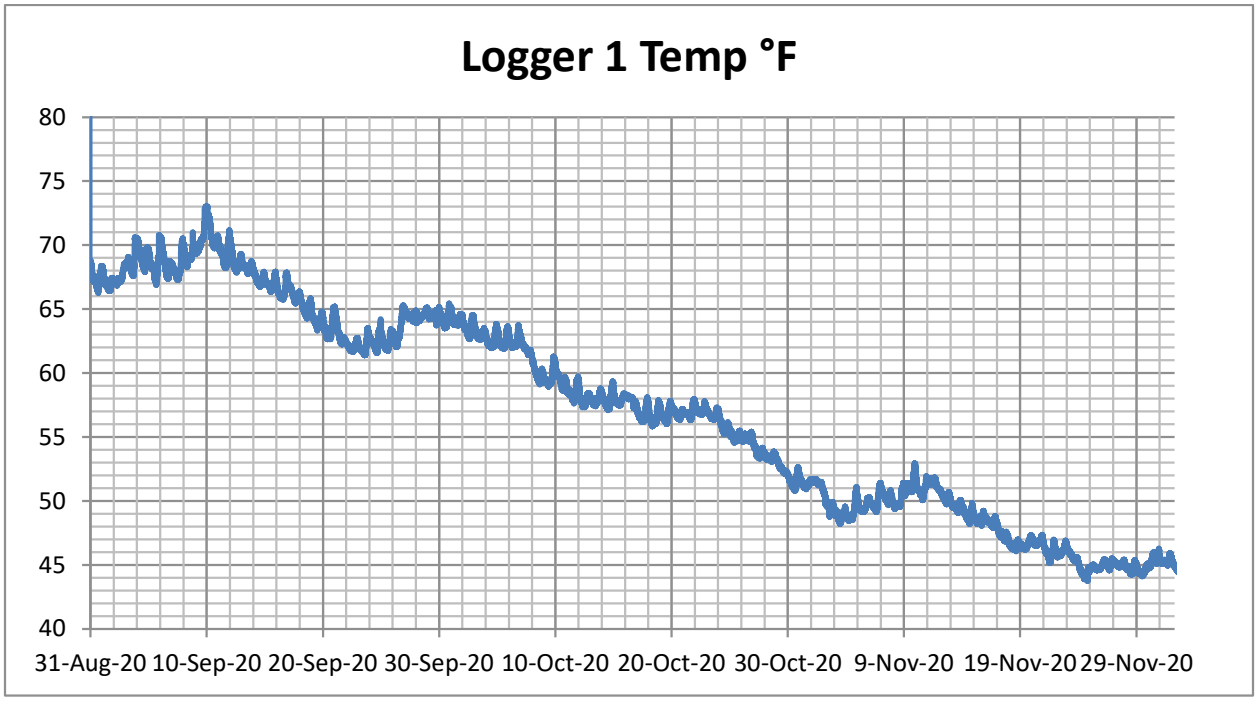


Figure 2-27 – Logger 1 Temp °F Graph – at potential spawning location 4

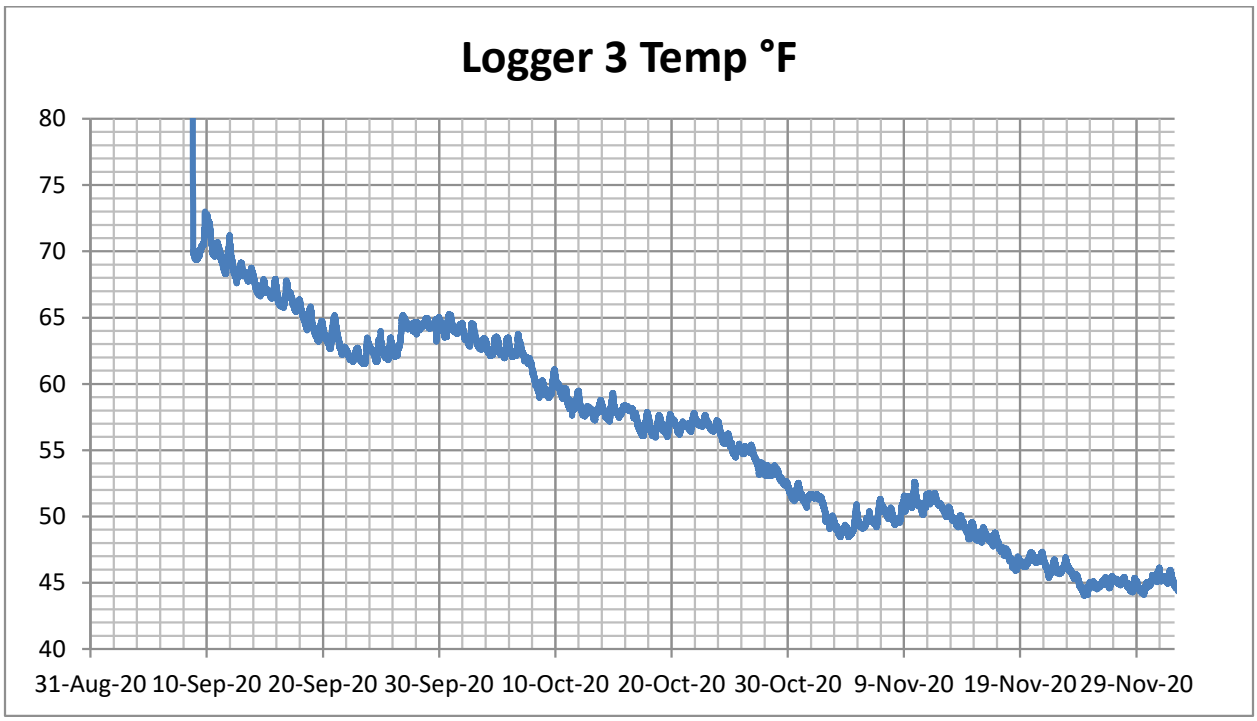


Figure 2-28 – Logger 3 Temp °F Graph – at potential spawning location 4

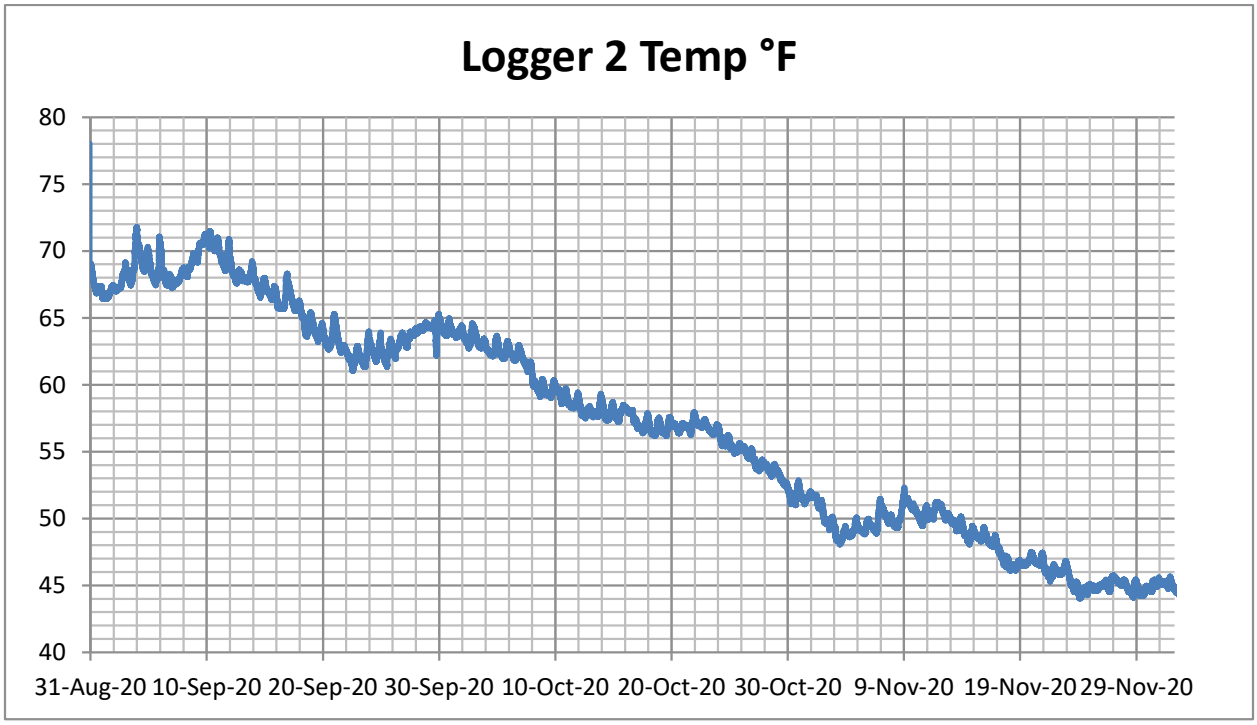


Figure 2-29 – Logger 2 Temp °F Graph – at potential spawning location 2

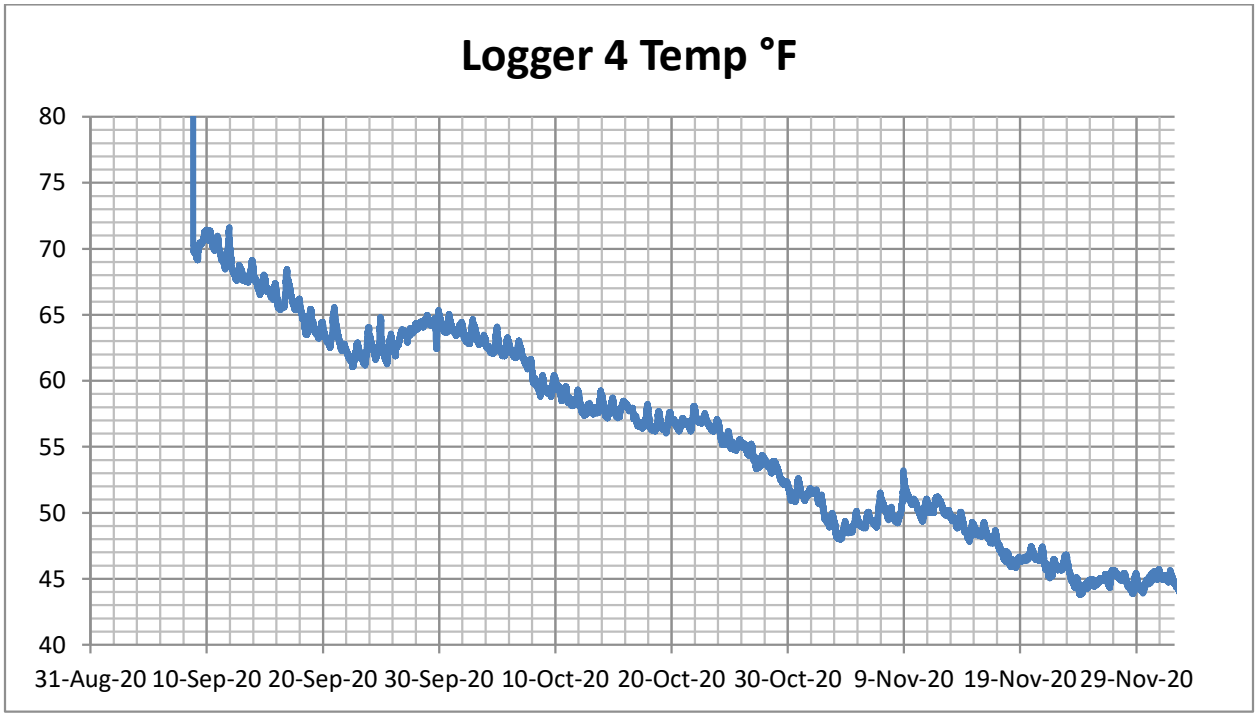


Figure 2-30 – Logger 4 Temp °F Graph – at potential spawning location 2

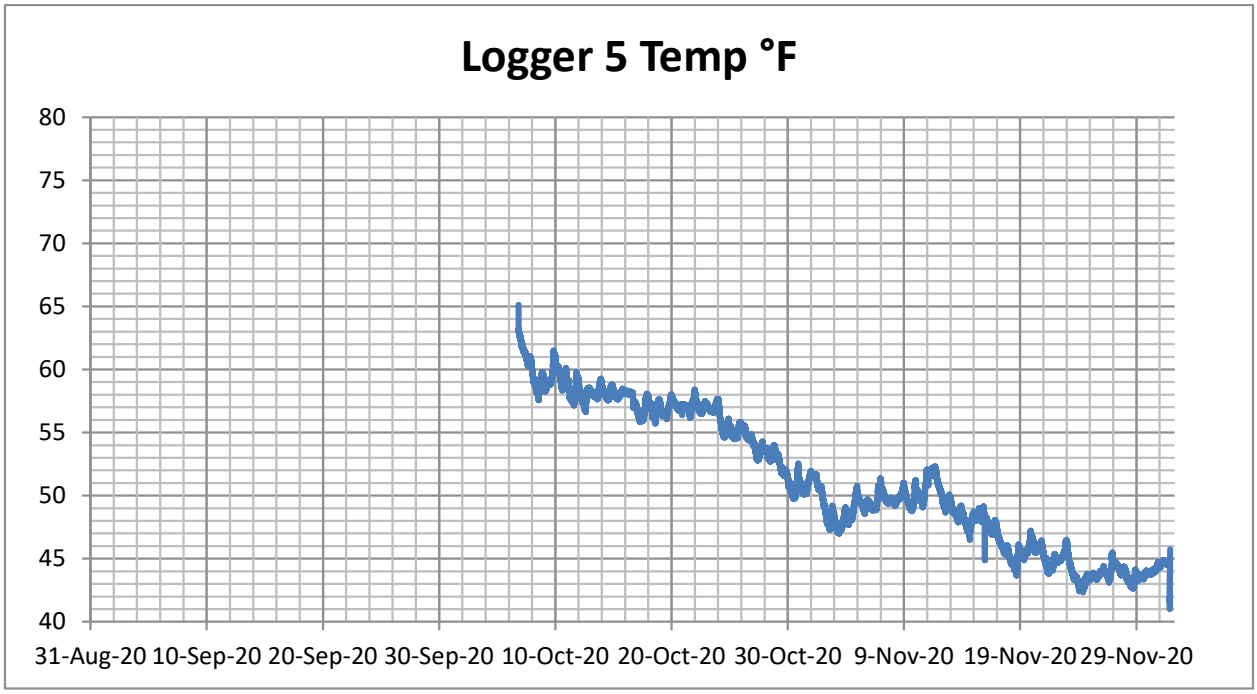


Figure 2-31 – Logger 5 Temp °F Graph – at the Dam

The logger at the dam, although it doesn't start until October 7, does follow the temperature of the initial 4 loggers quite closely.

2.1.3.1 Green Lake Level

The lake level, on August 31, 2020, when the loggers were installed was 5.75 at the staff gauge. On November 30, 2020, the lake level was 5.01 at the staff gauge.

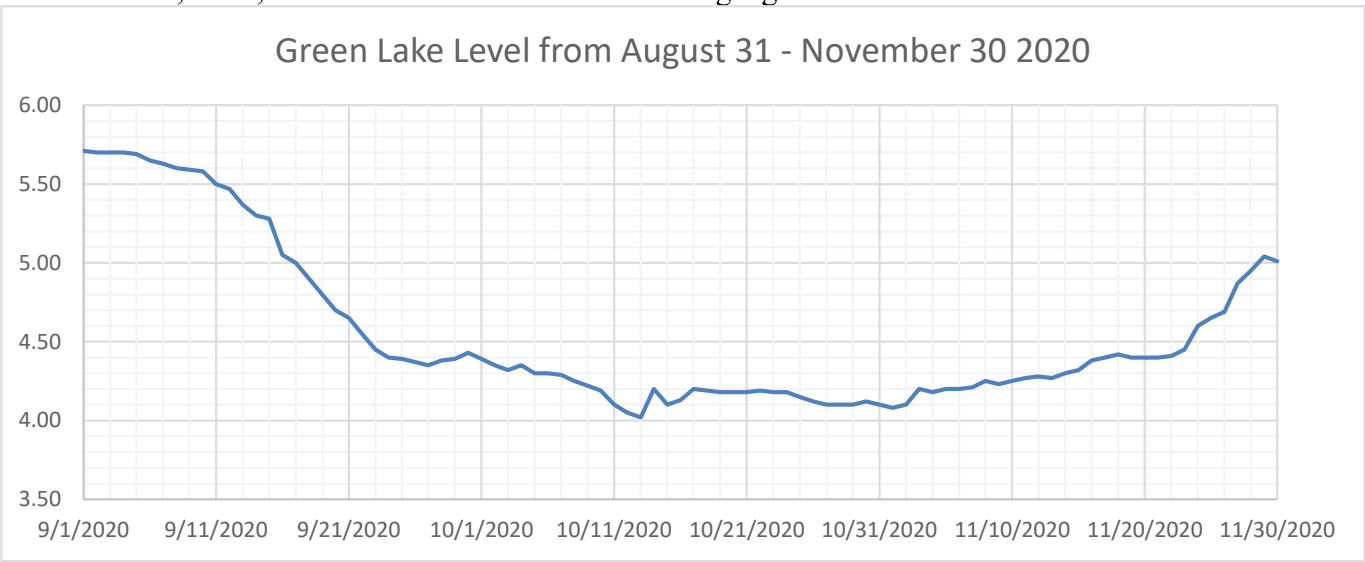


Figure 2-32 – Green Lake Level from August 31 - November 30 2020

2.1.3.2 Temperature Monitoring Equipment

Temperature monitoring containers were created, using HOBO Onset MX Pendant Temp MX2201 devices. Each container has one HOBO device, holes for the water to circulate through, a weight and a floating handle for retrieval.

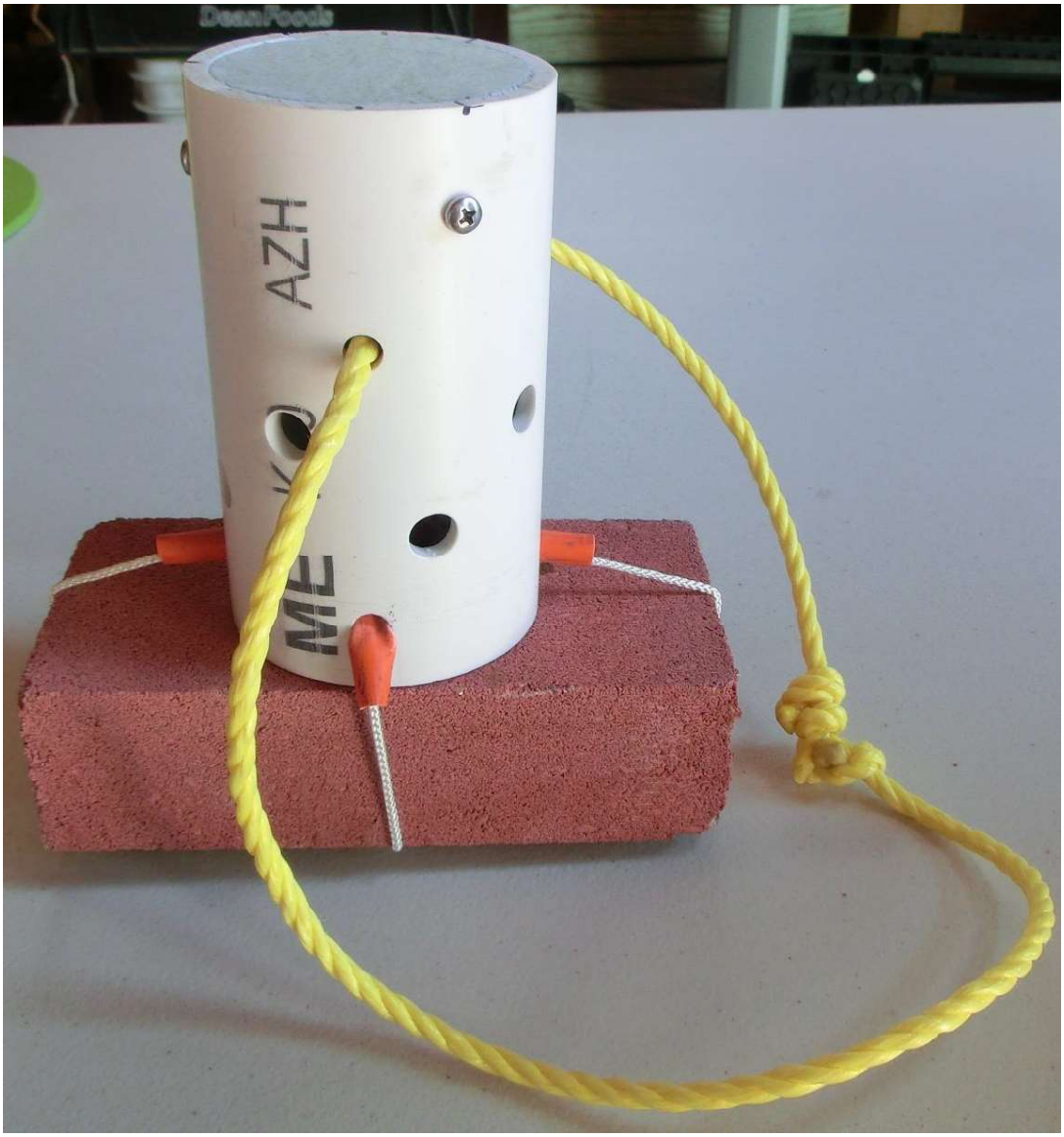


Photo 2-13 – GLWP Temperature Logger container

The HOBO device is managed using Bluetooth so it can be checked, to see if it is logging correctly, without opening the device. The assemblies did have to be retrieved from the water to do this however.

2.1.3.3 Variances from FERC-approved Study Plan and Proposed Modifications

The study plan and schedule did not vary from the FERC-approved study plan.

2.1.3.4 References

Frost, F.O. 2001. Arctic char management plan. Department of Inland Fisheries and Wildlife, Division of Fisheries and Hatcheries. November 2001.

2.1.4 Downstream Benthic Macroinvertebrate (BMI) Study 1-4:

The purpose of this study is to demonstrate whether current in-stream flow releases affect attainment of aquatic life and habitat criteria in the waters downstream of the Green Lake Dam. The BMI study will evaluate the current macroinvertebrate community structure and assess any impacts caused by project operations on waters downstream of the Project.

GLWP consulted with Paul Leeper – Biologist at at Moody Mountain Environmental Services. Paul set up baskets of rocks in the locations coordinated with MDEP

On August 27, 2020 – Paul placed 3 rock filled baskets in Reeds Brook at sites agreed with MDEP.

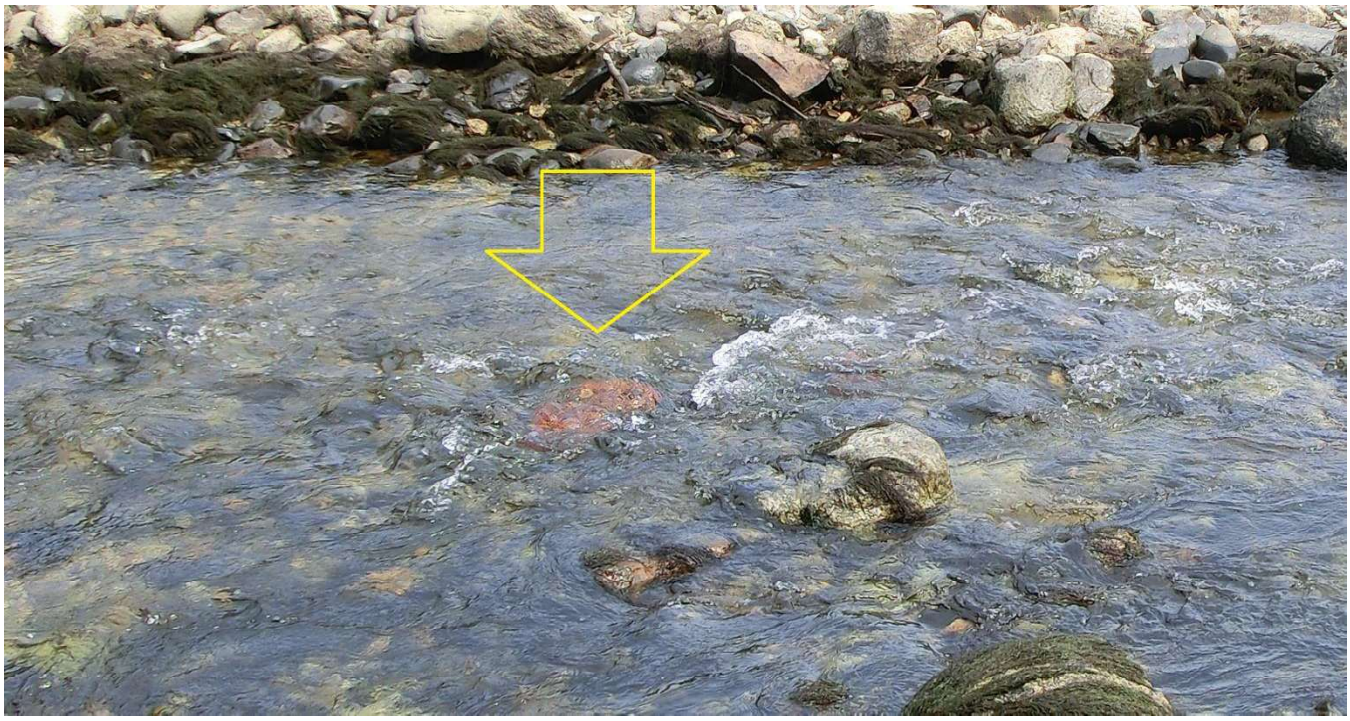


Photo 2-14 – A Rock Filled Basket in Reeds Brook

On September 24, 2020 Paul retrieved the baskets. He then collected the baskets and reviewed the contents.

The data has been sent to MDEP for analysis using the Linear Discriminant Model (LDM). The results are not yet available.

A full report will be prepared and submitted after the analysis and coordination has occurred.

2.1.4.1 Variances from FERC-approved Study Plan and Proposed Modifications

The study plan and schedule did not vary from the FERC-approved study plan.

2.1.5 Downstream Temperature and Dissolved Oxygen (DO) Study 1-5:

Temperature and dissolved oxygen (DO) must be monitored downstream of the Green Lake Dam to demonstrate whether the Project meets Maine's DO numeric criteria.

The data gathering was done in accordance with MDEP's Sampling Protocol for Hydropower Studies (September 2019).

1.

Figure 2-33 – Locations for Temperature and DO sampling in Reeds Brook.

Beginning on July 25, 2020 GLWP took 10 sets weekly of dissolved oxygen and temperature readings in Reeds Brook, one in the early morning and one after 2pm, at the locations requested by MDEP.

- DO 1) The Reeds Brook bypass reach below the dam but upstream of the Green Lake National Fish Hatchery filter backwash discharge.
- DO 2) The tailrace downstream of the powerhouse.
- DO 3) In the confluence of the tailrace and the Reeds Brook bypass.
- DO 4) The Reeds Brook bypass reach directly upstream of the confluence of the bypass and the tailrace.

2.1.5.1 Downstream Temperature and Dissolved Oxygen

The gates at the dam remained closed during the study period. With the gates closed, the flow past the dam into the brook is from dam and gate leakage. Such leakage will vary with lake level—higher lake levels mean more flow and lower levels less leakage. The following table shows the Flow Duration percent based on the level of the lake.

The Flow Duration % is divided in to 1500 to produce the value in the °C goal column.

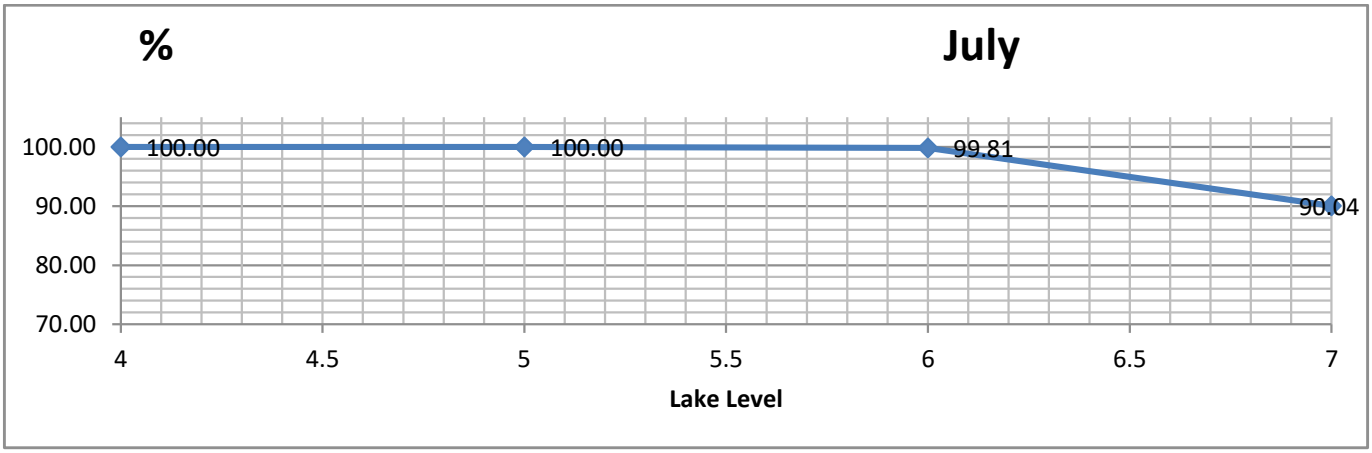


Figure 2-34 – July Flow Duration

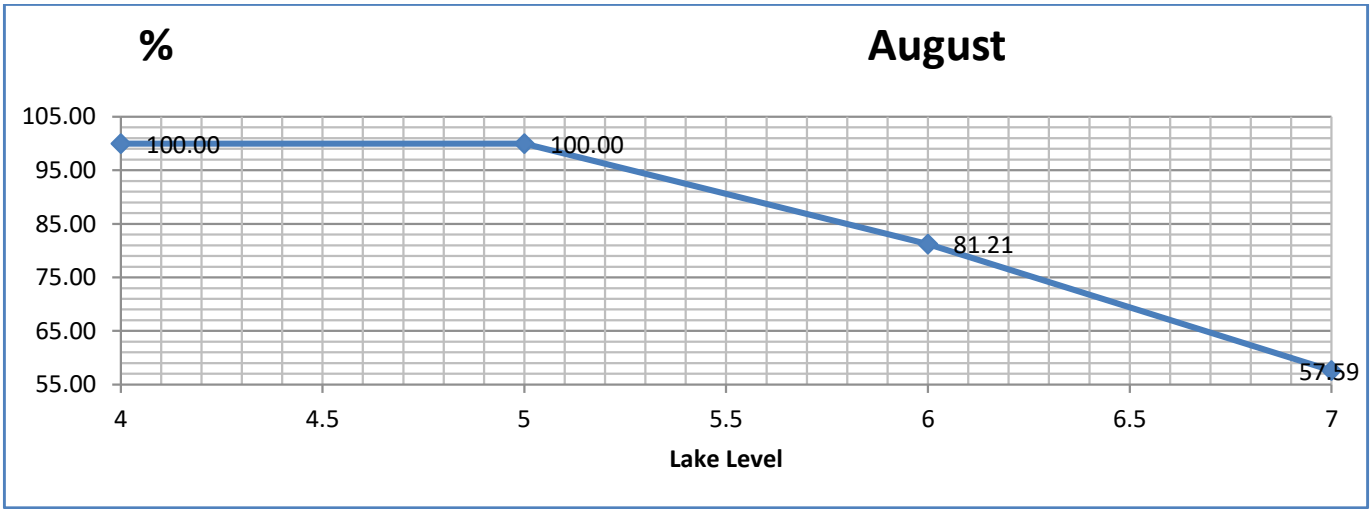


Figure 2-35 – August Flow Duration

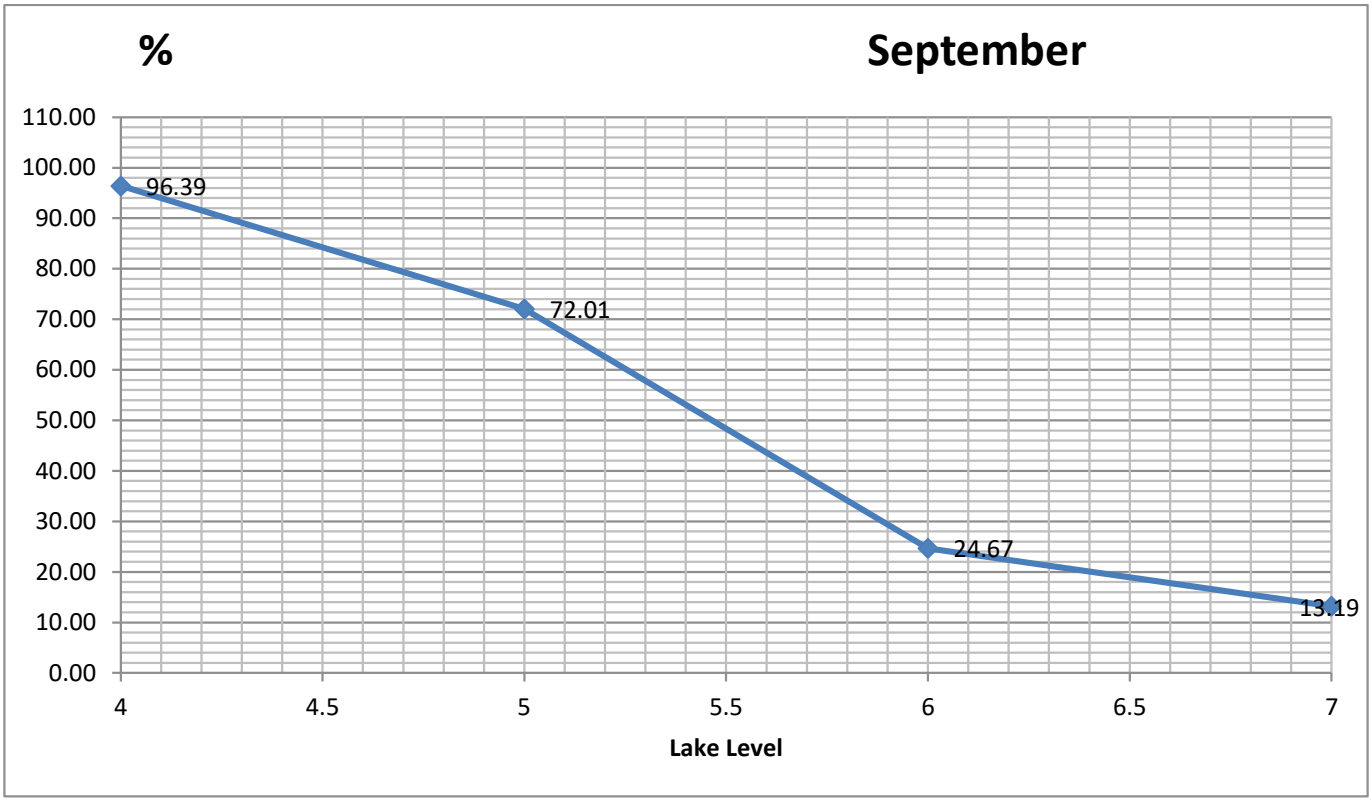


Figure 2-36 – September Flow Duration

Based on this, all sampling days from July through August comply with the required conditions.

			% Flow						
Date		Lake Level	Duration	°C goal	Point 1	Point 2	Point 3	Point 4	Ave Temp
25-Jul	AM	6.15	94.00	15.96	25.00	22.00	22.90	22.00	22.98
25-Jul	PM	6.15	94.00	15.96	27.00	25.00	26.10	24.70	25.70
31-Jul	AM	6.20	92.00	16.30	26.20	22.60	22.70	23.10	23.65
31-Jul	PM	6.20	92.00	16.30	28.00	25.30	25.30	25.10	25.93
7-Aug	AM	6.13	72.00	20.83	24.60	19.90	19.20	21.30	21.25
7-Aug	PM	6.13	72.00	20.83	25.60	23.60	20.50	23.50	23.30
14-Aug	AM	6.00	81.21	18.47	26.10	19.10	19.50	23.40	22.03
14-Aug	PM	6.00	81.21	18.47	26.90	25.00	23.20	25.50	25.15
21-Aug	AM	5.83	84.00	17.86	23.80	20.60	19.00	20.50	20.98
21-Aug	PM	5.83	84.00	17.86	24.50	22.70	19.60	22.50	22.33
29-Aug	AM	5.70	86.80	17.28	21.00	18.70	16.90	18.70	18.70
29-Aug	PM	5.70	86.80	17.28	21.10	19.00	17.40	18.90	19.10
4-Sep	AM	5.70	38.00	39.47	20.10	18.60	17.20	18.60	18.63
4-Sep	PM	5.70	38.00	39.47	22.50	21.50	19.20	21.80	21.25
11-Sep	AM	5.50	48.00	31.25	20.80	18.20	16.90	18.30	18.55
11-Sep	PM	5.50	48.00	31.25	21.20	21.10	20.50	19.30	20.53
18-Sep	AM	4.90	76.00	19.74	18.70	18.60	18.30	16.30	17.98
18-Sep	PM	4.90	76.00	19.74	17.80	18.80	18.40	17.00	18.00
24-Sep	AM	4.40	92.00	16.30	16.60	16.60	16.50	15.50	16.30
24-Sep	PM	4.40	92.00	16.30	17.90	17.40	17.10	17.40	17.45

Table 2-4 – Calculation for Water Temperature and Flow Duration exceeding 1500

This table provides the DO and temperature for the four locations for the full 10 weeks:

					DO 1		DO 2		DO 3		DO 4	
Date	Time	Flow Duration	Average Water Temp	=1500	Water Temp	DO	Water Temp	DO	Water Temp	DO	Water Temp	DO
25-Jul	6:30 AM	94.00	22.98	2159.65	25.00	8.05	22.00	8.21	22.90	8.42	22.00	8.55
25-Jul	2:17 PM	94.00	25.70	2415.80	27.00	7.62	25.00	8.72	26.10	9.14	24.70	8.45
31-Jul	6:06 AM	92.00	23.65	2175.80	26.20	7.64	22.60	8.03	22.70	8.08	23.10	8.30
31-Jul	2:17 PM	92.00	25.93	2385.10	28.00	7.50	25.30	8.61	25.30	8.68	25.10	8.45
7-Aug	6:09 AM	72.00	21.25	1530.00	24.60	7.94	19.90	8.83	19.20	8.60	21.30	8.72
7-Aug	2:14 PM	72.00	23.30	1677.60	25.60	7.92	23.60	8.72	20.50	8.99	23.50	8.64
14-Aug	6:04 AM	81.21	22.03	1788.65	26.10	7.65	19.10	7.89	19.50	8.55	23.40	8.33
14-Aug	2:26 PM	81.21	25.15	2042.43	26.90	7.73	25.00	8.73	23.20	8.76	25.50	8.43
21-Aug	6:17 AM	84.00	20.98	1761.90	23.80	7.78	20.60	8.71	19.00	8.60	20.50	8.75
21-Aug	2:34 PM	84.00	22.33	1875.30	24.50	7.81	22.70	8.65	19.60	9.08	22.50	8.71
29-Aug	6:07 AM	86.80	18.83	1634.01	21.00	7.59	18.70	9.00	16.90	9.07	18.70	9.07
29-Aug	4:04 PM	86.80	19.10	1657.88	21.10	7.71	19.00	8.87	17.40	8.99	18.90	8.96
4-Sep	6:13 AM	38.00	18.63	707.75	20.10	7.94	18.60	8.83	17.20	8.60	18.60	8.72
4-Sep	3:06 PM	38.00	21.25	807.50	22.50	7.92	21.50	8.72	19.20	8.99	21.80	8.64
11-Sep	6:09 AM	48.00	18.55	890.40	20.80	7.65	18.20	7.89	16.90	8.55	18.30	8.33
11-Sep	2:40 PM	48.00	20.53	985.20	21.20	7.73	21.10	8.73	20.50	8.76	19.30	8.43
18-Sep	6:12 AM	76.00	17.98	1366.10	18.70	7.78	18.60	8.71	18.30	8.60	16.30	8.75
18-Sep	2:38 PM	76.00	18.00	1368.00	17.80	7.81	18.80	8.65	18.40	9.08	17.00	8.71
24-Sep	6:19 AM	92.00	16.30	1499.60	16.60	7.59	16.60	9.00	16.50	9.07	15.50	9.07
24-Sep	2:36 PM	92.00	17.45	1605.40	17.90	7.71	17.40	8.87	17.10	8.99	17.40	8.96
			Average →			7.75		8.62		8.78		8.65
			Median →			7.73		8.72		8.76		8.68
			Minimum →			7.50		7.89		8.08		8.30
			Maximum →			8.05		9.00		9.14		9.07

Table 2-5 – Dissolved Oxygen and Temperature Readings at DO 1, DO 2, DO3, and DO 4

2.1.5.2 Variances from FERC-approved Study Plan and Proposed Modifications

GLWP had proposed installing loggers to capture the Temperature and DO readings in Reeds Brook. MDEP recommended using the discrete grab technology. With this exception, the study plan and schedule did not vary from the FERC-approved study plan.

2.2 Study #2 – Aquatic Resources – Encompasses Data Requested from MDEP for Aquatic Habitat Cross-Section Flow and from US NMFS In-stream Flow

Reeds Brook Habitat

Reeds Brook (the Brook) flows from the Green Lake Dam to Graham Lake, a straight line distance of 1800 feet[1]. From just below the Green Lake Dam the Brook drops 45 feet and flows 2000 feet before discharging into Graham Lake.

The marked points in the following image are on the right side of the Brook facing downstream (on the south side).

Image: Brook Path, Source GLWP and Google Maps

The following image shows the USGS elevation of the water surface of the Brook.

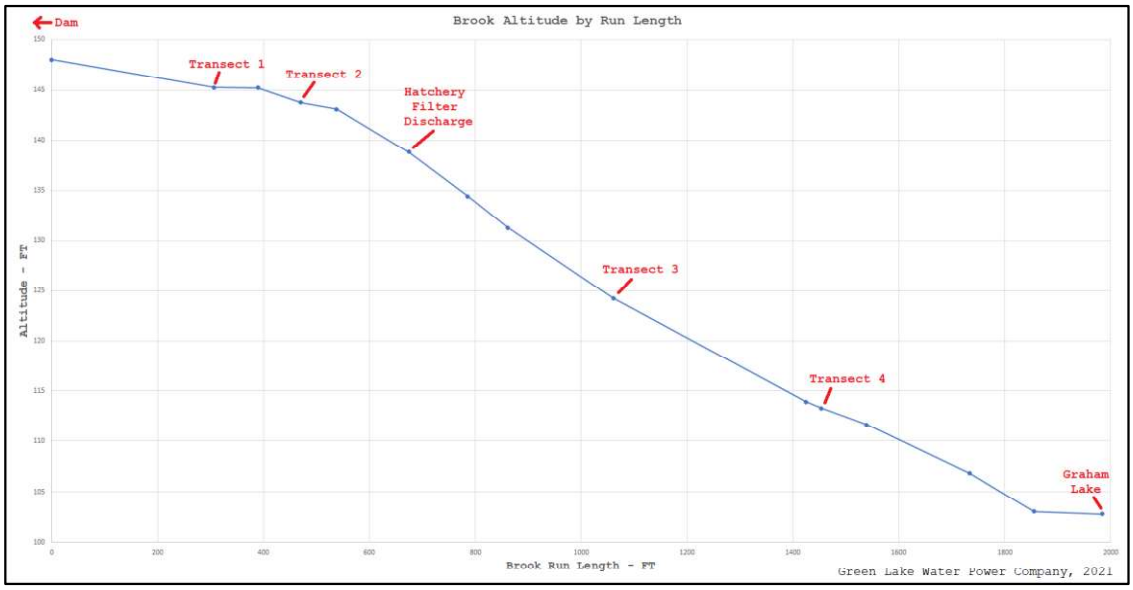


Figure 2-37 – Brook Run Elevation, Source GLWP

[1] Whole quantity numbers in this section are approximate.

During the Brook Habitat study the Brook was mapped to determine its course and slope, its extents were surveyed as to their characteristics, and four transects across the Brook were mapped in detail at multiple flows. Details on this study are included in the Brook Habitat Study appendix to this document. Study and analysis methods are described, as well as details on the results later in this section.

2.2.1 Brook Characteristics

The Brook characteristics are classified as Rosgen B3 (Reference: Fundamentals of Rosgen Stream Classification System | Watershed Academy Web | US EPA and https://cfpub.epa.gov/watertrain/pdf/s36.pdf). The substrate is mostly cobble with some gravel and boulders. The Brook has an average slope of 2.3% and a sinuosity of 1.1. The minimum measured slope of a section of the Brook is less than 1% and the maximum slope of a section is 4.15%.

The upper region of the Brook (before the Hatchery Filter discharge enters) is relatively wide, with a low slope. It is composed of about 60% riffle and 40% pools and is characterized by Transect 1 for the pools and Transect 2 for the riffle. The lower region of the Brook has a higher slope with about 69% riffle and 31% pools and is characterized by Transect 3 for the riffle and Transect 4 for the pools.

The complete, within the banks, Brook substrate surveyed as the following:

Type	Area (sq-ft)	Area (%)
Fines	0	0.0%
Small Gravel	4996	11.1%
Medium Gravel	2879	6.4%
Large Gravel	4336	9.6%
Small Cobble	7478	16.6%
Medium Cobble	8431	18.7%
Large Cobble	5677	12.6%
Small Boulder	5907	13.1%
Large Boulder	5337	11.9%
Total	45041	100.0%

2.2.2 Study Flows

Four flow levels were used for performing the Transect cross flow measurements. The flows were chosen to cover the range of current minimum flow up to the ½ cfs per square mile of drainage area flow.

Name	Dam Gate Opening	Approximate CFS
Flow 1	Dam & gate leakage	2
Flow 2	0.75 inches	5.5
Flow 3	1.5 inches	11
Flow 4	3.0 inches	22

The following graph shows the flow through Waste Gate 2 at the Green Lake dam for small openings at the lake level encountered during the transect flow study work. This graph reflects the flow through the gate with a clean fish screen in place upstream of the gate.

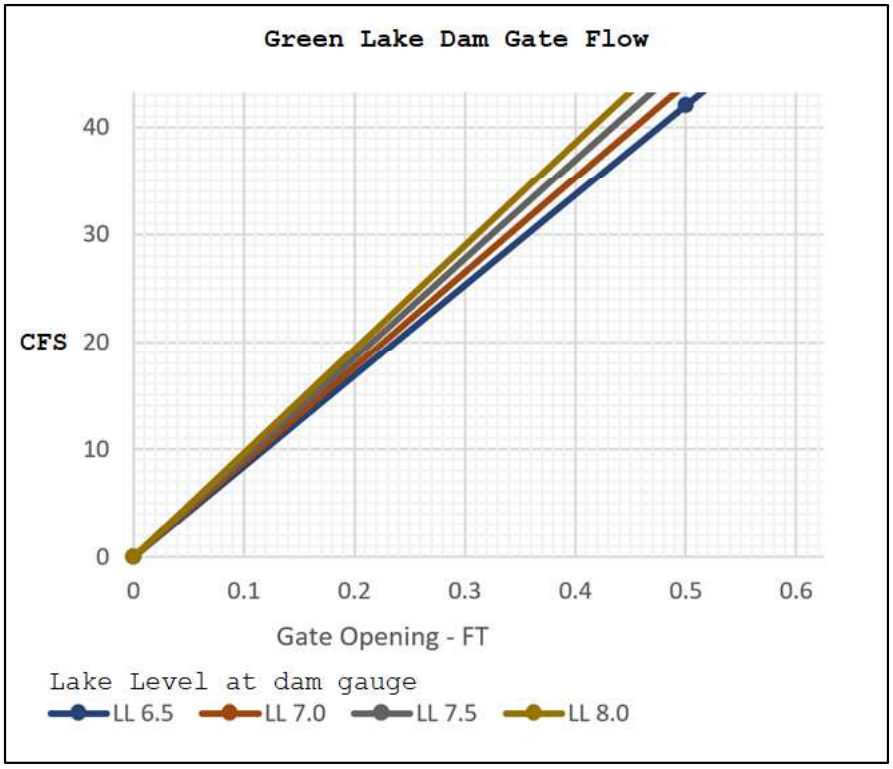


Figure 2-38 – Flow through Waste Gate 2

Source: GLWP and Bangor Hydroelectric

2.2.3 Transects

Four transects were proposed by GLWP after consultation with a Kleinschmdit Group biologist. These sites were verified as acceptable by MDEP and NMFS. The transect locations are shown on the Brook Path and Run Elevation images earlier in this section.

2.2.3.1 Transect 1

Transect 1 is 307 ft from the start of the Brook. It is a large, wide pool with an in-water substrate of small and medium cobble with interspersed gravel of varying sizes.

Photo 2-15 – Transect 1

Transect 1 Substrate	
Fines	0%
Gravel Small	18%
Gravel Medium	14%
Gravel Large	17%
Cobble Small	31%
Cobble Medium	15%
Cobble Large	0%
Boulder Small	5%
Boulder Large	0%

Table 2-6 – Transect 1 Water Substrate

This table shows the measured/calculated geometric and flow quantities for each of the four study flows at Transect 1:

	Elev - ft USGS	Width - ft	Flow Width - ft	Area - sqft	Flow - cfs	Avg Depth - ft	Avg Flow - ft/s
Flow 1	145.10	37.43	37.43	21.76	2.33	0.58	0.11
Flow 2	145.38	38.04	38.04	29.45	9.07	0.77	0.31
Flow 3	145.50	38.79	38.79	34.59	12.56	0.89	0.36
Flow 4	145.72	39.22	39.22	44.30	23.03	1.13	0.52

Table 2-7 – Transect 1 Flow Quantities

In the above table, "Width" is the overall distance from where the water meets the near bank to the far bank. "Flow Width" is the length of the water surface along the transect (would be less than "Width" if there were rocks projecting above the water surface, which there aren't on Transect 1.) "Avg Depth" is "Area" divided by "Flow Width." "Avg Flow" is "Flow" divided by "Area."

The diagram below shows the cross section of Transect 1 with the water levels at the four study flows.

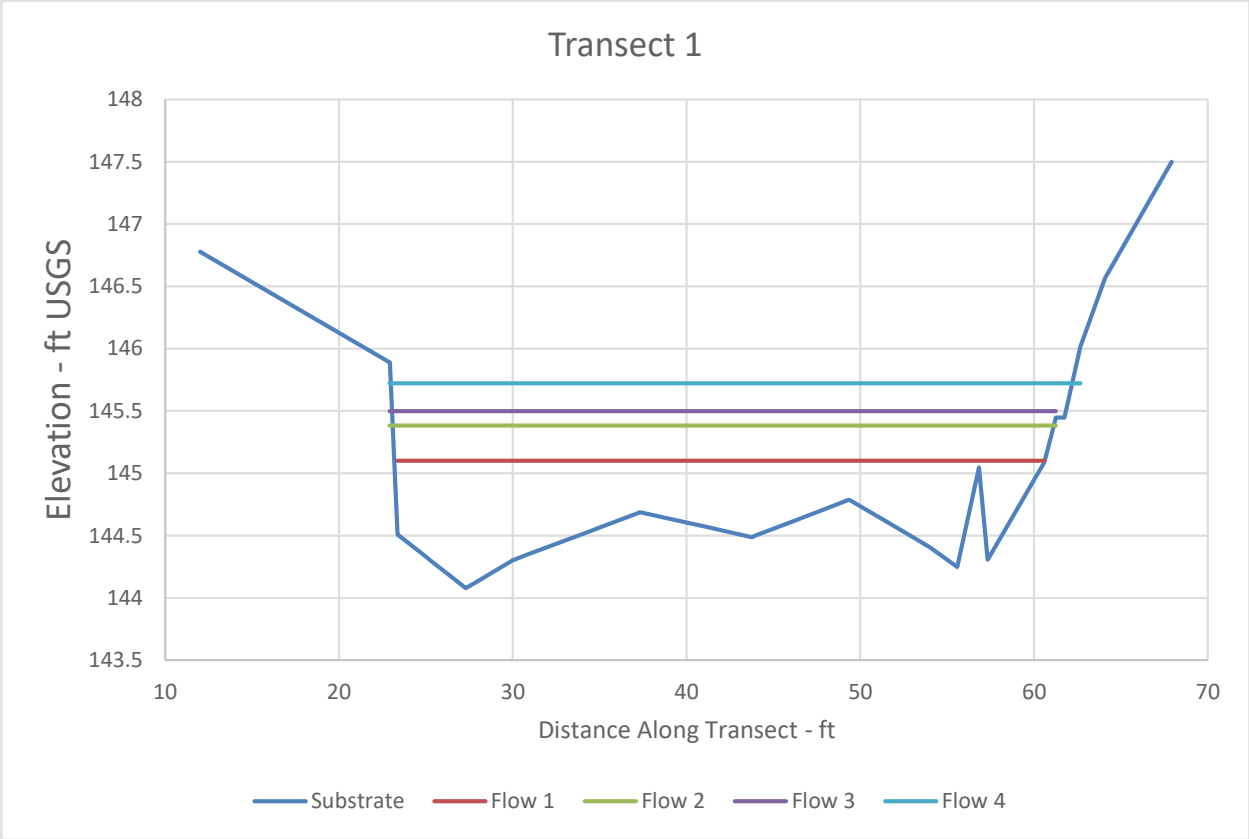


Figure 2-39 – Transect 1 Water Levels

Bank full at Transect 1 appears to be about Flow 4, as shown in the following picture:

Photo 2-16 – Bank full at Transect 1

The following pictures show Transect 1 along the transect line for the different flow levels.

Photo 2-17 – Transect 1 Flow 1

Photo 2-18 – Transect 1 Flow 2

Photo 2-19 – Transect 1 Flow 3

Photo 2-20 – Transect 1 Flow 4

2.2.3.2 Transect 2

Transect 2 is 471 ft from the start of the Brook and 164 feet from Transect 1. It is in a part of the Brook that is largely riffle, with some pools.

Photo 2-21 – Transect 2

The Transect 2 in-water substrate is as follows:

Transect 2 Substrate	
Fines	0%
Gravel Small	12%
Gravel Medium	9%
Gravel Large	5%
Cobble Small	10%
Cobble Medium	13%
Cobble Large	7%
Boulder Small	0%

Boulder Large	44%

Table 2-8 – Transect 2 Water Substrate

This table shows the measured/calculated geometric and flow quantities for each of the four study flows at Transect 2:

	Elev - ft USGS	Width - ft	Flow Width - ft	Area - sqft	Flow - cfs	Avg Depth - ft	Avg Flow - ft/s
Flow 1	143.47	22.83	10.50	4.82	4.15	0.46	0.86
Flow 2	143.67	23.92	12.33	7.81	5.85	0.63	0.75
Flow 3	143.78	26.00	14.92	9.48	12.44	0.64	1.31
Flow 4	143.92	26.83	15.50	11.55	19.17	0.75	1.66

Table 2-9 – Transect 2 Flow Quantities

The diagram below shows the cross section of Transect 2 with the water levels at the four study flows.

Figure 2-40 – Transect 2 Water Levels

Bank full for Transect 2 is about Flow 2 as shown in the following picture:

Photo 2-22 – Bank full for Transect 2

The following picture shows Flow 3 overtopping the bank:

Photo 2-23 – Transect 2

The following pictures show Transect 2 along the transect line for the different flow levels.

Photo 2-24 – Transect 2 Flow 1

Photo 2-25 – Transect 2 Flow 2

Photo 2-26 – Transect 2 Flow 3

Photo 2-27 – Transect 2 Flow 4

2.2.3.3 Transect 3

Transect 3 is 1061 ft from the start of the Brook and 590 feet from Transect 2. It is in the steepest part of the Brook that is largely riffle, with some small pools.

Photo 2-28 – Transect 3

The Transect 3 in-water substrate is as follows:

Transect 3 Substrate	
Fines	0%
Gravel Small	10%
Gravel Medium	3%
Gravel Large	7%
Cobble Small	12%
Cobble Medium	19%

Cobble Large	22%
Boulder Small	28%
Boulder Large	0%

Table 2-10 – Transect 3 Water Substrate

This table shows the measured/calculated geometric and flow quantities for each of the four study flows at Transect 3:

	Elev - ft USGS	Width - ft	Flow Width - ft	Area - sqft	Flow - cfs	Avg Depth - ft	Avg Flow - ft/s
Flow 1	124.23	17.17	15.75	7.51	6.44	0.48	0.86
Flow 2	124.53	17.75	16.75	12.53	15.60	0.75	1.24
Flow 3	124.63	20.25	17.33	14.33	22.33	0.83	1.56
Flow 4	124.86	20.83	17.92	17.39	27.52	0.97	1.58

Table 2-11 – Transect 3 Flow Quantities

The diagram below shows the cross section of Transect 3 with the water levels at the four study flows.

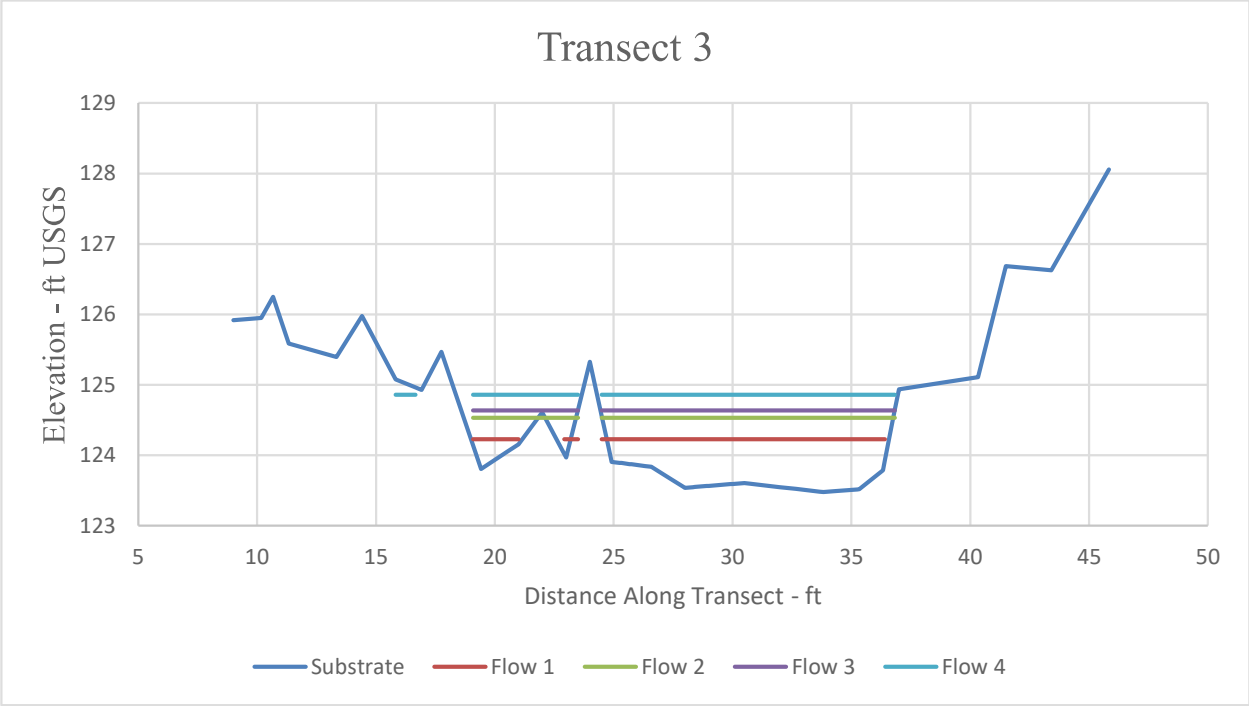


Figure 2-41 – Transect 3 Water Levels

Bank full is a bit more difficult to determine at Transect 3 because the banks are composed of large cobble and boulders. It appears to be about Flow 3, as shown in the following picture:

Photo 2-29 – Transect 3 Bank Full

The following pictures show Transect 3 along the transect line for the different flow levels.

Photo 2-30 – Transect 3 Flow 1

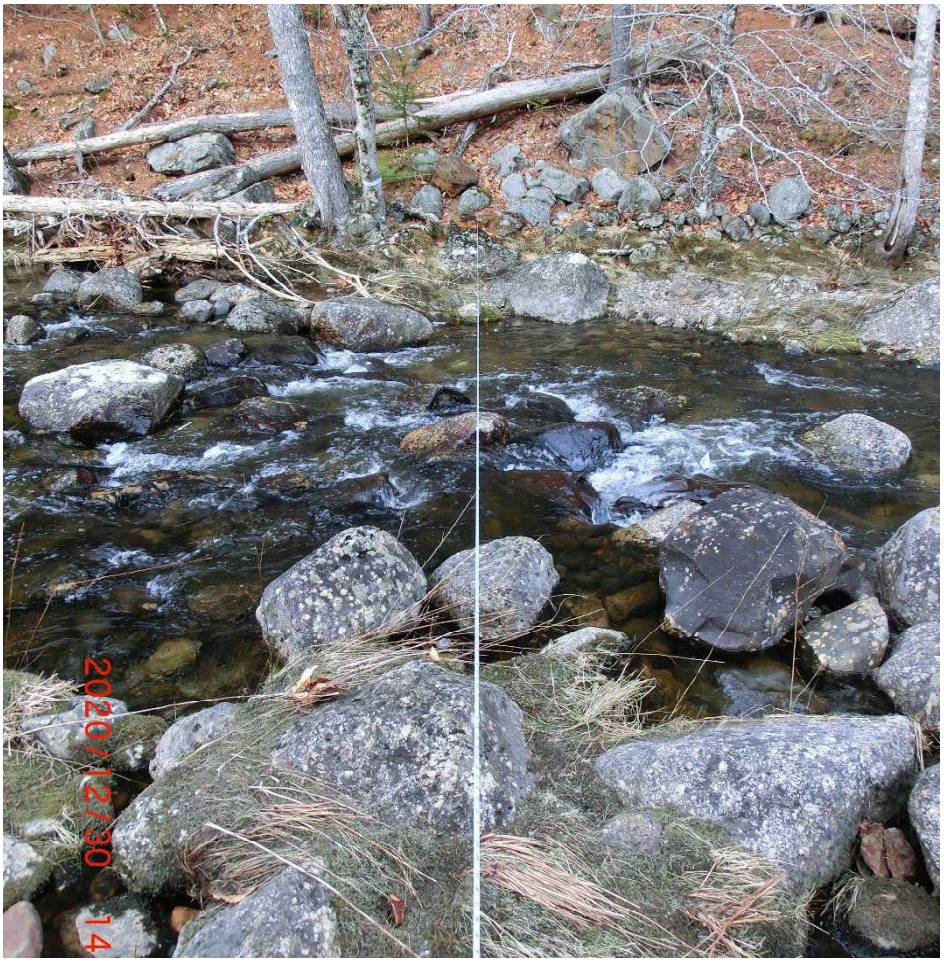


Photo 2-31 – Transect 3 Flow 2

Photo 2-32 – Transect 3 Flow 3

Photo 2-33 – Transect 3 Flow 4

2.2.3.4 Transect 4

Transect 4 is 1453 ft from the start of the Brook, 392 feet from Transect 3, and 531 feet from Graham Lake. It at the end of the steepest part of the Brook. The Brook from Transect 4 to Graham Lake is a mixture of riffle and pools.

Photo 2-34 – Transect 4

Photo 2-35 – Transect 4

The Transect 4 in-water substrate is as follows:

Transect 4 Substrate	
Fines	0%
Gravel Small	3%
Gravel Medium	3%
Gravel Large	11%
Cobble Small	15%
Cobble Medium	27%
Cobble Large	13%
Boulder Small	2%
Boulder Large	26%

Table 2-12 – Transect 4 Water Substrate

This table shows the measured/calculated geometric and flow quantities for each of the four study flows at Transect 4:

	Elev - ft USGS	Width - ft	Flow Width - ft	Area - sqft	Flow - cfs	Avg Depth - ft	Avg Flow - ft/s
Flow 1	113.16	15.12	15.12	21.08	5.82	1.39	0.28
Flow 2	113.24	15.52	15.52	22.49	8.85	1.45	0.39
Flow 3	113.35	15.74	15.74	24.23	14.28	1.54	0.59
Flow 4	113.66	16.28	16.28	28.95	33.02	1.78	1.14

Table 2-13 – Transect 4 Flow Quantities

The diagram below shows the cross section of Transect 4 with the water levels at the four study flows.

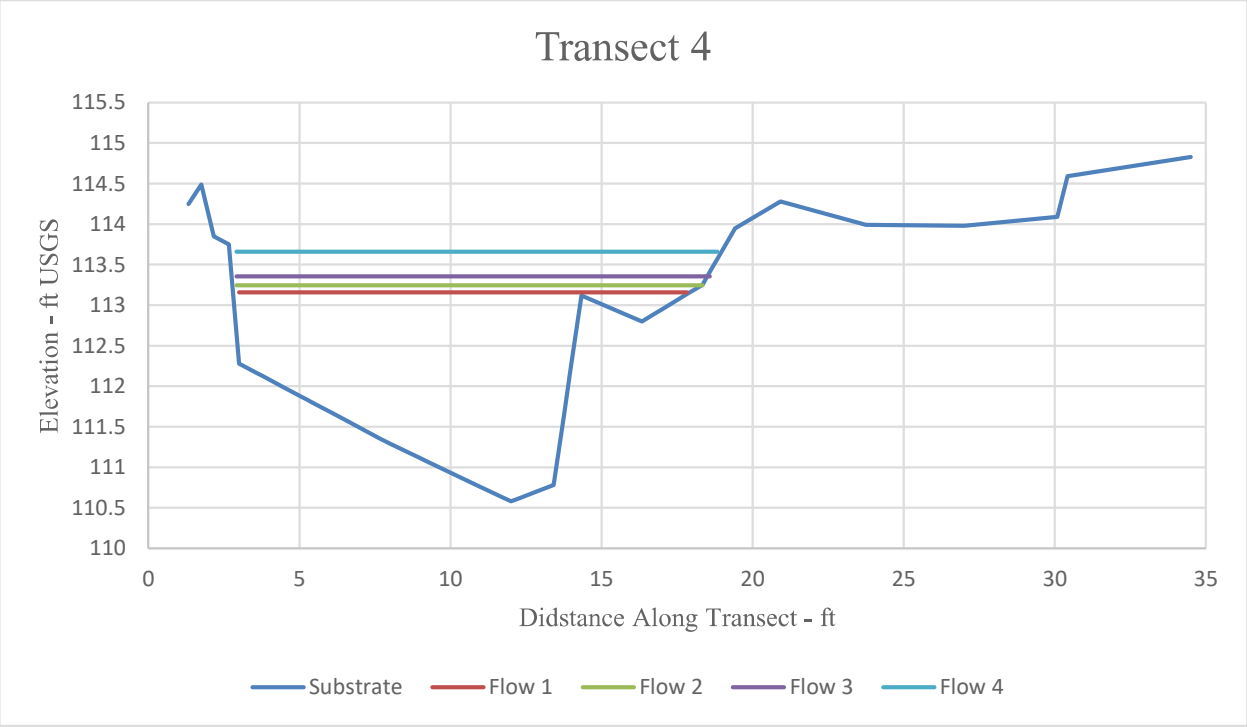


Figure 2-42 – Transect 4 Water Levels

Transect 4 appears to be bank full around Flow 3, as shown in the following picture:

Photo 2-36 – Transect 4 Bank Full

The following pictures show Transect 4 along the transect line for the different flow levels.

Photo 2-37 – Transect 4 Flow 1

Photo 2-38 – Transect 4 Flow 2

Photo 2-39 – Transect 4 Flow 3

Photo 2-40 – Transect 4 Flow 4

2.2.4 Methodology:

The following equipment was used to map along each transect:

- A CST/Berger SAL32XD level with tripod.
- An adjustable aim laser gunsight with a custom, adjustable mount attached to the tripod.
- Four Fiberglass tape measures 200 ft long.
- A fiberglass surveying rod calibrated in feet and tenths of feet.
- A Marsh-McBirney Model 2000 Flo-Mate flowmeter.

The level calibration was checked using the "in field" technique at the start of the transect mapping work. It was found to automatically level within 0.001 vertical feet at 75 feet distance.

The Marsh-McBirney flowmeter had an up to date calibration sticker and it's zero value was found to be within spec (per the manual) at the beginning of the transect flow measurements.

Each transect was mapped using a 4 stage process in the field:

1) The tape measure was strung on the transect line. The level was set up and the laser sight was adjusted so it was at the same height as the sight line of the level, hit the same point on the far bank as the level sighted, and was close to and parallel to the transect tape (using the level as a reference, and adjusting the laser site vertically with the bracket and setting the sight angle with the windage and elevation knobs on the laser.) At this point, the laser dot defined the line and sight level of the transect. One person then moved along along the transect with the surveying rod taking readings at points were the slope of the bottom, or substrate type changed, while another person took notes. The tape was read for distances and the laser dot on the surveying rod for height readings.
2) On a day when the typical minimum flow ("Flow 1") was occurring (runoff from past rain had died down) the flowmeter was used to sample flows and measure depths and distances across the transect. The reading locations were chosen based on the patterns of flow across the transects such that depths, widths and flows were measured for each area of flow (or no flow) of the Brook.

3) The gate at the dam was set to 3 inches open for "Flow 4." Another set of distance, depth and flow measurements was taken with the measurement locations chosen based on the flow patterns across the transect.
4) The gate at the dam was set to 0.75 inches open for "Flow 2" and a third set of measurements was taken.
5) The gate at the dam was set to 1.5 inches open for "Flow 3" and a fourth set of measurements was taken.

Each flow water level was determined by calculating the level at which the area between a level line and the substrate was equal to the area between the water surface and the substrate measured during the flow conditions. This approach was adopted because it was not as sensitive to errors caused by shifting substrate rocks, slight changes in the tape measure, or changing flow patterns during and between different flow measurements.

The following equipment was used to map the Brook path and altitude:

- A custom barometric pressure monitor based on a Setra 270 800-1100 mb pressure sensor.
- A custom altimeter and GPS unit based on a Setra 270 800-1100 mb pressure sensor and an Air530 GNSS using GPS, GLONASS and SBAS satellites.

The Brook was mapped using the following approach:

1) The base barometric pressure monitor was used to measure and record the local barometric pressure every second during the mapping work.
2) The altimeter placed outside for about an hour to acclimate to the air temperature.
3) The altimeter was placed at locations to be measured, triggered to take a set of readings and then un-triggered after several minutes. The altimeter captured and recorded pressure and GPS readings every second while triggered.
4) Two of the locations measured were at two widely different, known, heights (the dam and the power station) so these readings could be used for altimeter calibration.
5) The logs from the base and altimeter units were post processed to remove readings when the GPS did not have a good fix or the readings were otherwise unstable. Each altimeter reading was subtracted from the base unit reading for the same second to get a pressure difference between the base and altimeter.
6) Using the air temperature and pressure the theoretical local density of air was calculated and used to determine a "ft per mb" value. This value was fine-tuned using the readings taken at know heights.
7) The readings were processed to determine the location and height of each measured position.

Accuracy:

The power station "known elevation" spot was measured at the start and completion of the mapping work. The heights calculated from the two sets of readings differed by less than ½ foot. From the testing of the units it appears the GPS accuracy (with clear view of the sky and several minutes of readings) is within about 2 feet. With a couple minutes of readings the altimeter appears to be accurate to less than 1 foot. Its resolution is less than 3 inches.

Photo 2-41 – Flow Meters

2.2.5 Variances from FERC-approved Study Plan and Proposed Modifications

The study plan did not vary from the FERC-approved study plan but, because of heavy rain during the fall, this work was completed January 23, 2021.

2.3 Study #3 – Aquatic Resources - Eel Passage Survey Requested by the United States Fish and Wildlife Service (US FWS)

The Green Lake Project structures are believed to block the upstream and downstream movement of American eel. Passage facilities designed for American eel may be needed to reestablish the connection between rearing and spawning habitats.

Eel observation was carried out at night at the dam and lower in the Brook. Eel observation began in May and was done weekly in June and into July. No eels were observed and no potential predators were sighted.

The study was ended in coordination with Anna Harris, US Fish and Wildlife Service, who wrote "I believe you spoke with Gail from DMR earlier this week. Gail and I connected today and based on her recommendation, and my knowledge of our study request, it is recommended that at the Green Lake Project, you conduct two more studies in July to be sure there are no eels present. And if nothing is caught, additional studies would be referred until after there is upstream passage at the Ellsworth dam."

Two additional night time observations were done in July with no eels observed so the study was ended.

2.3.1 Eel Passage Survey Events

Photo 2-42 – Looking for eels at night – spillway

Photo 2-43 – Looking for eels at night – below dam

Date	Start (hours)	End (hours)	Weather	Notes
11-May-20	9pm	9:45pm	Light rain.	Observation at and below the dam followed by observation at the brook by the power house. No eels were observed. One spill gate 20% open. Spillway damp from waves. Pond full. No eels or potential predators sighted.
6-Jun-20	9:12pm	9:56pm	0.47 inch rain earlier in the day.	Observation at and below the dam and in the gate wells. Looked in gaps between rocks in the brook and up toward the North East spillway. Pond at 6.46' on the staff gauge. Plenty of water running downstream. Inspected stream below dam and into the gate wells – no signs of eels. Also checked the brook by the power house. No eels were observed. No potential predators sighted.

14-Jun-20	9:17pm	9:57pm	No rain, 57 F	Plenty of water running downstream Inspected stream below dam and into the gate wells - no signs of eels Checked in gaps between rocks Checked around brook by the power station, no sign of eels. Saw some crayfish 5-6" in pool by spillway flume and one or two down the stream. No predators.
20-Jun-20	9:25pm	9:56pm	No rain, 72 F	Plenty of water running downstream Inspected stream below dam and into the gate wells - no signs of eels Checked in gaps between rocks Checked around brook by the power station, no sign of eels Saw some crayfish 5-6" in pool by spillway flume and one or two down the stream No predators Lots of fireflys.
29-Jun-20	9:47pm	10:43pm	Light rain, ground is damp, temp 65F wind 3mph NE	Plenty of water running downstream. Inspected stream below dam and into the gate wells - no signs of eels. Big turtle just below the gates! Maybe a foot long. Checked in gaps between rocks. Checked around brook by the power station. Saw some big spiders by the gates and in the spillway flume. No eels were observed. No potential predators sighted. Pond at 6.4' on the staff gauge.
5-Jul-20	9:10pm	9:58pm	Overcast, light rain, ground is damp, temp 58F wind 3mph SE	Plenty of water running downstream. Inspected stream below dam and into the gate wells - no signs of eels. Checked in gaps between rocks. Checked around brook by the power station. Spiders, lots of big ones, probably 3" across on rocks, spillway and in the gates. Pond at 6.36' on the staff gauge. No eels were observed. No potential predators sighted.
14-Jul-20	9:50pm	10:45pm	Overcast, no rain, ground is dry, temp 63F wind 6mph NE	Plenty of water running downstream. Inspected stream below dam and into the gate wells - no signs of eels. Checked in gaps between rocks. Checked around brook by the power station, no sign of eels. Spiders, lots of big ones, probably 3" across on rocks, spillway and in the gates. A couple of crayfish in the brook. Pond at 6.30' on the staff gauge. No eels were observed. No potential predators sighted
26-Jul-20	9:16pm	9:50pm	Light rain, ground is damp, temp 76F wind 2mph WNW	Plenty of water running downstream. Inspected stream below dam and into the gate wells - no signs of eels. Checked in gaps between rocks. Checked around brook by the power station. Saw some big spiders by the gates and in the spillway flume. Pond at 6.15' on the staff gauge. No eels were observed. No potential predators sighted.

Table 2-14 – Night time Eel Surveys

2.3.2 Variances from FERC-approved Study Plan and Proposed Modifications

The study plan and schedule did not vary from the FERC-approved study plan.

2.4 Study #4 – Cultural Resources – Erosion Reconnaissance Survey

2.4.1 Architectural Study

In accordance with Section 106, GLWP consulted with Patrick O'Bannon, an Historian at Gray & Pape, who is on the list of approved historic preservation consultants. Patrick conducted an architectural survey within the Project boundary to assess possible effects to historic resources from issuance of a new operating license for the continued maintenance and operation of the existing Project.

MHPC agreed with the results in the report from Gray & Pape as noted in this letter:

MAINE HISTORIC PRESERVATION COMMISSION
55 CAPITOL STREET
65 STATE HOUSE STATION
AUGUSTA, MAINE
04333

JANET T. MILLS
GOVERNOR

KIRK F. MOHNEY
DIRECTOR

September 2, 2020

Ms. Kendal Anderson
Gray & Pape
60 Valley Street
Suite 103
Providence, RI 02909

Project: MHPC# 0155-19 Green Lake Hydroelectric Project; Reed Brook; FERC 7189
Architectural Survey
Town: Ellsworth, ME

Dear Ms.Anderson:

In response to your recent request, the Commission has reviewed the information received August 19, 2020 to continue consultation on the above referenced project in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA).

Our office concurs with Gray & Pape's finding that no architectural properties are eligible for listing in the National Register of Historic Places.

Please contact Megan M. Rideout of our staff if we can be of further assistance in this matter.

Sincerely,

Kirk F. Mohney

Kirk F. Mohney
State Historic Preservation Officer

Figure 2-43 – Approval Letter from MHPC

2.4.1.1 Variances from FERC-approved Study Plan and Proposed Modifications

The study plan and schedule did not vary from the FERC-approved study plan.

2.4.2 Erosion Survey

GLWP used USGS maps to identify the areas around Green Lake that have steep banks. 17 sites were identified.

On August 31, 2020 GLWP took a boat out on Green Lake and toured the perimeter to inspect the identified steep slope sites for erosion, as well as to locate any additional sites that had significant erosion. One picture was taken of each site.

No erosion was found that GLWP believes would extend the Area of Potential Effect beyond the Project Boundary.

One of the targeted sites, and another site that was identified during this reconnaissance, had minor erosion issues. Both of these sites are on the point South West of the dam as noted on this section of map. GLWP went out on the lake again on October 19, 2020 to gather further pictures of these 2 sites.

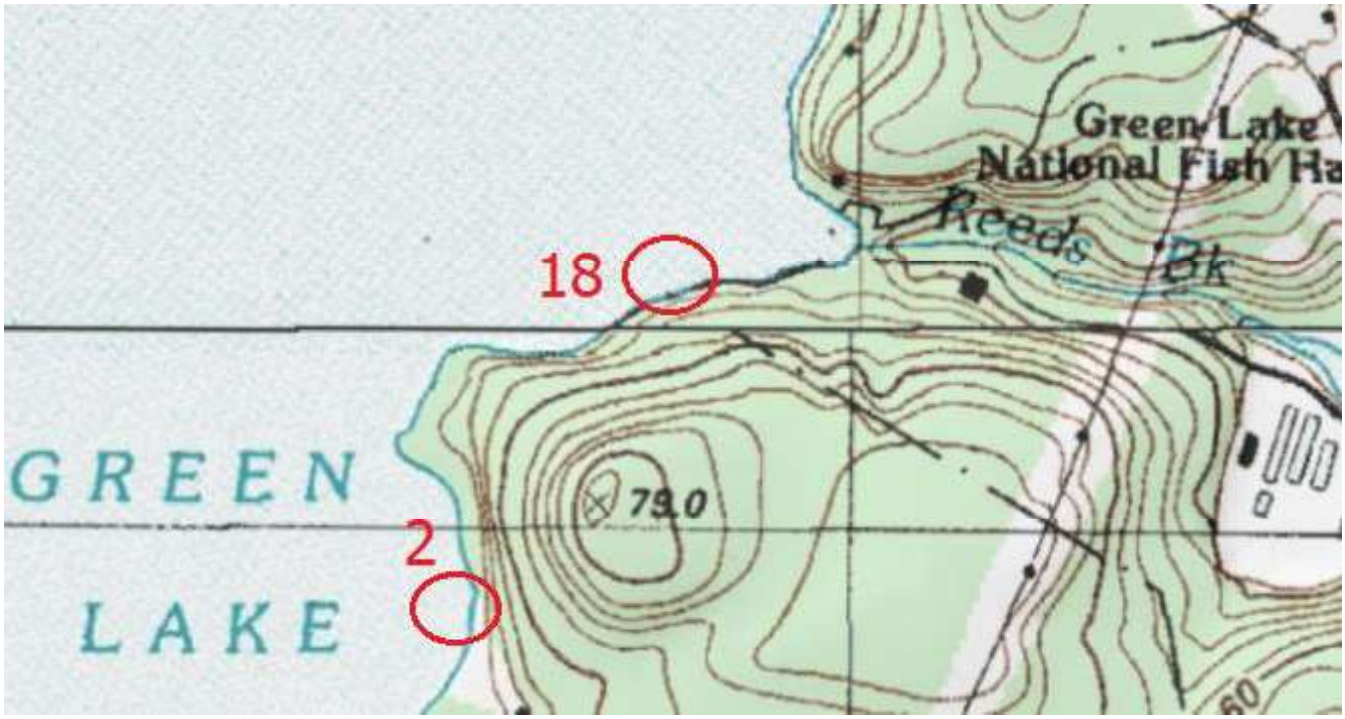


Figure 2-44 – Map of possible Erosion Sites

Site 2:

Site 2:

Site 18

Site 18

Site 18 

2.4.2.1 Survey Pictures around Green Lake

These are the sites that were reviewed and determined not to have erosion issues. Starting at the south corner and heading North East, anti-clockwise, the three map sections show the location of each of the pictures following it.

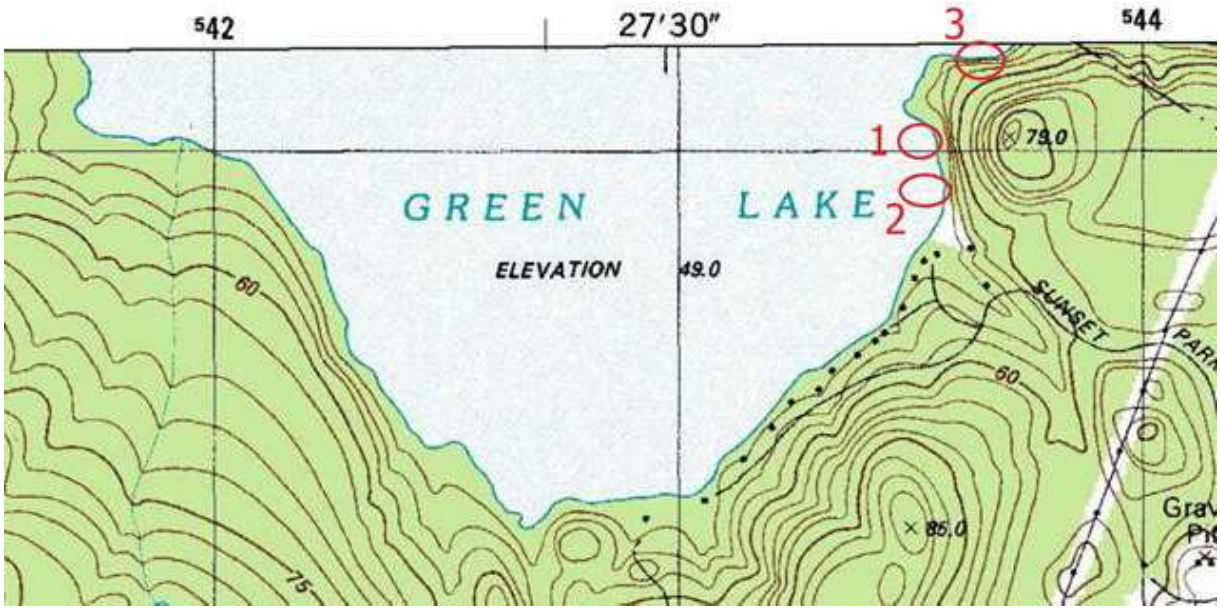


Figure 2-45 – Erosion Survey South End

Location 1

Location 3

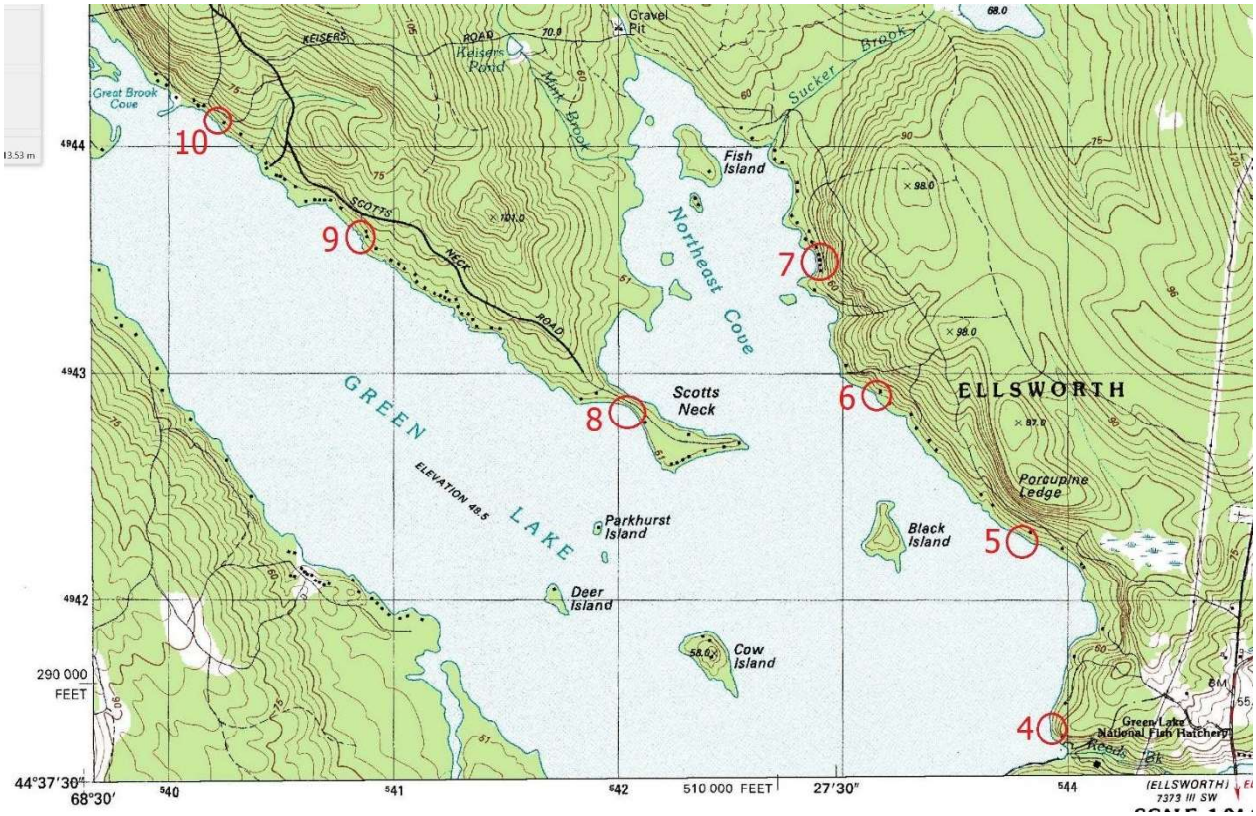


Figure 2-46 – Erosion Survey South East End

Location 4

Location 5

Location 6

Location 7

Location 8

Location 9

Location 10

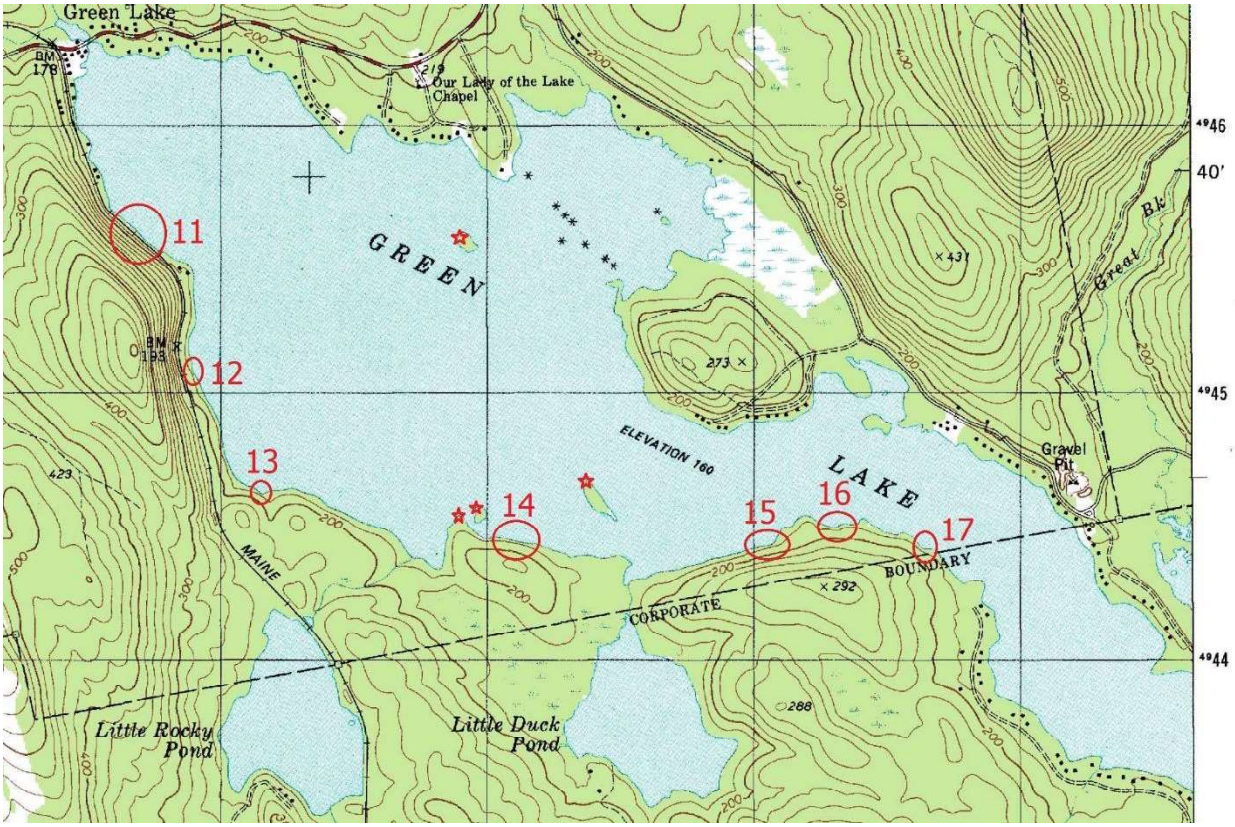


Figure 2-47 – Erosion Survey North End

Location 11

Location 12

Location 13

Location 14

Location 15

Location 16

Location 17

And while we were on the lake, we were kept company by the loons.

Photo 2-44 – Loons on the lake

2.4.2.2 Variances from FERC-approved Study Plan and Proposed Modifications

The study plan and schedule did not vary from the FERC-approved study plan.

2.5 ADDITIONAL INFORMATION REQUESTED

In a letter to GLWP submitted on December 5, 2019, in Schedule B, FERC requested additional information on the Project.

2.5.1 Terrestrial Resources

2.5.1.1 Loon Data

1. Section 5.7.1 of the PAD states that loons occur in the project area. However, the PAD does not describe the abundance, timing, activities, and general distribution of common loons within the project area. The Green Lake Association has indicated that they participate in the Maine Audubon's annual loon count on Green Lake. To assist staff with its environmental analysis of the proposed project, please provide the results from the loon counts on Green Lake. To the extent possible, the information should include annual totals of adults and chicks observed, the timing of nesting, and the locations of nests.

The Green Lake Association coordinated with the Audobon Society to collect the data on the loon, chick and nest counts. Given the information on where the data had been gathered by the GLA, GLWP collected the latest loon and nest counts from the Lakes Of Maine website.
The Audobon organization started gathering the count on the nests in 1999, they don't track or store the location of the nests.
On the timing of nesting, females usually lay two mottled brown eggs between mid-May and mid-June. Both parents incubate the eggs for about 29 days. From: Loon-Guide.pdf (maineaudubon.org)

YEAR	#Adults	#Chicks	Nests
1983	11	0	
1984	14	0	
1985	14	1	
1986	12	1	
1987	38	11	
1988	25	5	
1989	26	3	
1990	21	7	
1991	20	3	
1992	18	3	
1993	19	0	
1994	15	0	
1995	22	1	
1996	17	2	
1997	12	3	
1998	21	2	
1999	23	1	1
2000	26	3	0
2001	2	0	0

YEAR	#Adults	#Chicks	Nests
2002	19	0	2
2003	14	1	2
2004	12	2	0
2005	23	1	1
2006	16	0	1
2007	11	0	0
2008	9	0	0
2009	12	0	0
2010	15	2	0
2011	11	1	2
2012	21	0	0
2013	22	2	0
2014	20	3	0
2015	14	3	0
2016	25	1	0
2017	21	1	0
2018	43	1	0
2019	29	3	1

Table 2-15 – Loon and Nest Count

2.5.2 Recreation and Land Management

2.5.2.1 Impoundment Levels

2. Private landowners expressed concern during scoping about the effects of lowering the lake level after Labor Day on recreation within the project boundary. To assist staff with its environmental analysis of the effects of the annual drawdown on recreation, please file daily impoundment levels for the project from September 1 through November 31 from 2015 through 2019.

2.5.2.1.1 Impoundment Levels from 2015-2019 – September – November

Table 2-16 – Green Lake Project Impoundment Levels

	2015	2016	2017	2018	2019		2015	2016	2017	2018	2019
1-Sep	5.90	5.55	5.20	5.79	6.82	17-Oct	4.21	3.80	3.45	4.10	4.20
2-Sep	5.85	5.50	5.15	5.79	6.80	18-Oct	4.25	3.80	3.45	4.10	4.25
3-Sep	5.85	5.50	5.12	5.72	6.75	19-Oct	4.20	3.80	3.40	4.00	4.25
4-Sep	5.85	5.50	5.20	5.72	6.71	20-Oct	4.20	3.80	3.40	4.01	4.19
5-Sep	5.80	5.48	5.11	5.69	6.68	21-Oct	4.20	3.70	3.39	4.00	4.25
6-Sep	5.80	5.40	5.10	5.69	6.65	22-Oct	4.25	3.75	3.39	4.00	4.25
7-Sep	5.80	5.31	5.18	5.65	6.68	23-Oct	4.30	3.80	3.35	3.90	4.55
8-Sep	5.75	5.25	5.15	5.59	6.65	24-Oct	4.25	3.80	3.30	4.00	4.70
9-Sep	5.70	5.25	5.12	5.45	6.59	25-Oct	4.25	3.80	3.35	4.05	4.79
10-Sep	5.69	5.25	5.10	5.32	6.55	26-Oct	4.25	3.80	3.60	4.00	4.80
11-Sep	5.70	5.25	5.00	5.39	6.55	27-Oct	4.25	3.80	3.70	3.90	4.90
12-Sep	5.70	5.25	4.91	5.30	6.49	28-Oct	4.20	3.80	3.70	4.00	5.08
13-Sep	5.69	5.15	4.81	5.29	6.43	29-Oct	4.59	3.85	3.65	4.10	5.18
14-Sep	5.70	5.10	4.78	5.19	6.38	30-Oct	4.80	3.85	3.65	4.20	5.25
15-Sep	5.65	5.00	4.69	5.18	6.33	31-Oct	4.85	3.85	3.75	4.15	5.39
16-Sep	5.51	4.90	4.60	5.18	6.29	1-Nov	4.85	3.85	3.80	4.20	5.50
17-Sep	5.45	4.80	4.55	5.10	6.25	2-Nov	4.85	3.85	3.80	4.29	5.68
18-Sep	5.39	4.79	4.45	5.09	6.18	3-Nov	4.80	3.85	3.80	4.50	5.78
19-Sep	5.31	4.70	4.39	5.09	6.13	4-Nov	4.80	3.85	3.71	4.80	5.89
20-Sep	5.25	4.60	4.29	5.05	6.05	5-Nov	4.79	3.85	3.71	4.90	5.98
21-Sep	5.21	4.50	4.20	5.00	6.00	6-Nov	4.75	3.85	3.70	5.08	6.15
22-Sep	5.01	4.45	4.11	4.98	5.97	7-Nov	4.75	3.85	3.70	5.30	6.22
23-Sep	4.91	4.40	4.10	4.90	5.88	8-Nov	4.75	3.85	3.75	5.42	6.30
24-Sep	4.89	4.40	4.09	4.80	5.83	9-Nov	4.70	3.85	3.75	5.51	6.40
25-Sep	4.75	4.40	4.05	4.72	5.80	10-Nov	4.69	3.85	3.75	5.70	6.50
26-Sep	4.70	4.29	4.00	4.71	5.77	11-Nov	4.65	3.85	3.75	5.90	6.55
27-Sep	4.59	4.29	3.99	4.74	5.71	12-Nov	4.60	3.85	3.70	6.00	6.60
28-Sep	4.49	4.19	3.99	4.69	5.65	13-Nov	4.55	3.85	3.65	6.08	6.70
29-Sep	4.41	4.19	3.99	4.58	5.60	14-Nov	4.55	3.80	3.65	6.10	6.62
30-Sep	4.79	4.15	3.90	4.50	5.51	15-Nov	4.55	3.80	3.60	6.40	6.62
1-Oct	5.65	4.10	3.90	4.45	5.45	16-Nov	4.55	3.80	3.59	6.50	6.60
2-Oct	5.79	4.10	3.90	4.39	5.40	17-Nov	4.60	3.80	3.60	6.55	6.57
3-Oct	5.70	4.05	3.90	4.40	5.32	18-Nov	4.65	3.80	3.55	6.58	6.58
4-Oct	5.69	4.01	3.61	4.35	5.25	19-Nov	4.62	3.90	3.60	6.58	6.60
5-Oct	5.48	4.00	3.61	4.25	5.10	20-Nov	4.69	3.90	3.70	6.57	6.63
6-Oct	5.30	4.00	3.52	4.18	5.00	21-Nov	4.85	3.99	3.65	6.60	6.65
7-Oct	5.15	4.00	3.52	4.11	4.90	22-Nov	4.82	3.99	3.61	6.60	6.65
8-Oct	4.99	4.00	3.52	4.05	4.85	23-Nov	5.05	3.99	3.61	6.60	6.65
9-Oct	4.88	4.00	3.52	4.00	4.78	24-Nov	5.10	3.95	3.75	6.55	6.72

10-Oct	4.70	4.00	3.69	4.02	4.65		25-Nov	5.12	3.95	3.75	6.50	6.80
11-Oct	4.60	4.00	3.69	4.08	4.50		26-Nov	5.13	3.95	3.80	6.53	6.95
12-Oct	4.49	4.00	3.55	4.10	4.45		27-Nov	5.15	4.10	3.80	6.61	6.98
13-Oct	4.39	4.00	3.55	4.09	4.20		28-Nov	5.18	4.10	3.81	6.69	7.08
14-Oct	4.29	3.80	3.52	4.03	4.09		29-Nov	5.15	4.15	3.81	6.75	7.05
15-Oct	4.19	3.80	3.50	4.00	4.04		30-Nov	5.10	4.40	3.80	6.80	7.00
16-Oct	4.20	3.80	3.50	4.05	4.09							

2.5.2.2 Docks and Beaches

3. During the proposed study plan meeting held on October 10, 2019, the Green Lake Association stated that it would work with landowners to collect data on private docks, in order to assist with an analysis of the effects of lowering the lake level on recreation. In order to assist Commission staff in its environmental analysis, please provide the information collected by the Green Lake Association on private docks, including, to the extent available: (1) the location of the dock on the impoundment (including any georeferenced data); (2) the type of dock (i.e., permanent, floating, lift-out docks); and (2) the elevation and/or depth of the dock, taken at its end. If possible, please also document the location/type of other shoreline private usage, such as beach areas.

2.5.2.2.1 Docks

Dale Jellison of the Green Lake Association (GLA) sent a survey out to the GLA members requesting information on dock locations, types and elevation and /or depth of the docks. Also included in the survey were questions regarding the lake recreational usage and the effects of the fall drawdown.

The survey resulted in 85 responses.

2.5.2.2.1.1 The location of the docks on the impoundment.

The information provided by GLA included the address of each dock on the lake. Using Google Maps the locations of the docks were were mapped on the lake and the GPS coordinates were noted.

By way of comparison, the location of all docks visible on the lake using Google Maps was drawn separately. The GPS coordinates of the docks found was noted. There are 218 docks represented in the Google Maps dock search.

This data shows that the docks included in the survey account for about 40% of the docks visible on the lake in the Google Maps search.

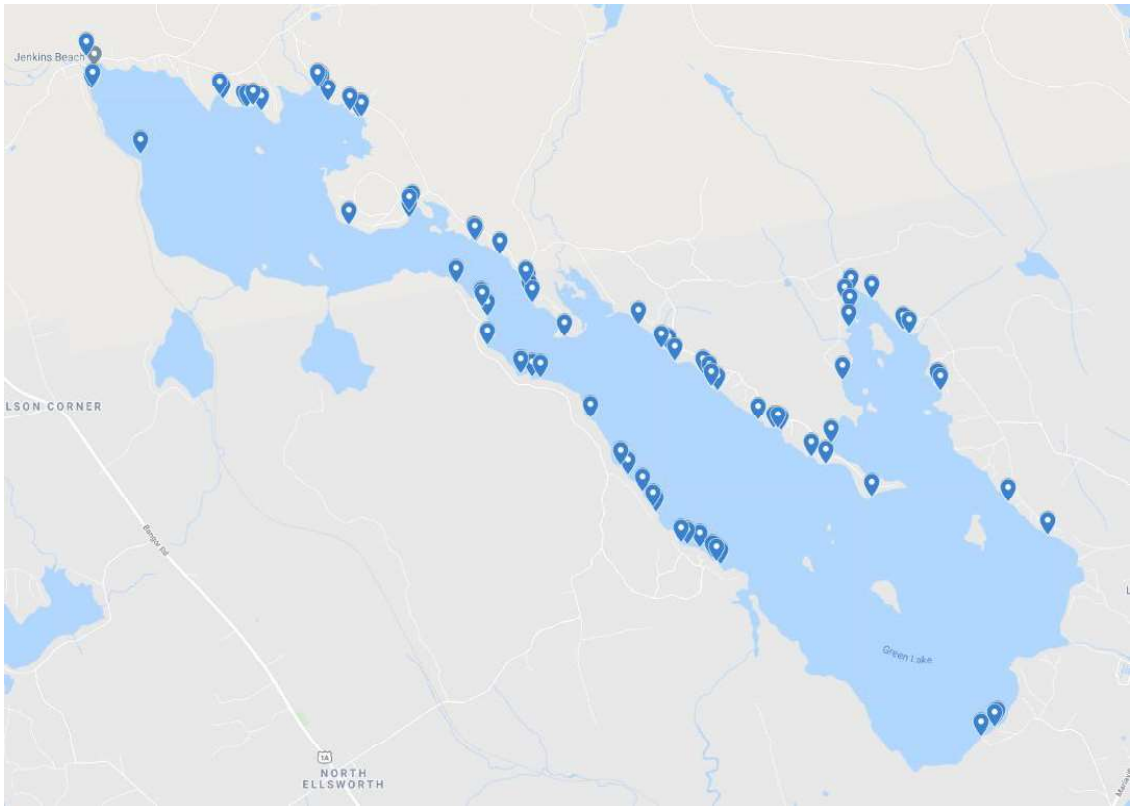


Figure 2-48 – Location of Docks included in the GLA Survey data

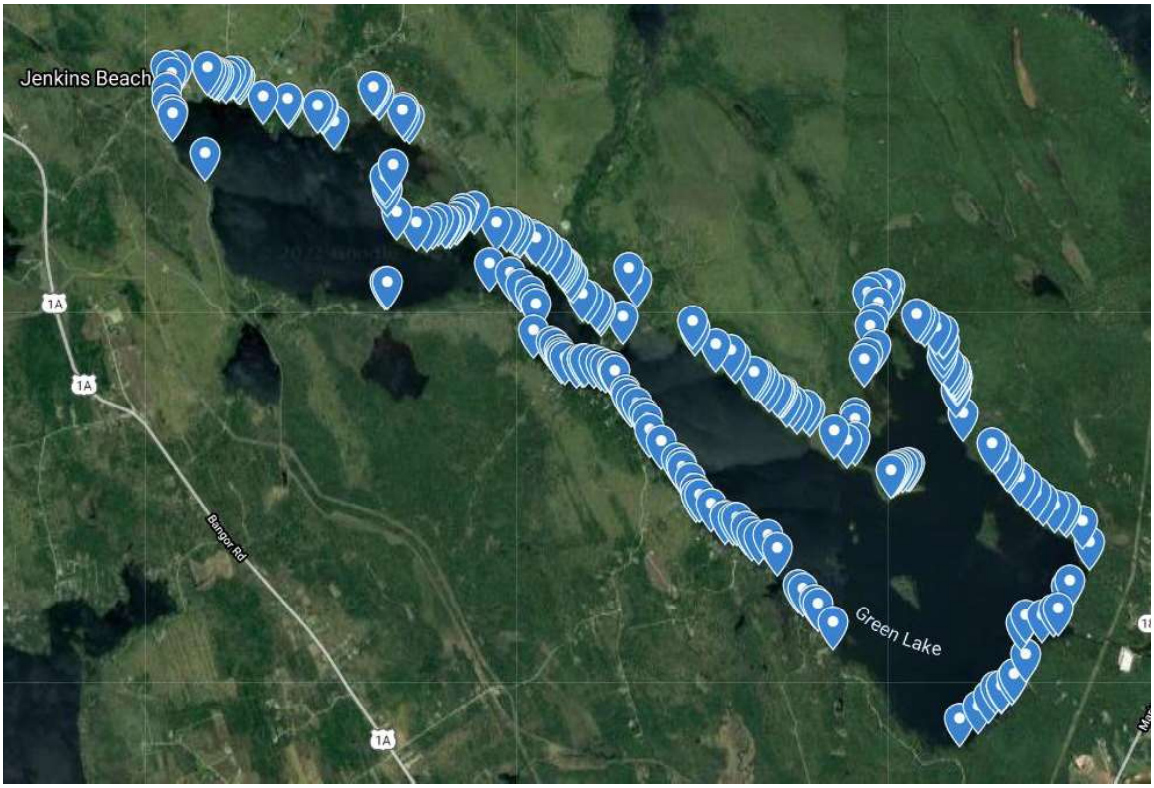


Figure 2-49 – Location of Docks included in the Google Maps survey

2.5.2.2.1.2 The type of docks

Some docks are made up of sections with more than one type. Of a total of 85 docks, 15 are either totally permanent, or have a permanent section, and 76 have 1 piece or more that are taken out for the winter.

Total Responses	Permanent	Floating	Lift Out	Removed for Winter
85	**15**	**38**	**53**	**76**

2.5.2.2.1.3 The elevation and/or depth of the dock, taken at its end.

1' or less	**> 1' <= 2'**	**> 2' <= 3'**	**> 3' <= 4'**	**> 4' <= 5'**	**> 5' <= 6'**	**> 6' <=7'**	**> 7' <= 8'**	**> 8' <= 9'**	**> 9'**
7	6	9	11	7	16	5	9	1	15

2.5.2.2.1.4 Additional survey data

The GLA Survey asked about extending the summer level. As was discussed in the Scoping Meeting, last June, a number of people indicated that they would be interested in extending the summer period. There were also several people who believe that the current drawdown is fine. The responses to this, including any comments, are included below.

2.5.2.2.2 Beaches

Audrey Tunney – Green Lake Association President – surveyed the lake for private beaches – this is her report:

"On Saturday, September 5th I toured the perimeter of Green Lake in an effort to count the number of beaches along the lake. A couple of matters to note. I did not count Jenkins Beach as it is open to the public and not associated with a private dwelling. I also did not count the beach at the Ellsworth public landing. I did count the beach at Violettes Landing, as it is now privately owned and provides beach access to three dwellings. Lastly I did not venture in to Boggy Brook as many rocks revealed by the low water made access for my boat impossible. The same is true for the far end of Northeast Cove, Great Brook and Mann Brook. In total I counted 145 beaches associated with dwellings along the lake."

2.5.2.3 Additional GLA Survey Questions:

The GLA Survey included the questions:

Do you sometimes suspend or limit your recreational use of the lake earlier than you'd like as a result of the water level droppingrapidly after Labor Day until October 15th?

64 responses said Yes and 21 said No

If you answered Yes, would you continue to use the lake for recreational purposes if the summer water level was extended beyond Labor Day weekend?

If you answered Yes, through which of the following dates would you like to see? (select one):
Sept 15th _____ Sept 30th _____ Oct 15th _____ Oct 30th _____

The 64 Yes responses, chose to extend the higher water level as shown in this table:

Yes	15-Sep	30-Sep	15-Oct	30-Oct	No
64	4	20	29	12	21

2.5.2.4 Dock Survey Comments

These comments were provided in response to the GLA Dock Survey.

After September weather is less favorable for boating & fishing season ends. Now, however, sometimes I need to get my boat out before 9/30 because water level drops low enough to make it difficult to trailer out AND ramp angle to dock gets too steep. However, I would like to see GLWPC continue & I understand need to be profitable to make that happen.

At least September would be nice. It can be such a great weather month. It is sad we take our docks out when it is still hot. Thank you.

At minimal recreation level we can just manage to use our pocket beach for 4 floating sections. Anything below that it's impossible and we have to incur significant expense to have them taken out at the public landing and hauled up the road.

At the rate that the lake is dropping I will be unable to have boat at dock by the end of July

Brook goes dry at dock by Sept 15. !5 days more would probably be helpful. The drawdown (October 15th goal) results in moving boat & pwc by week after Labor Day. Having 30 days would be great but 15 would be huge!

Dropping the water works for the benefit of one company to the detriment of multiple property owners.

Due to elevation of stationary dock and level of water we often have to take our boat out mid to late August because we can no longer get in and out of boat.

Have ice damage due to too high water levels in Winter. Dock built in 1960

I have a 130' dock that still only extends to a water level of 2.5-3.0 (May/June) and then is barely 2ft by August 1st. Water levels of May/June should remain until Oct 1st.

I just returned from Maine. On July 28th the water was 15 inches lower than it was on Memorial Day. By August I'm going to have to tie my kayak to the end of my 40ft dock to kayak.

I think the lake would be safer for boating if the water level stayed higher. Also better for removing boats for those with larger boatsincluding pontoons.

I would continue to swim in September. By October I like the lower level to permit work on my seawall. Higher lake level helps with dock removal; however, I am accustomed to taking out dock by Columbus Day.

It has been very difficult to bring the float out of the water on to shore the last few years since the water level has been so low on Labor Day weekend. The exposed rocks interfere with moving the float on to land.

Our boat is on a boat lift. Some years by the end of August the water level is too low to use the lift forcing us to take the boat out sooner than we would like.

Our problem isn't so much a boat mooring; we take the boat out by early Sep due to potential storms. Problem is water intake pipe for domestic use gets high and dry. Adding additional pipe length doesn't work as pump already works hard to move water up steep embankment. We lose water pressure by maybe Sept 20 and have no water for domestic use, so we have to close up earlier than we'd like.

Property owners need to consider allowing GLWPC to maintain the post Labor Day water level near their optimum efficiency level. I estimate the dam raised the natural level by 2 to 2.5! If not relicensed, who will assume the cost of maintaining the dam?

Right now by the end of September we don't even have a foot of water at the end of the dock.

September is beautiful on the lake - would like to use boat through September

Since the last section floats, we need to remove it before the water drops which is typically Labor Day weekend. Which also means the boat also needs to come out. Sept would be a nice month to continue using the boat.

The drop in water has a significant impact on our waterfront. We live in Maine so we would love the water level to stay high longer

Water is extremely low early this summer. I wish water level wasn't lowered as much in the Spring.

Water level is too low in August. Water level should stay consistent June through August

Water levels are a concern for everyone but in shallow waters, such as Benoit & Keiser Way it's very much exaggerated. I have difficulty pulling my dock without water.

Water should be regulated and we should be notified as our boats would have been on land after Labor Day weekend. We had some significant damage last several years due to level of water and ice damage.

We are seasonal - late June to early September

We do not limit activities when water level drops.

We have to take our boat and dock out the first week of August or we can't get them out. After first week of September we cannot access lake with Kayaks as we have no water.

We live on Green Lake year round - in Jellison Cove - and lowering the water level Labor Day weekend curtails our ability to use the boat at all during the fall as we can't get the boat out of the cove after Labor Day when the water goes down. Really wish the date of lowering was extended !!!

We lose so much water starting around July 4th we need to remove our boat by Labor Day weekend. We see a change in our water level as a result of Climate change as well. We are also seeing uninvasive plant life! Algae. The Audobon Society (Mr & Mrs Rowe) were taking samples.

When we put dock in (usually end June) water level hits bottom of dock. There is no beach area. As summer goes on and water level drops, mid to end of August, I gain more beach (which I prefer!).

While the dock is located in already shallow water during Summer, if the lake level remained nowmal it would definitely continue to be used

With the Maine summers short and Sept weather usually nice it would be great to extend boating time in the lake.

Would appreciate not having to take boats & docks out just after Labor Day when the family is usually here. Also, Sept is beautiful and we would love to enjoy the lake for at least another month & even 1 1/2 months.

3.0 END OF INITIAL STUDY REPORT

Document Accession #: 20210211-5070 Filed Date: 02/11/2021

Document Content(s)

Ms. Kimberly D. Bose, Secretary
March 11, 2021

VIA E-FILING
Ms. Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N. E.
Washington, DC 20426

RE: Green Lake Hydroelectric Project (FERC No. 7189)
Initial Study Report Meeting Summary

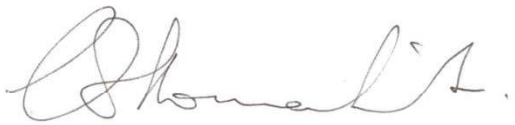
Dear Secretary Bose:

On February 9, 2021, the Licensee for the Green Lake Hydroelectric Project, Green Lake Water Power Company (GLWP), submitted the Initial Study Report (ISR) for the relicensing of the Green Lake Hydroelectric Project (Project).

GLWP held a video/phone meeting with relicensing participants and Commission staff on February 24, 2021 (i.e., within 15 days following the filing of the ISR in accordance with 18 CFR § 5.15(c) and the project Process Plan and Schedule) to discuss results/status for all studies contained in the ISR and modifications to the study plans, if necessary.

As required by 18 CFR § 5.15(c), GLWP has prepared an ISR Meeting Summary. The Meeting Summary, and additional requested data, is appended to the meeting notes and included in an Excel spreadsheet as an attachment. The meeting presentation is also provided as an attachment.

If you have any questions regarding the ISR Meeting Summary, please contact me by email at caroline@greenlakewaterpower.com or by phone at (425) 553-6718



Sincerely,
Caroline Kleinschmidt
Relicensing Coordinator
Green Lake Water Power Co.

Enclosures:
2021-03-11-Green-Lake-Project-ISR-Meeting-Summary.pdf
2021-02-24-GLWP-ISR-Meeting-Presentation.pdf
2021-03-11-GLWP-ISR-Meeting-Attachment-B.xlsx

cc: Distribution List

Green Lake Project 7189 ISR-Meeting Summary Distribution List March 11, 2021

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GREEN LAKE WATER POWER CO.
GREEN LAKE PROJECT (FERC NO. 7189) RELICENSING
INITIAL STUDY REPORT MEETING
WEDNESDAY, FEBRUARY 24, 2021, 9:00 AM

VIA VIDEOCONFERENCE

ATTENDEES:

Audie Tunney, Green Lake Association (GLA)
Dale Jellison, GLA
Joe Jenkins, Jenkins Beach & GLA
Dan Tierney, NMFS
Oliver Cox, USFWS & Green Lake National Fish Hatchery (GLNFH)
Julianne Rosset, USFWS
Corbin Hilling, USFWS
Bill Connelly, FERC
Nick Palso, FERC
Amanda Gill, FERC
Kathy Howatt, MDEP
Chris Sferra, MDEP
Casey Clark, MDMR
John Perry, MIFW
Bert Kleinschmidt, Green Lake Water Power (GLWP)
Caroline Kleinschmidt, GLWP
Kayla Hopkins, Kleinschmidt Associates

Appendices:

Appendix A: Study 2 – Supplement for Minimum Flow proposal.
Appendix B: Study 3 – Email from Anna Harris regarding Eel Survey

Attachments:

Attachment A: ISR Meeting Presentation
Attachment B: Spreadsheet including:
- Impoundment DO/T Profile readings
- Impoundment levels 2015-2020 Sep-Nov
- Dock locations and specifics

GLWP filed the Initial Study Report (ISR) with the FERC and interested parties on February 9, 2021, as part of relicensing the Green Lake Hydroelectric Project (FERC No. 7189). The filing was in accordance with the regulations of FERC's Integrated Licensing Process (ILP) (18 Code of Federal Regulations [CFR] 5) and with the Project's Process Plan and Schedule. The ISR described the study progress and results to date of studies implemented by GLWP. An updated ISR was filed February 11, 2021 to correct formatting, typos and add additional data.

This summary document presents the proceedings of the meeting held on February 24, 2021 to go over the ISR. A copy of the meeting presentation is included as Attachment A. In accordance with the Process Plan and Schedule contained in FERC's Scoping Document 2 (SD2), this meeting summary must be filed with the FERC no later than March 11, 2021.

WELCOME AND INTRODUCTIONS

Bert Kleinschmidt (GLWP) welcomed those attending the ISR meeting and reviewed general meeting logistics. Bert noted that the presentation would include a summary of each study, followed by a discussion of any questions or comments.

INITIAL STUDY REPORT REVIEW

The ISR meeting presentation was made available to all attendees prior to the meeting.

STUDIES INCLUDED IN THE REVISED STUDY PLAN

1-1) Impoundment Trophic State Study
1-2) Impoundment Habitat Study
1-3) Impoundment Temperature Study
1-4) Downstream Benthic Macroinvertebrate Study
1-5) Downstream Dissolved Oxygen and Temperature Study
2) Bypass Reach Aquatic Habitat and In-Stream Flow Study
3) Eel Passage Survey
4-1) Architectural Survey
4-2) Erosion Survey
Additional Information Requested
5-1) Loon counts and nests
5-2) Impoundment Levels
5-3) Docks and Beaches

REVIEW OF INDIVIDUAL STUDIES

This conference call/meeting was to discuss the Initial Study Report, including the studies conducted in 2020, additional information requests, and answer questions and comments from stakeholders. The presentation itself is provided in Attachment A, so the following is a summary of the discussions and questions asked during the meeting.

1-1) Impoundment Trophic State Study

- Bill Connelly (FERC) and Chris Sferra (MDEP) – requested the excel form of the profile data DO and temperature.
    - This information is included in Attachment B to this document.
- Chris Sferra (MDEP) – Questioned the two different stations and the max depths for each, wanting clarification.
    - Bert Kleinschmidt (GLWP) – correct. At station 1, it was planned to go to 50 meters, to be around one meter off the bottom. Station 2, planned to go up to 85 feet but hit bottom around 60-65 feet.

1-2) Impoundment Habitat Study

- Chris Sferra (MDEP) – confirming question – when saying you underestimated the lake area and overestimate the draw down, is this because you were trying to get a ballpark of the max drawdown would be?
    - Bert Kleinschmidt (GLWP) – yes. While doing analysis, made simplifying assumptions. Assumed lake layers had square edges rather than calculating beveled edges, knowing it was a bit inaccurate in the direction of making the drawdown percentages worse than they actually were. This was done to be on the "safe" side.

1-3) Impoundment Temperature Study

- Bill Connelly (FERC) – requested the draw down profile data of 2020 to compare to previous years (2015-2020).
    - Bert Kleinschmidt (GLWP) – typically 6 weeks for draw down, this year the main part of the drawdown was accomplished in 12 days. It was a dry year. The Project was shut down from June 4, 2020 through September 11, 2020.
    - Fall lake level profiles updated to include 2020 are included in Attachment B to this document.

1-4) Downstream Benthic Macroinvertebrate Study

- Bill Connelly (FERC) – Asked when will the report will be ready?
    - Bert Kleinschmidt (GLWP) - a few weeks from now, based on MDEP review.
- Kathy Howatt (MDEP) – will you be planning to put this as a supplemental report to include with the initial study report.
    - Bert Kleinschmidt - Yes, we will file this as a supplement to the ISR
- Chris Sferra (MDEP) – asked for a summary of where the rock bags were deployed.
    - Bert Kleinschmidt (GLWP) - four sites suggested by MDEP for the temperature and DO readings. Deployed at the three applicable sites of those four sites.

1-5) Downstream Dissolved Oxygen and Temperature Study

- Bert Kleinschmidt (GLWP) stated that MDEP requires 5 days with the product of the water temperature (in Celsius) times the flow duration of the time of samples exceeding 1500.
    - Kathy Howatt (MDEP) – not familiar with the 5 sampling days at 1500 requirement.
    - Bert Kleinschmidt (GLWP) – found in the 2019 sampling document. Statement that there must be at least 5 days of the 10 total days that meet the 1500.
- Bill Connelly (FERC) – in table 2-4 temp goal is what it would have to be to meet the 1500, what are "Point 1", "Point 2", "Point 3", and "Point 4"?
    - Bert Kleinschmidt (GLWP) - Temperature reading at each of the four stations. If the temp is higher than the target, then they meet the 1500 criterion.

2) Bypass Reach Aquatic Habitat and In Stream Flow Study

- Chris Sferra (MDEP)– flow width in feet equals bank full width?
    - Bert Kleinschmidt (GLWP) - No, "Flow Width" is surface width of the water, "Width" is bank to bank width.
- Kathy Howatt (MDEP) – MDEP is looking for at least 75% wetted bank width at each transect. So, MDEP is looking bank for full width on each transect, measurements of wetted area. When doing transects, would not choose an area that had an island or large rock that would impair measurements. Overall, this would get you to a lower minimum flow if you can show the 75% wetted width. Bank full width by the wetted width calculation.

  - Bert Kleinschmidt (GLWP) – looked at what flows are at bank full. Will go back and specifically measure bank full width at each transection or clarify what that width is from the measurements already taken.
  - Kathy Howatt (MDEP) – What we're asking for is the minimum flow proposed for operations at 75% of the bank full width.
- Bill Connelly (FERC) – at each flow, there is difference in what the discharge was at each transect.
  - Bert Kleinschmidt (GLWP) – the hatchery discharge comes in between Transects 2 and 3, that increases the flow in the brook. Flow meter accuracy under some of the flow conditions experienced likely has contributed to this as well.
  - Oliver Cox (Hatchery) – the water treatment plant, filters water and there is an overflow at the plant. The excess water flows back to the stream. There are a couple culverts into the stream and leaks in the penstock too that contribute to the flow in the bypass reach.
- Kathy Howatt (MDEP) – is there a range estimate of the leakage from penstock,
  - Bert Kleinschmidt (GLWP) No, it varies. The penstock is 36 years old. There are only certain times of the year that it can be shut down for patching. We patch in the fall, after drawdown, and leakage goes down. Over the winter and summer is will slowly increase.
  - Kathy Howatt (MDEP) – concerned that the leakage will skew flows from the dam.
  - Bert Kleinschmidt (GLWP) - We completed the patching work shortly before we did the measurements in the Brook
  - Kathy Howatt (MDEP) – Ok, great, that's good.

3) <u>Eel Passage Survey</u>

- Julianne Rosset (USFWS) – questioned the use of a standard flashlight and not a red light to do the inspection. Requested the quote with/from Anna Harris from the ISR that was provided by email.
  - Bert Kleinschmidt (GLWP) – stated that documentation of eel surveys at other sites mentioned the use of search lights and binoculars rather than red lights. Clarified that the flashlight was not turned on for the entire time. Turned off and on when searching.
- Casey Clark (MDMR) – have you done other studies at other sites for eels? Gail from MDMR was not able to come out during surveying?
  - Bert Kleinschmidt (GLWP) - No. this is the only site. Bert and Caroline completed the study.
- Dale Jellison – this study does not necessarily mean that there are no eels in Green Lake?
  - Bert Kleinschmidt (GLWP) - Correct
- Casey Clark (MDMR) – did you check wetted areas on the outskirts of the dam.
  - Bert Kleinschmidt (GLWP) - Yes, walked down the brook 150 feet or so and looked from there along both banks and on rocks, all concrete structures of the dam, anywhere there were areas that eels could potentially go or climb.
- Julianne Rosset (USFWS) – no downstream passage eel study, is there evidence or observations whether eels pass through the penstock?
  - Bert Kleinschmidt (GLWP) – There are 1 inch trash racks. We do experience things that we suspect may be eels through the penstock at times. While shut down, believe eels tried to pass where water was flowing through penstock leaks or taps.

4-1) <u>Architectural Survey</u>

- No questions

4-2) Erosion Survey

- No questions on erosion.
- Audie Tunney (GLA) – what is the project area?
    - Bert Kleinschmidt (GLWP) – the project boundary around the lake is at 161 elevation, just above the full water level of 160.7 elevation.

Additional Information Requested

5-1) Loon Counts and Nests

- Audie Tunney (GLA) – rock formation in the narrows, called the thumb cap, is an area that has had noted loon nests in the past. There are occasions that the water level has covered that area during nesting.
- Kathy Howatt (MDEP) – during mid-May and mid-June, what operational constraints do you have?
    - Bert Kleinschmidt (GLWP) - the current license allows 4.0 to 7.2 level until June 1 and then 6.2 to 7.2 level. Usually about mid-April we have the spring thaw which can bring the lake level up suddenly. We try to keep around 6.7 level for summer.

5-2) Impoundment Levels

- No questions

5-3) Docks and Beaches

- No questions

- Bert Kleinschmidt (GLWP) mentioned that GLWP was able to launch and retrieve an 18.5 ft boat from/to a trailer at the Ellsworth boat ramp throughout the lake studies period. This included launching and retrieving at a water level of 4.18 ft (about 2 inches above the lowest drawdown level).

Overall Questions and Discussion:

- Dale Jellison (GLA) – You've discussed replacement and repairs to penstock, do you see replacing gates from the leakage of the dam?
    - Bert Kleinschmidt (GLWP) – no proposed replacements at this time.
- Joe Jenkins (GLA) – Stated that after water level goes below 5 feet, his launch is difficult to use.
- Audie Tunney (GLA) – The association has a much greater interest for having water access thru September to November to use the boats. Increasing number of people living around the lake than there used to be.
- Bert Kleinschmidt (GLWP) – so the problem people are having is with their docks, rather than the Ellsworth boat launch?
- Audie Tunney (GLA) – Yes
- Casey Clark (MDMR) – What are the upcoming dates for comments and filings?
    - Bert Kleinschmidt (GLWP) & Nick Palso (FERC) - 15 days to publish summary of ISR meeting and 30-day comment period. Scoping document is still correct for dates.

Appendices:

Appendix A:

Study 2: Bypass Reach Aquatic Habitat and In Stream Flow Study

This ISR supplement contains the bank-full widths and channel depths measured at each transect for each study flow value.

Transect 1:
Bank-full bank to bank width: 40.92 ft

	Bank to Bank Width - ft	Flow - cfs	Average Depth - ft	Channel Depth - ft	Average Speed - ft/s	Percent Bank-full Width
Flow 1	37.43	2.33	0.58	0.77	0.11	91.48%
Flow 2	38.04	9.07	0.77	1.22	0.31	92.98%
Flow 3	38.79	12.56	0.89	1.40	0.36	94.79%
Flow 4	39.22	23.03	1.13	1.60	0.52	95.85%

Transect 2:
Bank-full bank to bank width: 27.08 ft

	Bank to Bank Width - ft	Flow - cfs	Average Depth - ft	Channel Depth - ft	Average Speed - ft/s	Percent Bank-full Width
Flow 1	22.83	4.15	0.46	0.74	0.86	84.31%
Flow 2	23.92	5.85	0.63	0.91	0.75	88.31%
Flow 3	26.00	12.44	0.64	1.27	1.31	96.00%
Flow 4	26.83	19.17	0.75	1.35	1.66	99.08%

Transect 3:
Bank-full bank to bank width: 21.08 ft

	Bank to Bank Width - ft	Flow - cfs	Average Depth - ft	Channel Depth - ft	Average Speed - ft/s	Percent Bank-full Width
Flow 1	17.17	6.44	0.48	0.8	0.86	81.42%
Flow 2	17.75	15.60	0.75	0.95	1.24	84.19%
Flow 3	20.25	22.33	0.83	1.23	1.56	96.05%
Flow 4	20.83	27.52	0.97	1.34	1.58	98.81%

Transect 4:
Bank-full bank to bank width: 16.54 ft

	Bank to Bank Width - ft	Flow - cfs	Average Depth - ft	Channel Depth - ft	Average Speed - ft/s	Percent Bank-full Width
Flow 1	15.12	5.82	1.39	2.56	0.28	91.39%
Flow 2	15.52	8.85	1.45	2.82	0.39	93.84%
Flow 3	15.74	14.28	1.54	3.06	0.59	95.15%

Proposed Minimum Flow:

Flow 1 keeps more than 75% of the bank width watered at all transects.

The minimum channel water depth measured was at Transect 2 with Flow 1: 0.74 ft (9 inches).

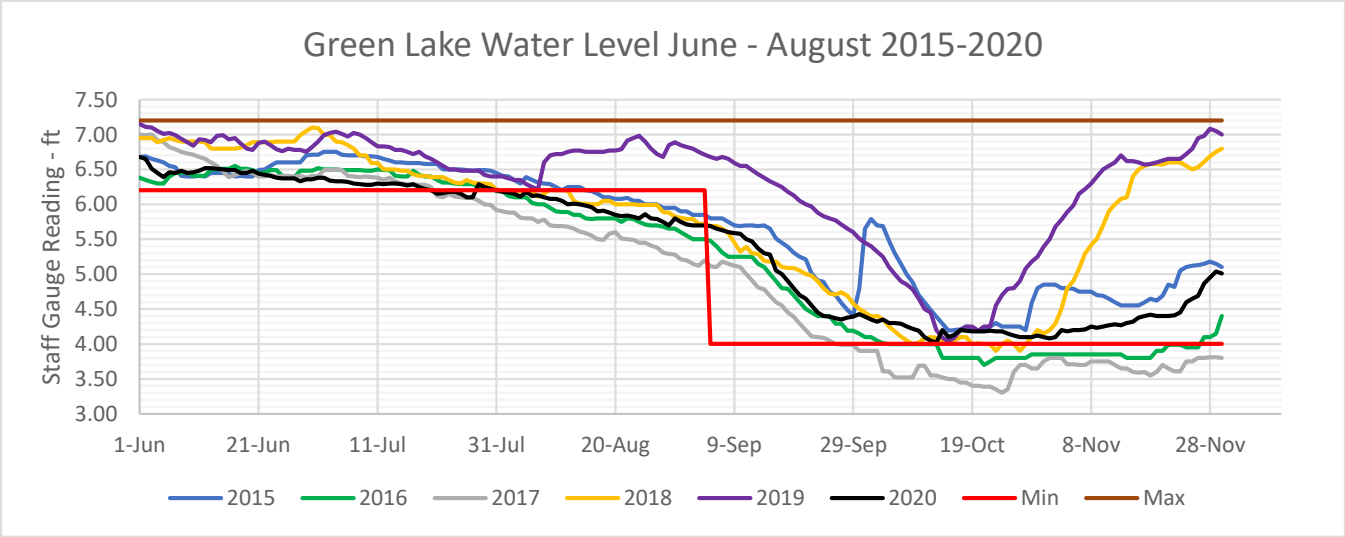
The Flow 1 flows measured at Transect 1 and Transect 2 (upstream of the GLNFH filter discharge) were 2.3 and 4.2 cfs respectively. There was no significant inflow to the stream above Transect 2 other than than the leakage at the dam at the time of the measurements. Both of these transects are somewhat problematic from a flow measurement viewpoint at low flow values. Much of Transect 1 has water speeds within the acceptable "zero reading" band of the flow meter, and Transect 2 has a combination of shooting and tranquil flow that challenges some of the flow meter flow characteristics assumptions. However, Flow 1 was dam leakage with the lake level within the normal Project summer operating range.

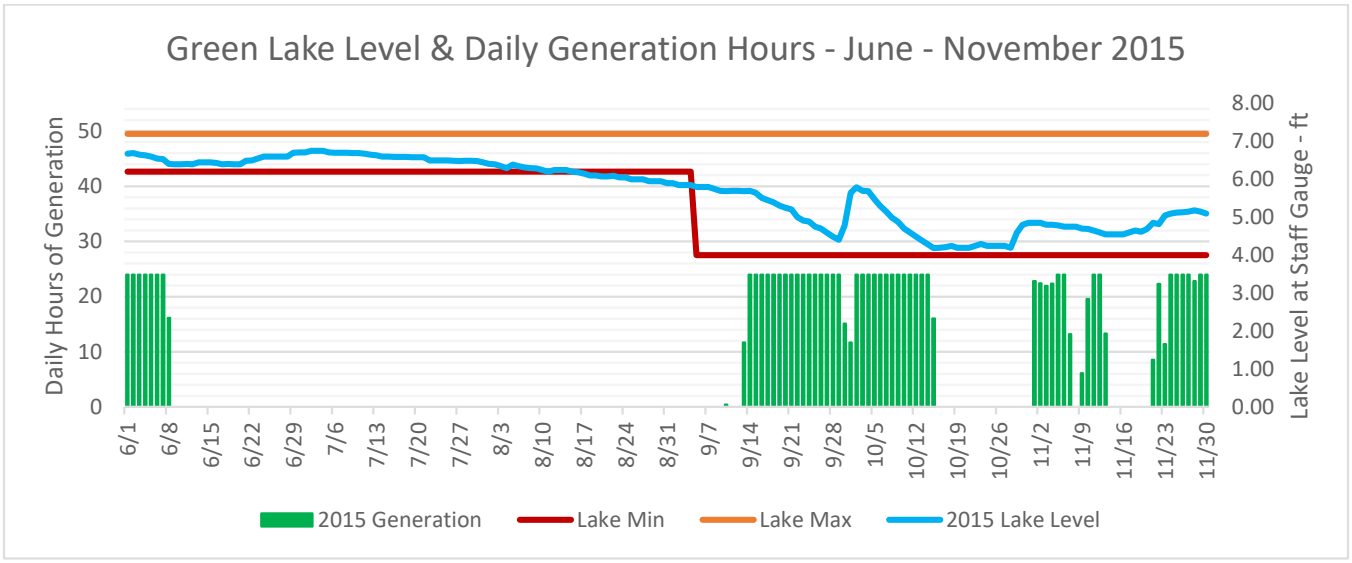
From the DEP permit for the initial Project licensing: "The estimated average annual flow for Reeds Brook is 98 cfs from a drainage area of 57.5 [sic] square miles. The regulated 7 day average low flow which has a 1-in-10 year recurrence interval (7Q10) for Reeds Brook is 1 cfs. The unregulated 7Q10 is estimated at 5.2 cfs." The 57.5 sq-mi drainage area is believed by GLWP to be inaccurate, the actual drainage area of Green Lake is estimated at 45-47 sq-mi.

It should be noted that the unregulated flow would reflect Green Lake without a dam, and therefore, without the Hatchery. The regulated flow would reflect the presence of the Green Lake dam and the GLNFH. The GLNFH has priority use of up to 30 cfs of flow from Green Lake. It is not uncommon for this to be more than the inflow to the lake (especially during the summer), hence the original 1 cfs minimum flow value set when the Hatchery was licensed and built. Typically, despite little or no summer generation, GLWP experiences falling lake levels during at least July and August.

Based on information collected and historical analysis associated with the Green Lake National Fish Hatchery construction, 1 cfs is sufficient.

The following graphs show the lake levels during the Summer and during the Fall, for the past 6 years, and also the project generation times during those same periods.




Green Lake Level & Daily Generation Hours - June - November 2015
Daily Hours of Generation
Lake Level at Staff Gauge - ft
0
10
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40
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0.00
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2.00
3.00
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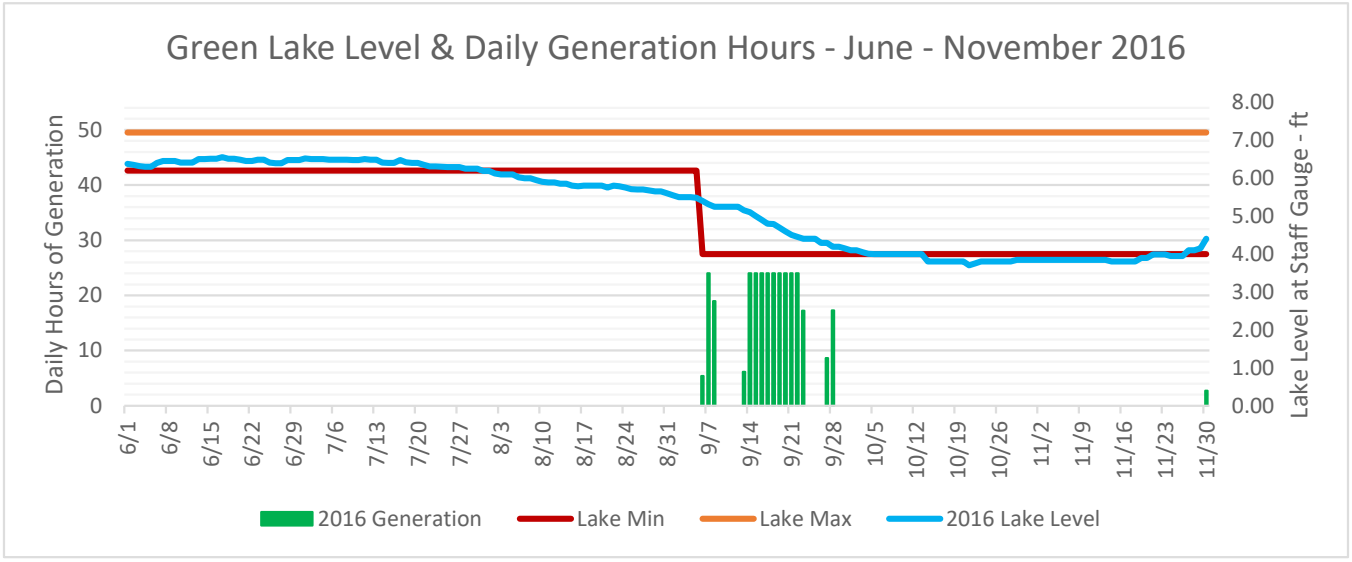
11/23
11/30
2015 Generation
Lake Min
Lake Max
2015 Lake Level


Green Lake Level & Daily Generation Hours - June - November 2016
Daily Hours of Generation
Lake Level at Staff Gauge - ft
0
10
20
30
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50
0.00
1.00
2.00
3.00
4.00
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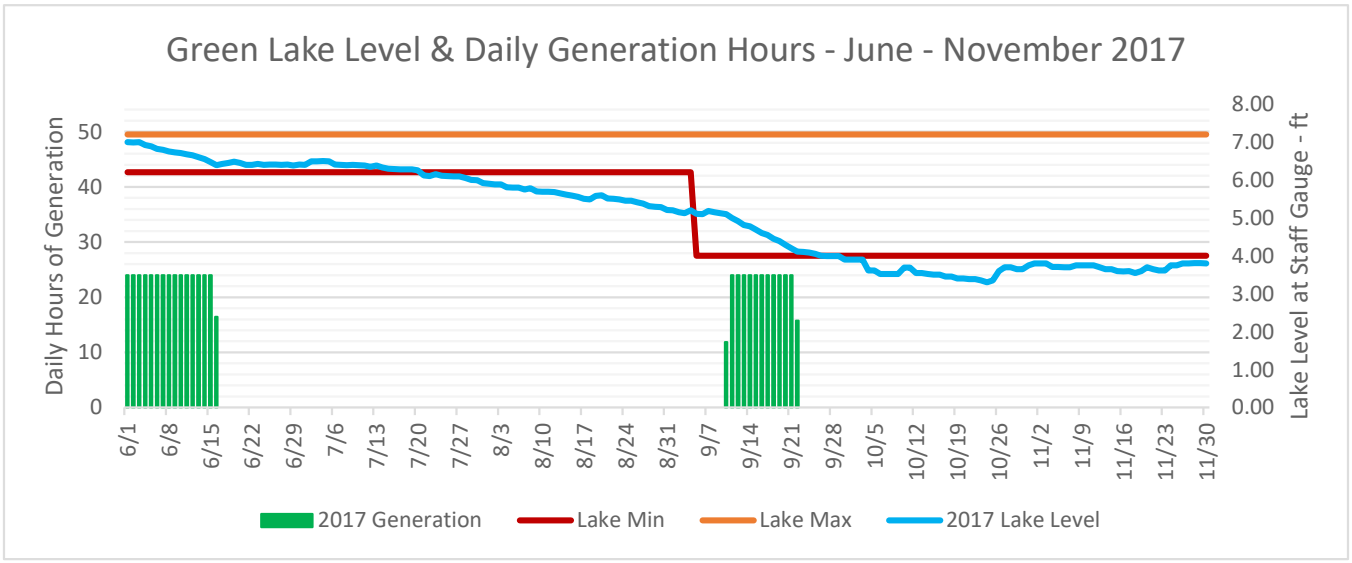
11/16
11/23
11/30
2016 Generation
Lake Min
Lake Max
2016 Lake Level


Green Lake Level & Daily Generation Hours - June - November 2017
Daily Hours of Generation
Lake Level at Staff Gauge - ft
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7/6
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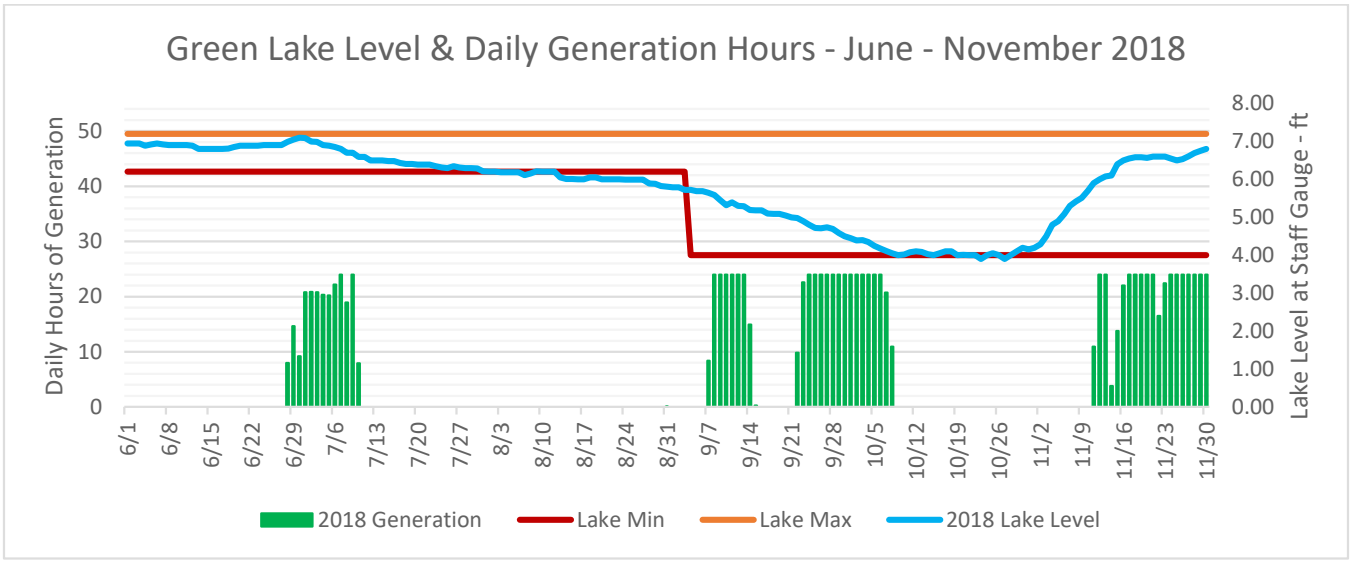
11/30
2017 Generation
Lake Min
Lake Max
2017 Lake Level


Green Lake Level & Daily Generation Hours - June - November 2018
Daily Hours of Generation
Lake Level at Staff Gauge - ft
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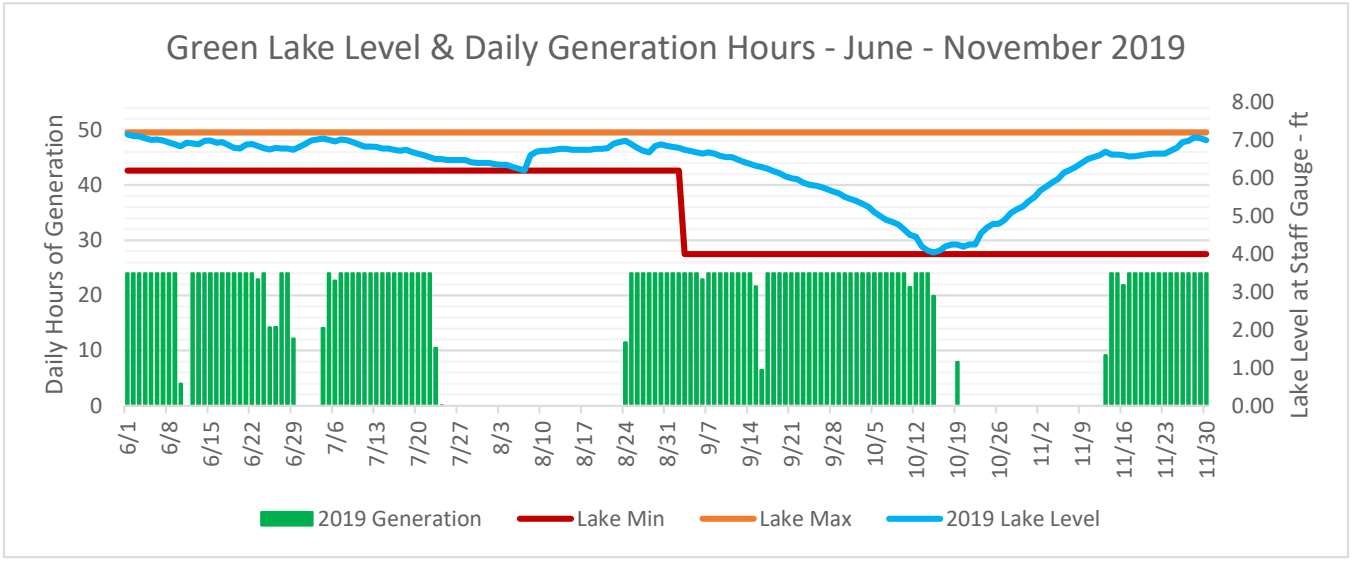
2018 Generation
Lake Min
Lake Max
2018 Lake Level


Green Lake Level & Daily Generation Hours - June - November 2019
Daily Hours of Generation
Lake Level at Staff Gauge - ft
0
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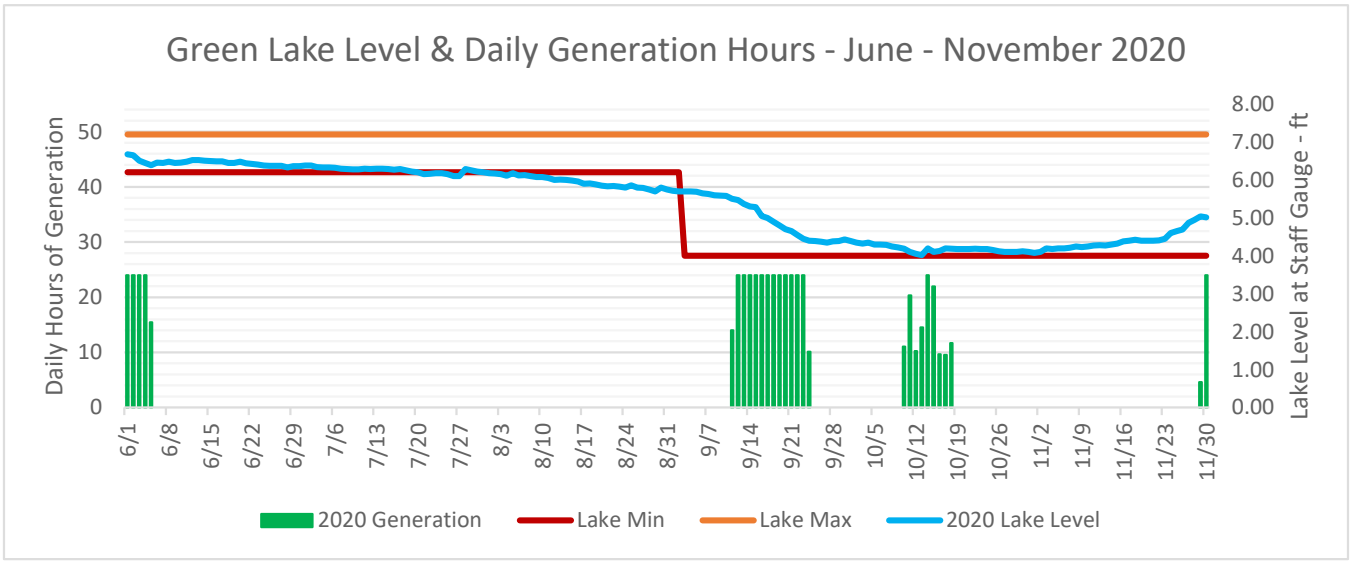
2019 Generation
Lake Min
Lake Max
2019 Lake Level


Green Lake Level & Daily Generation Hours - June - November 2020
Daily Hours of Generation
Lake Level at Staff Gauge - ft
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9/14
9/21
9/28
10/5
10/12
10/19
10/26
11/2
11/9
11/16
11/23
11/30
2020 Generation
Lake Min
Lake Max
2020 Lake Level

Appendix B:

Study 3: Eel Passage Survey

Email from Anna Harris

From: Harris, Anna <anna_harris@fws.gov>
Sent: Friday, July 10, 2020 11:43 AM
To: caroline@greenlakewaterpower.com
Cc: Sojkowski, Bryan <Bryan_Sojkowski@fws.gov>
Subject: Green Lake Water Power (P-7189) - Eel study plan

Hi Caroline,

Thanks for contacting me earlier about this project. I believe you spoke with Gail from DMR earlier this week. Gail and I connected today and based on her recommendation, and my knowledge of our study request, it is recommended that at the Green Lake Project, you conduct two more studies in July to be sure there are no eels present. And if nothing is caught, additional studies would be referred until after there is upstream passage at the Ellsworth dam.
Please let me know if you have any additional questions.

all the best,
Anna

Anna Harris
Maine Field Office Project Leader
Maine-NH Fish and Wildlife Complex
US Fish and Wildlife Service
Cell Phone: 207-949-0561

Document Accession #: 20210311-5107 Filed Date: 03/11/2021

Introductions and Orientation

- Meeting participants
  - Name
  - Organization or area of interest
- Meeting protocol
  - Questions and discussion
  - Messaging
  - Please mute microphone when not talking
  - If all else fails:
    - Email: Caroline@GreenLakeWaterpower.com
    - Landline: 207-667-3322
- This meeting is being recorded
  - The raw recording file is expected to be quite large
  - We are not expecting to make the recording available for download

Study List

1-1) Impoundment Trophic State Study

1-2) Impoundment Habitat Study

1-3) Impoundment Temperature Study

1-4) Downstream Benthic Macroinvertebrate Study

1-5) Downstream Dissolved Oxygen and Temperature Study

2) Bypass Reach Aquatic Habitat and In-Stream Flow Study

3) Eel Passage Survey

4-1) Architectural Survey

4-2) Erosion Survey

Additional Information Requested

5-1) Loon counts and nests

5-2) Impoundment Levels

5-3) Docks and Beaches

1-1) Impoundment Trophic State Study

Green Lake water sampling was performed per MDEP's protocols.

Timing:

- Went out on the lake twice each month
- 17-Jun-2020 through 19-Oct-2020
- Late summer extended sampling on 26/27-Aug-2020

Two sampling stations:

- Station #1, NW end of lake
- Station #2, SE end of lake

Samples at each station:

- Secchi disk reading
- DO/T profile
- Epilemnetic core water samples

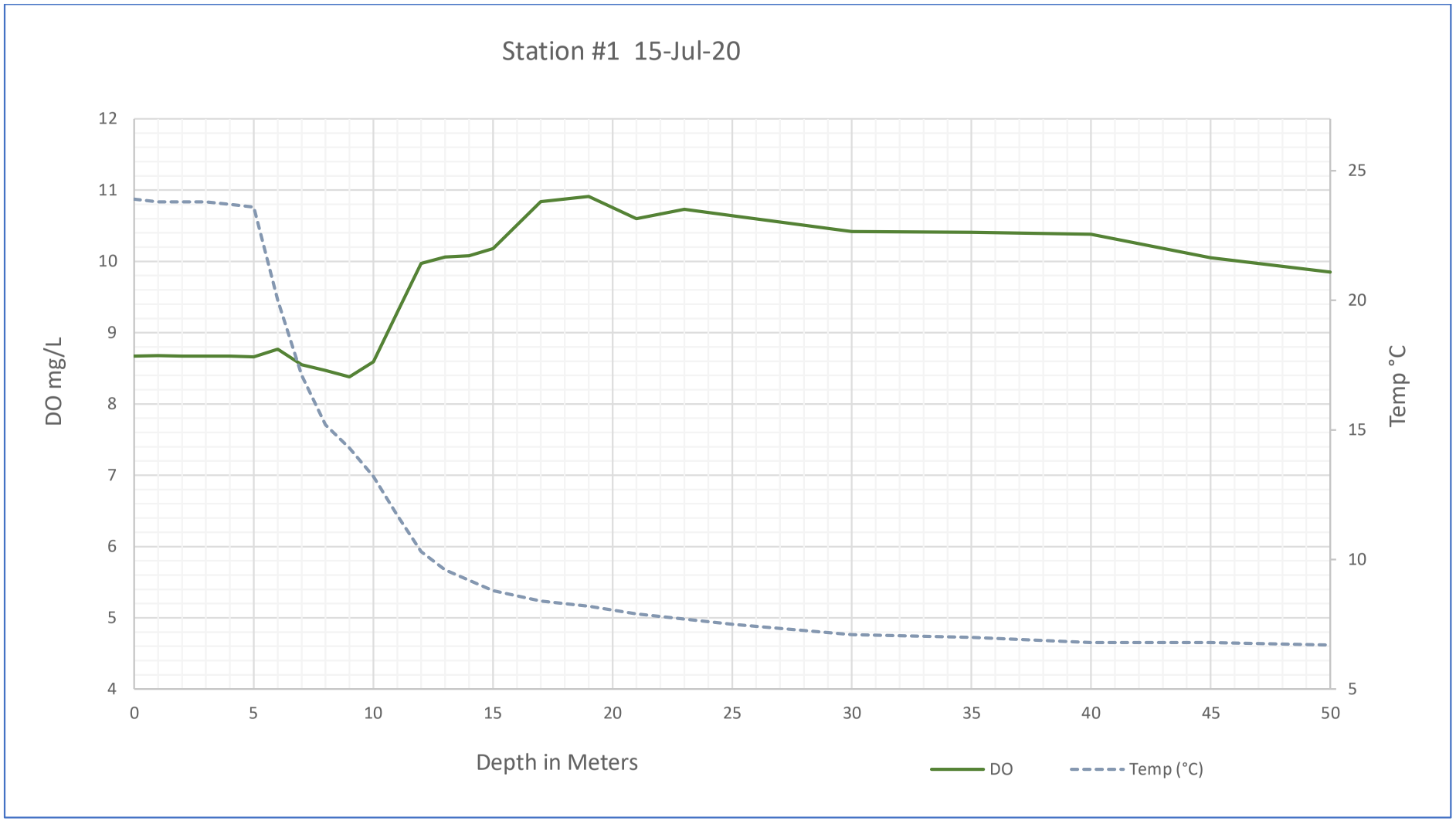
Water samples processed at HETL in Augusta

- Water sample temperatures were tightly managed from boat to lab

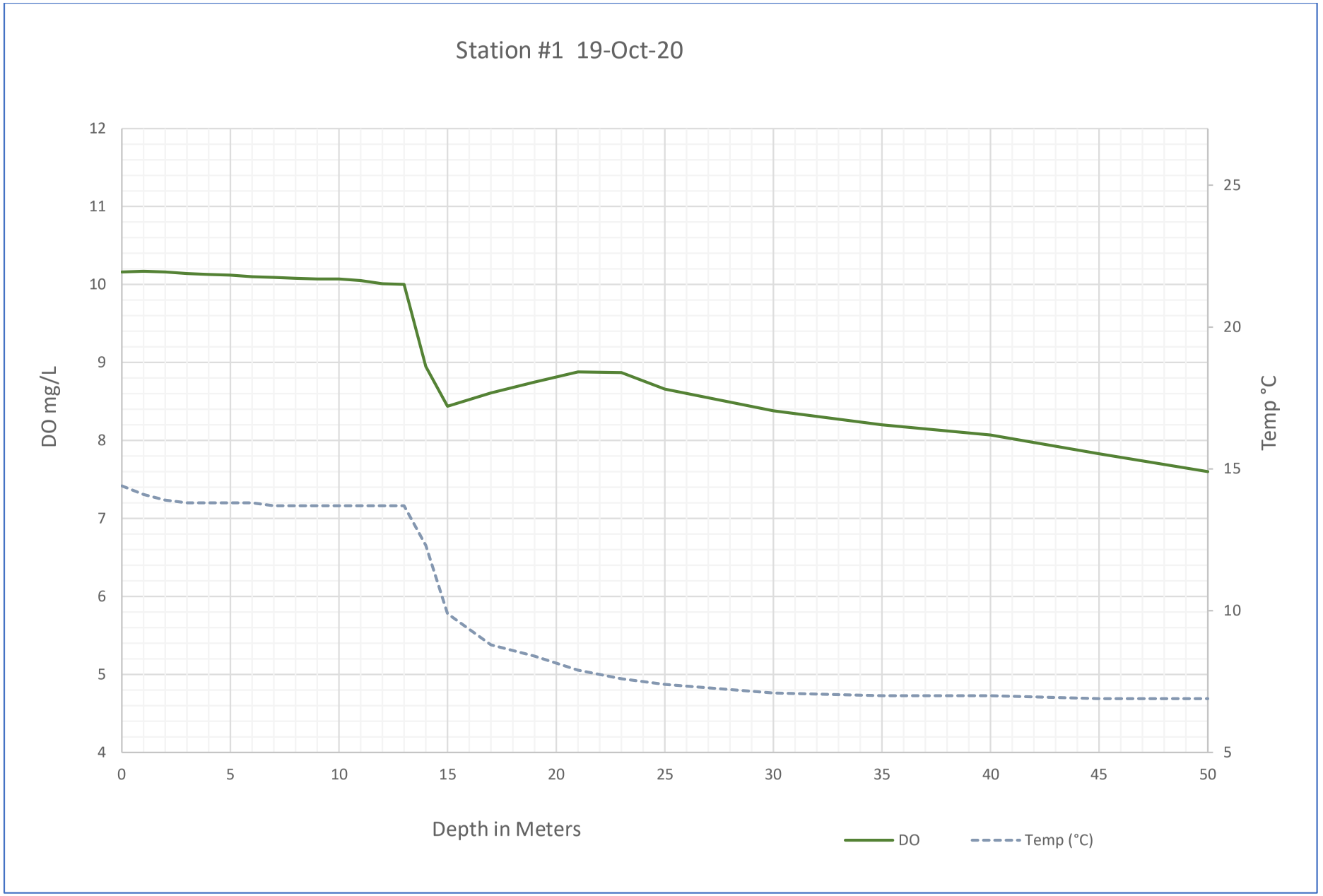
Results:

The lake was found to stratify during the summer.

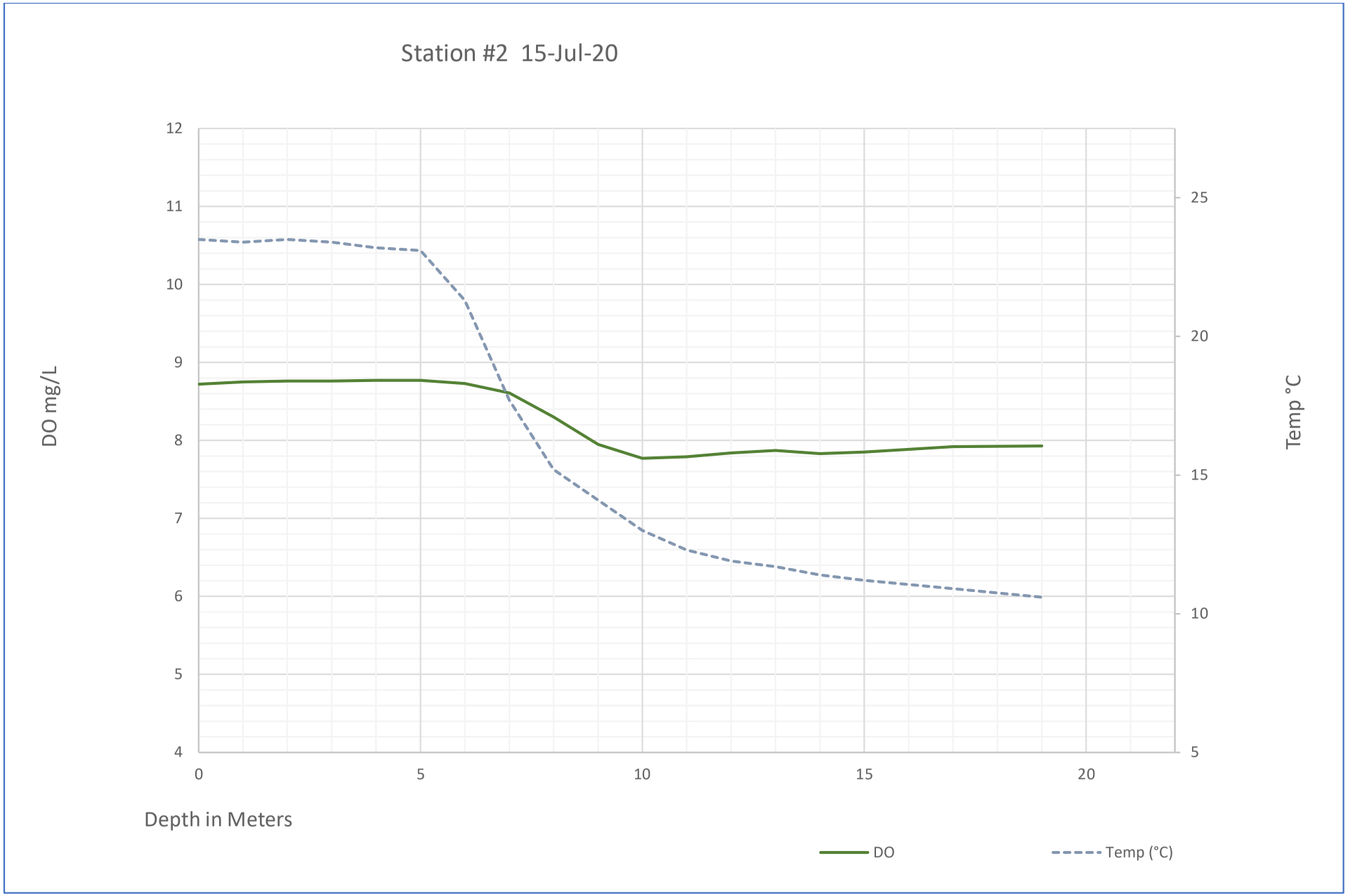
Here is a typical mid-summer DO/T profile for station #1:



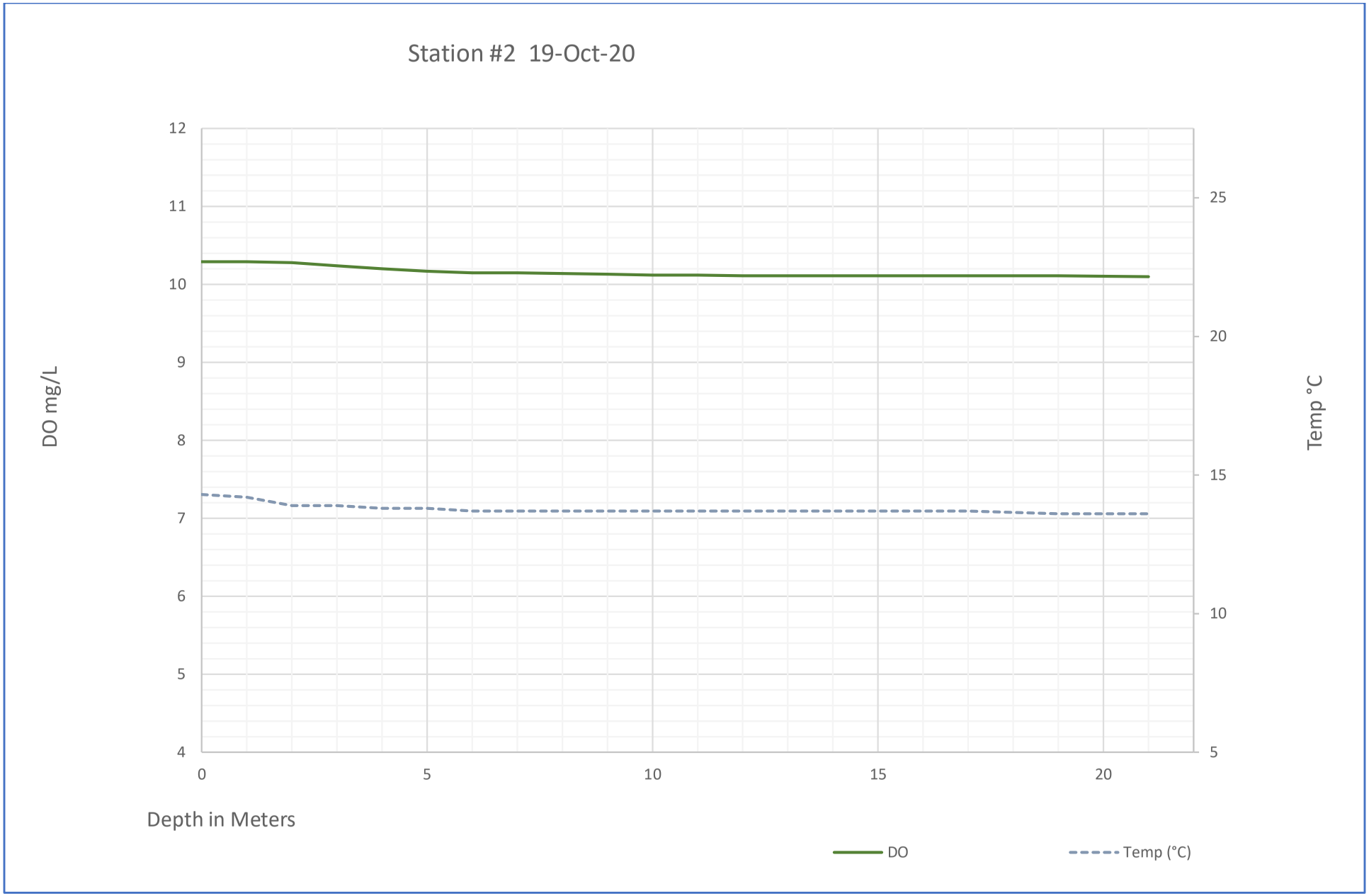
On the last day of sampling, Station #1 was still stratified:



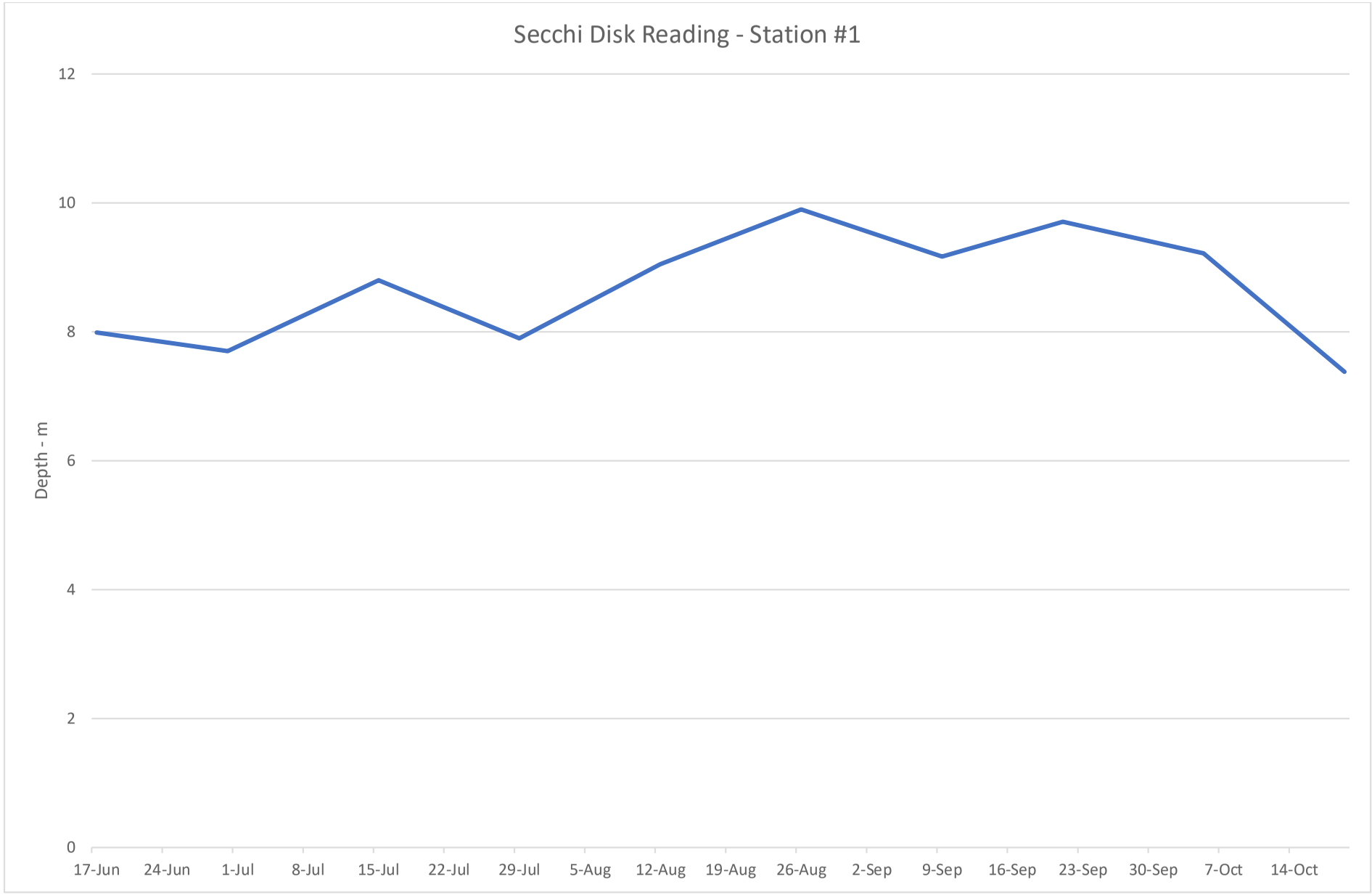
During much of the sampling period, Station #2 was stratified:



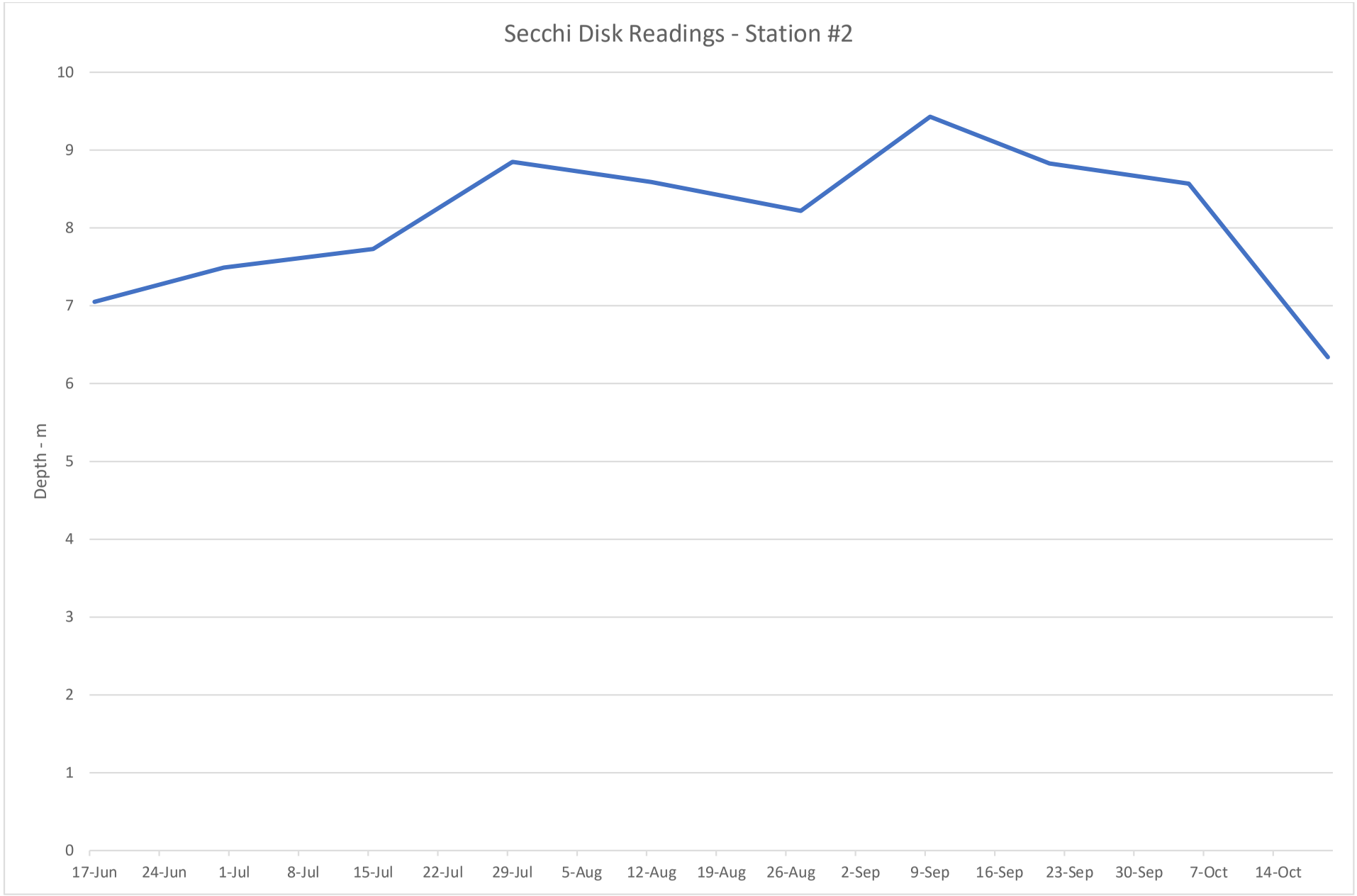
By the end of sampling in the fall, Station #2 was not stratified:



Secchi disk readings at Station #1:



Secchi disk readings at Station #2:



All epilimnetic core and late-summer sampling event HETL results are included in the ISR.

The mean Secchi disk reading for all sample days at both stations is 8.395 m.

Twice this reading, converted to feet, is 55.08 ft.

This value was needed for the Impoundment Habitat Study.

Questions?

1-2) Impoundment Habitat Study

MDEP requires either:

- At least 75% of the impoundment littoral zone remain watered

  or
- A study is done of the impoundment littoral aquatic life communities

Per MDEP guidance, Green Lake littoral zone depth: 55 ft.

The 75% test is applied to both littoral zone surface area and volume.

This was mainly a desk study using:

Impoundment Trophic State Study Secchi disk data

Navionics Plus bathometry

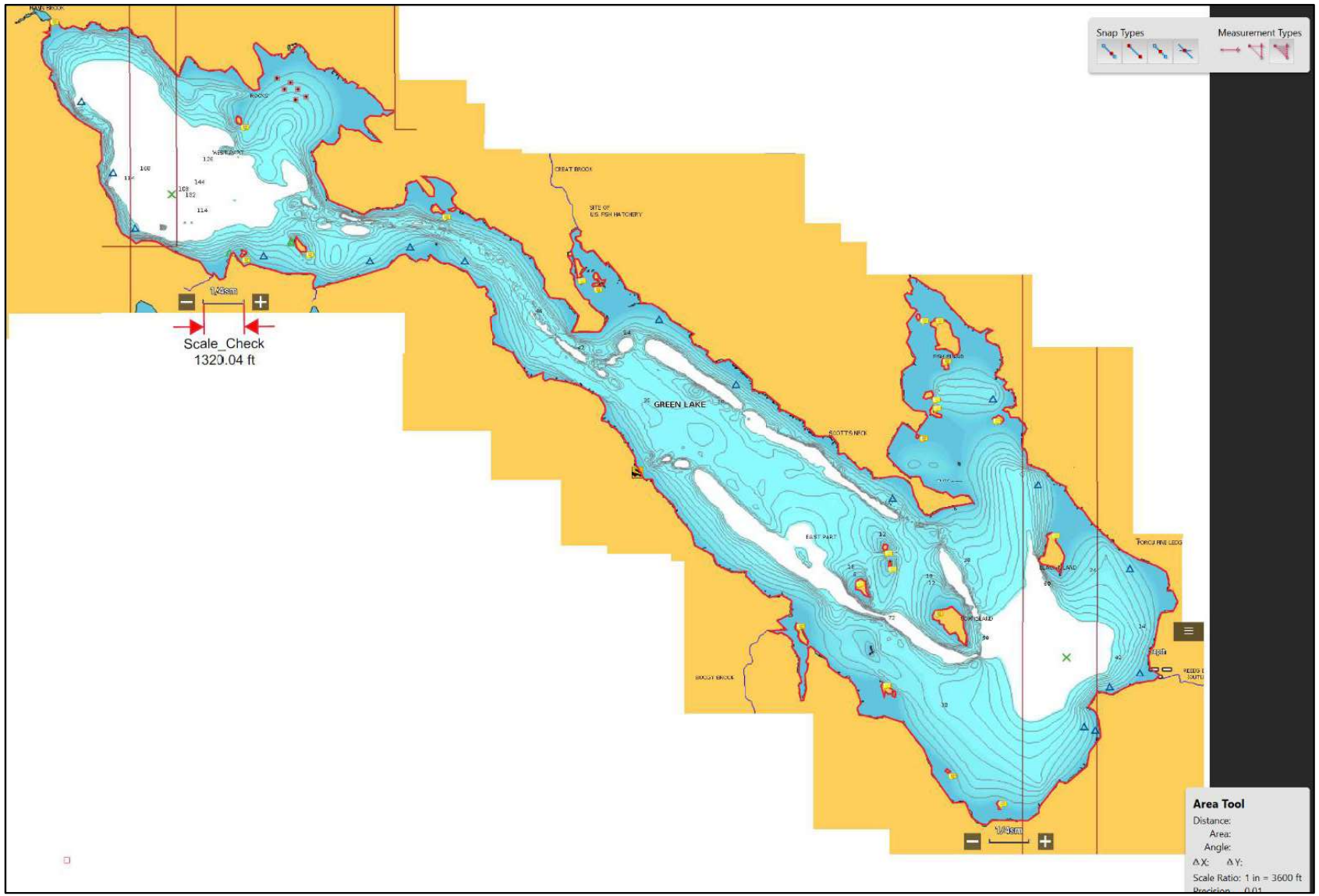
Axiom 9 RV chart-plotter/depth-sounder

Adobe Acrobat Reader DC

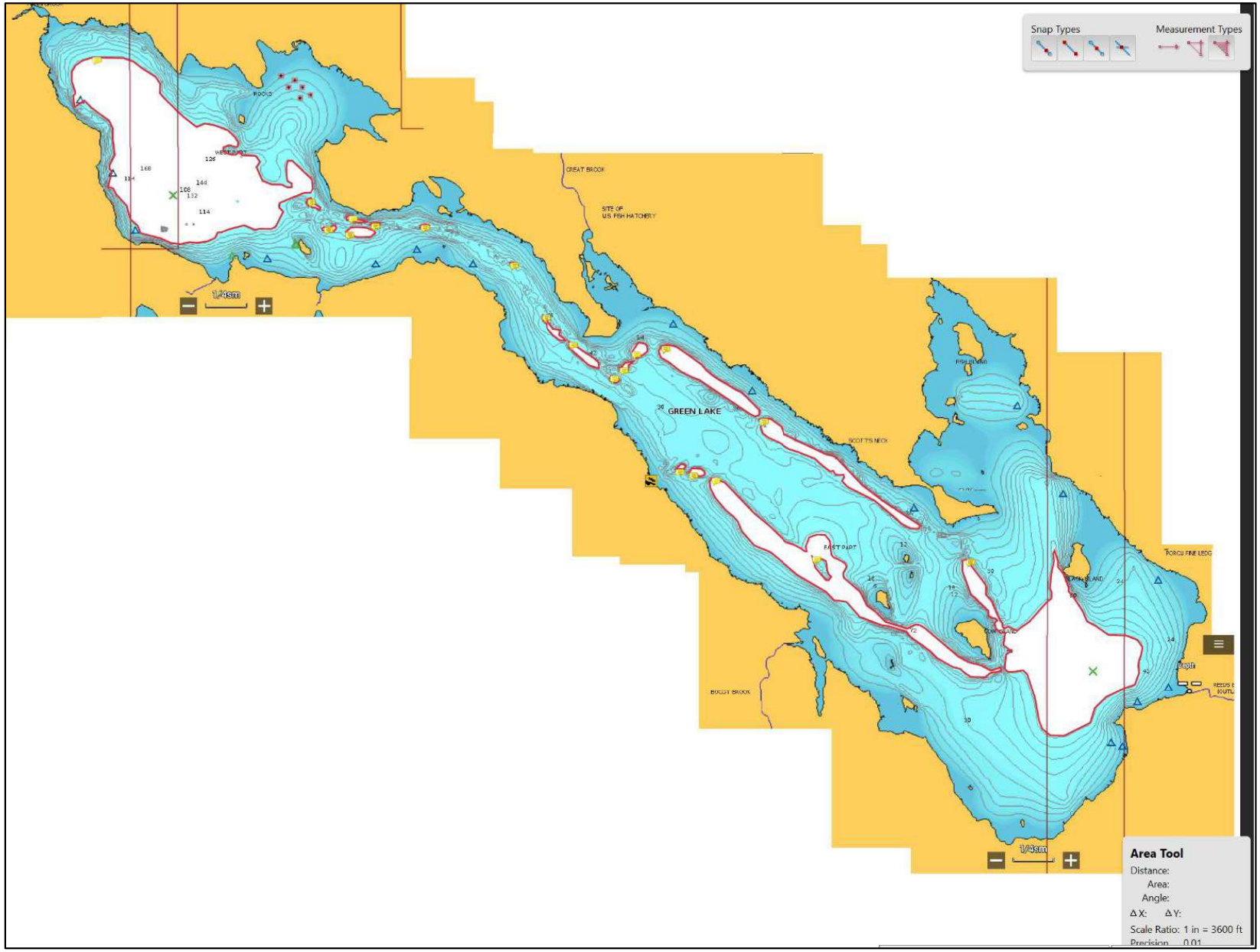
Green Lake knowledge gained by GLWP during earlier studies

Methodology

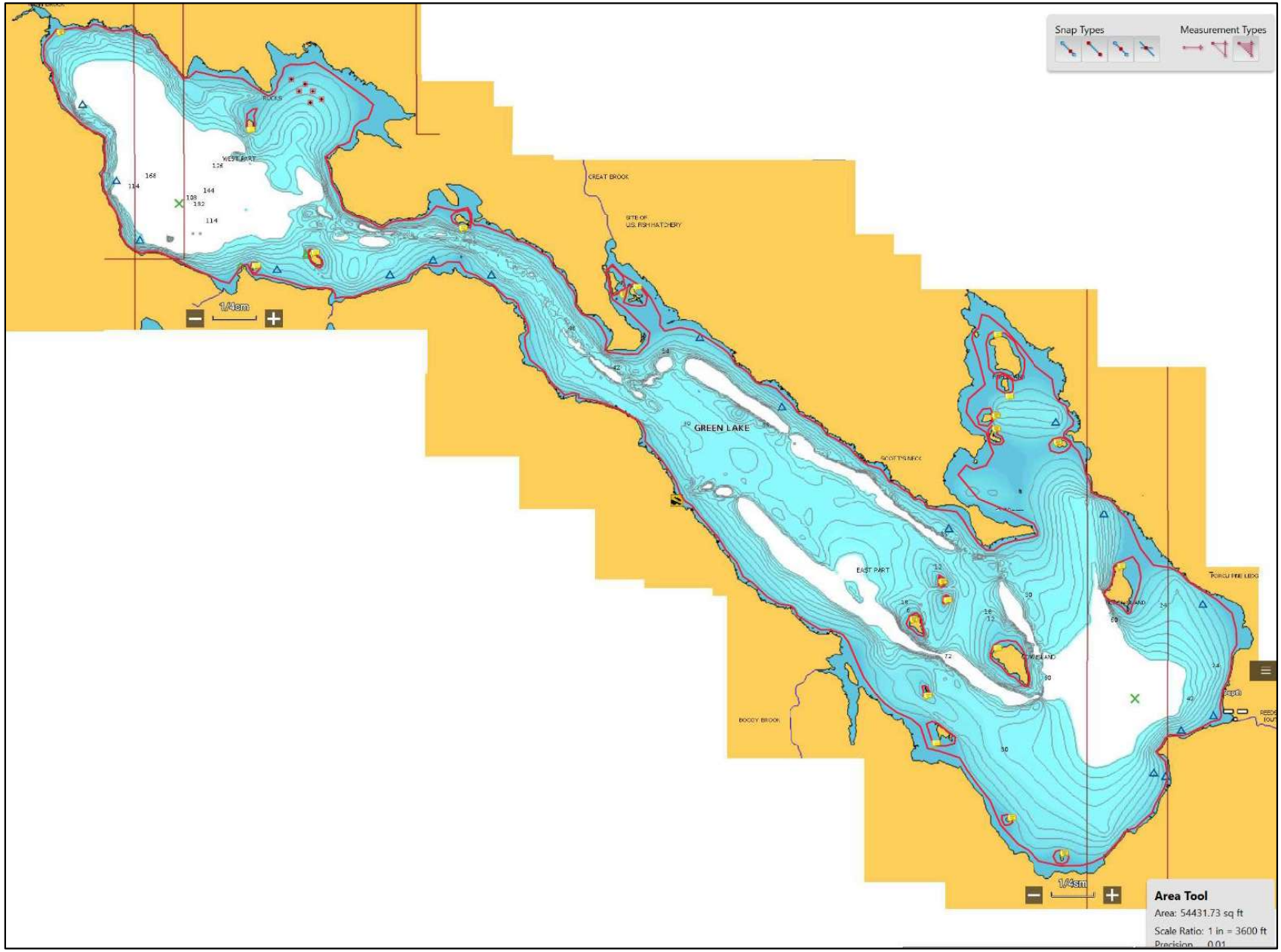
Lake perimeters were traced to get included areas:



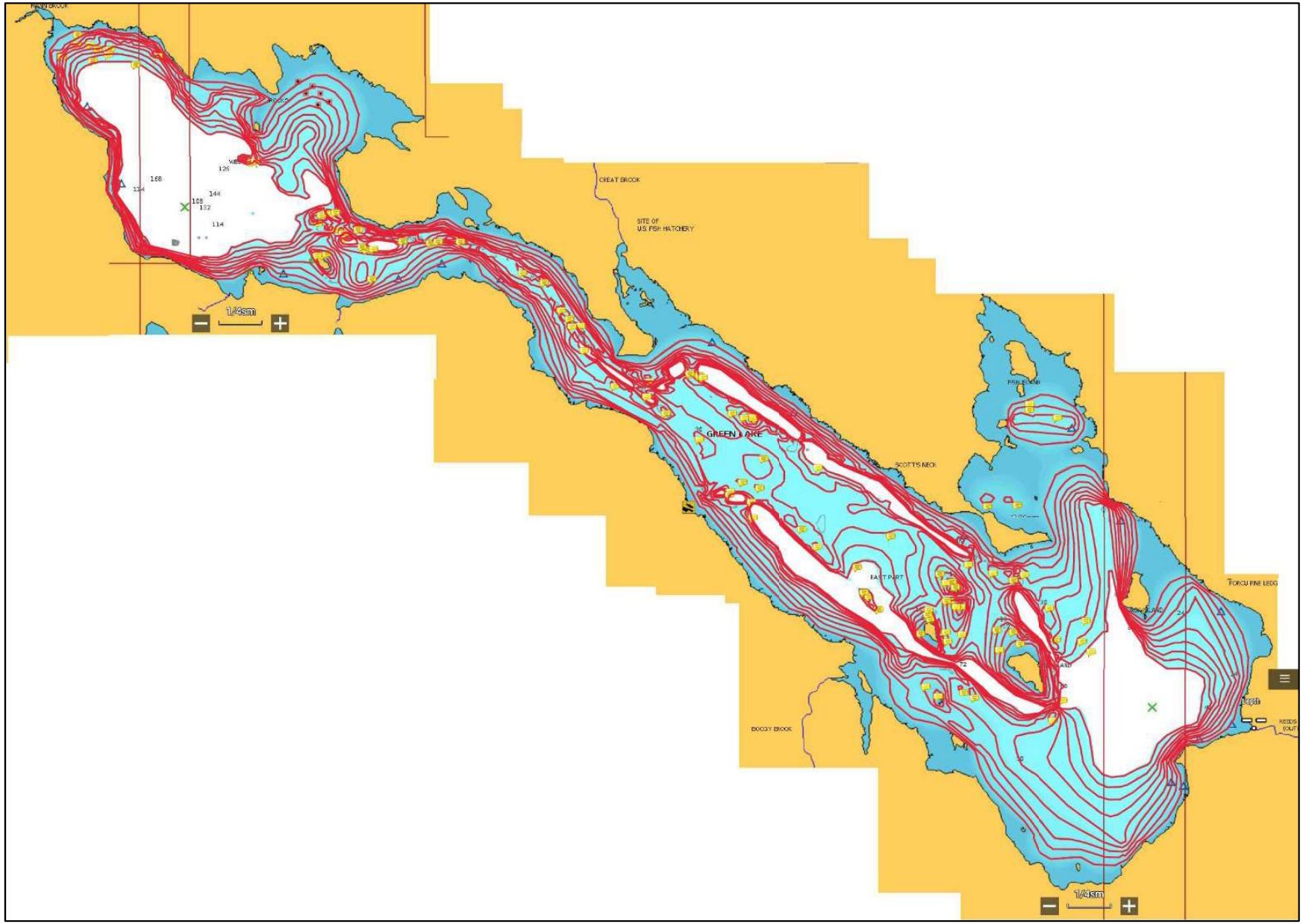
Littoral zone areas were traced to get included areas:



Drawdown limit was traced to non-drawdown area of lake:



6-ft contour lines were traced:



Scale of Navionics Plus bathymetry was calibrated against USGS maps.

From measured areas (and known depths) the following were calculated:

Area of water of lake

Lake surface area of littoral zone with lake full

Lake surface area reduction from drawdown

Lake littoral zone surface area drawdown percentage

Total volume of littoral zone when lake is full

Littoral zone volume reduction from drawdown

Lake littoral zone volume drawdown percentage

Results:

Littoral zone drawdown percentages:

Area: 14.4%

Volume: 13.3%

Amount of littoral zone that remains watered:

Area: 85.6%

Volume: 86.7%

Questions?

1-3) Impoundment Temperature Study

This study was requested by the FERC to inform licensing decisions involving Artic char in Green Lake.

Temperature loggers were deployed in the lake at likely Arctic char spawning locations and water depths to determine when during the fall the water temperature drops to 10°C (50°F).

Loggers were deployed 31-Aug-2020 and retrieved 01-Dec-2020.

Loggers were deployed so as to remain at a depth of 1.5-6 ft

Four potential logging locations were specified by Maine DIFW:

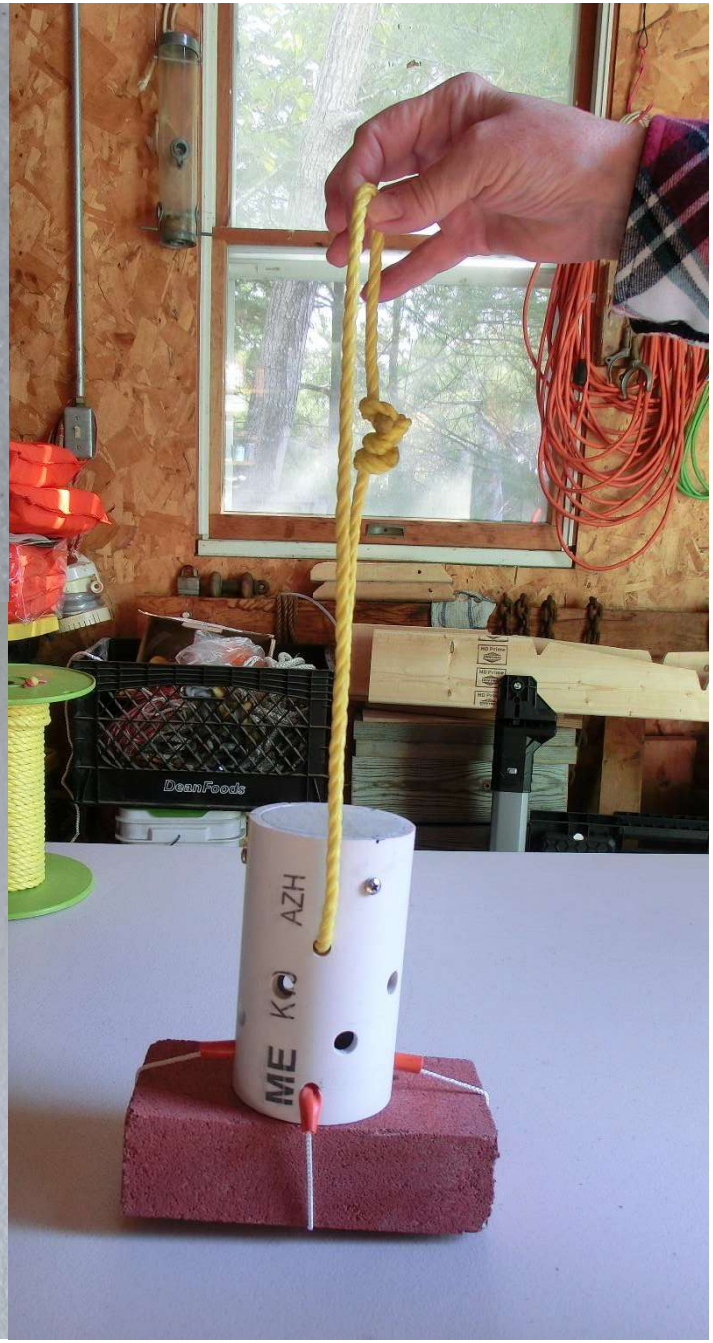
Loggers were deployed at sites 2 and 4.


2020/8/31 14:28


2020/8/31 14:49

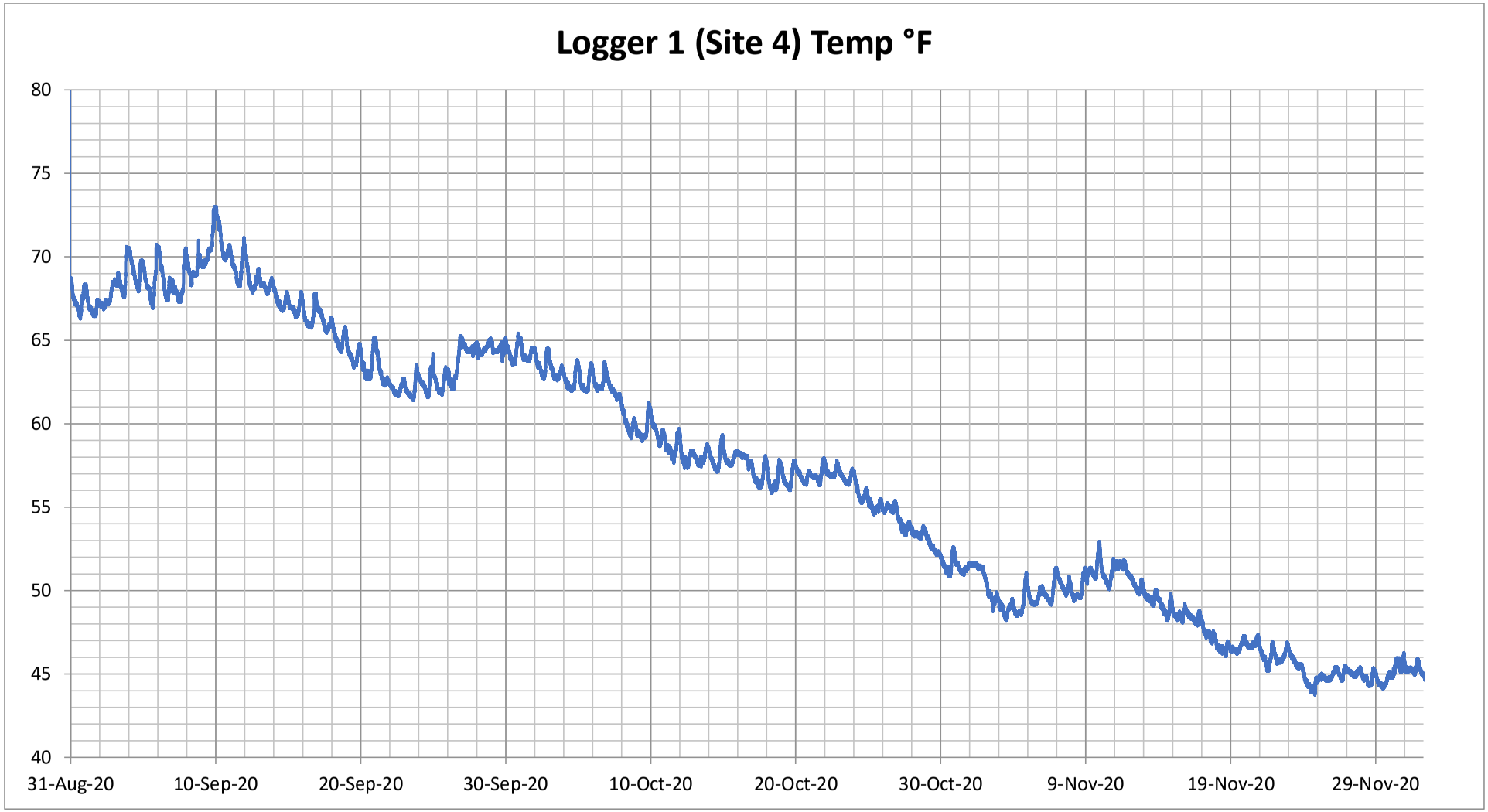

HOBO
Pendant
MX Temp

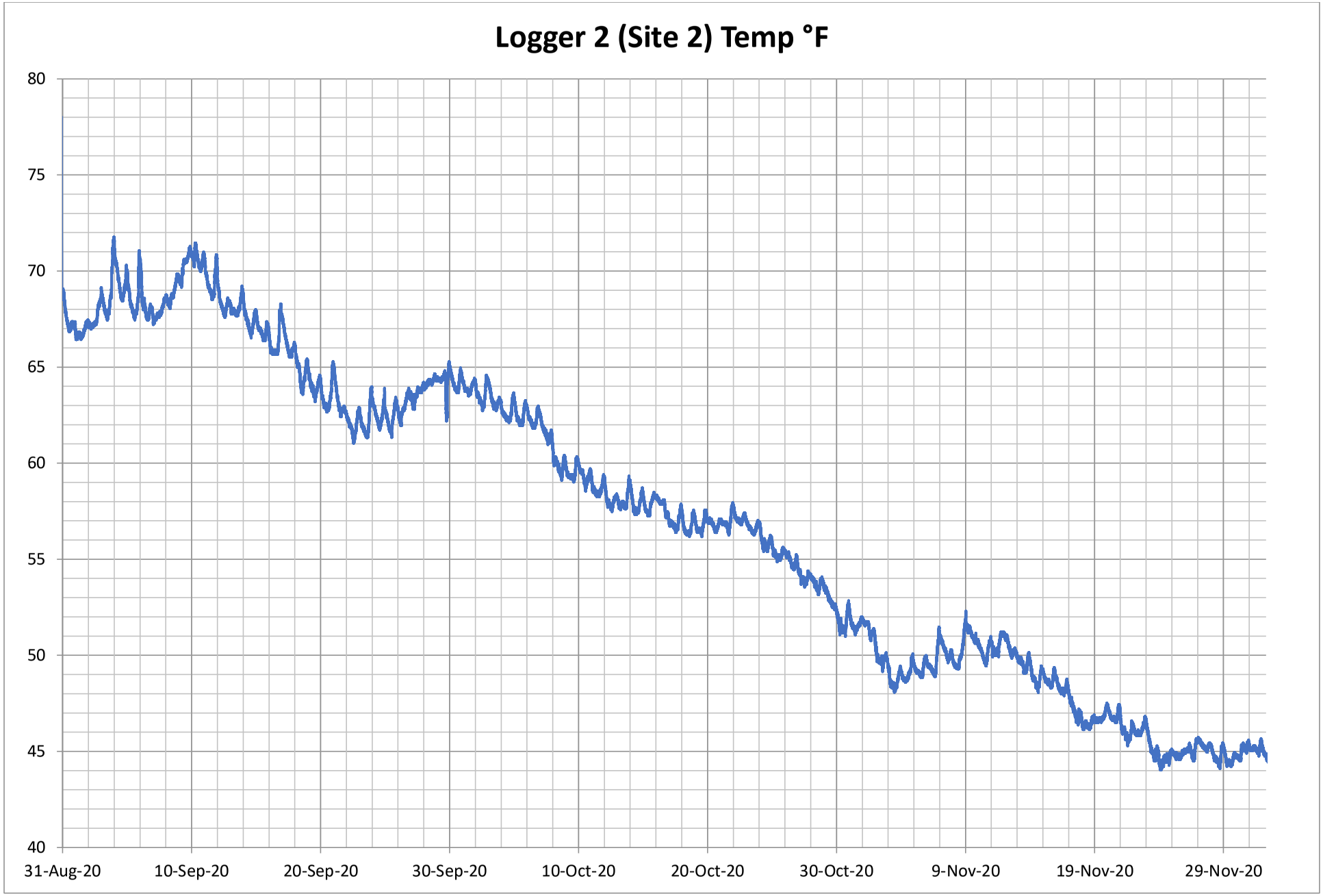

HOBO
2020/10/7 11:26


DeanFoods
AZH
ME K

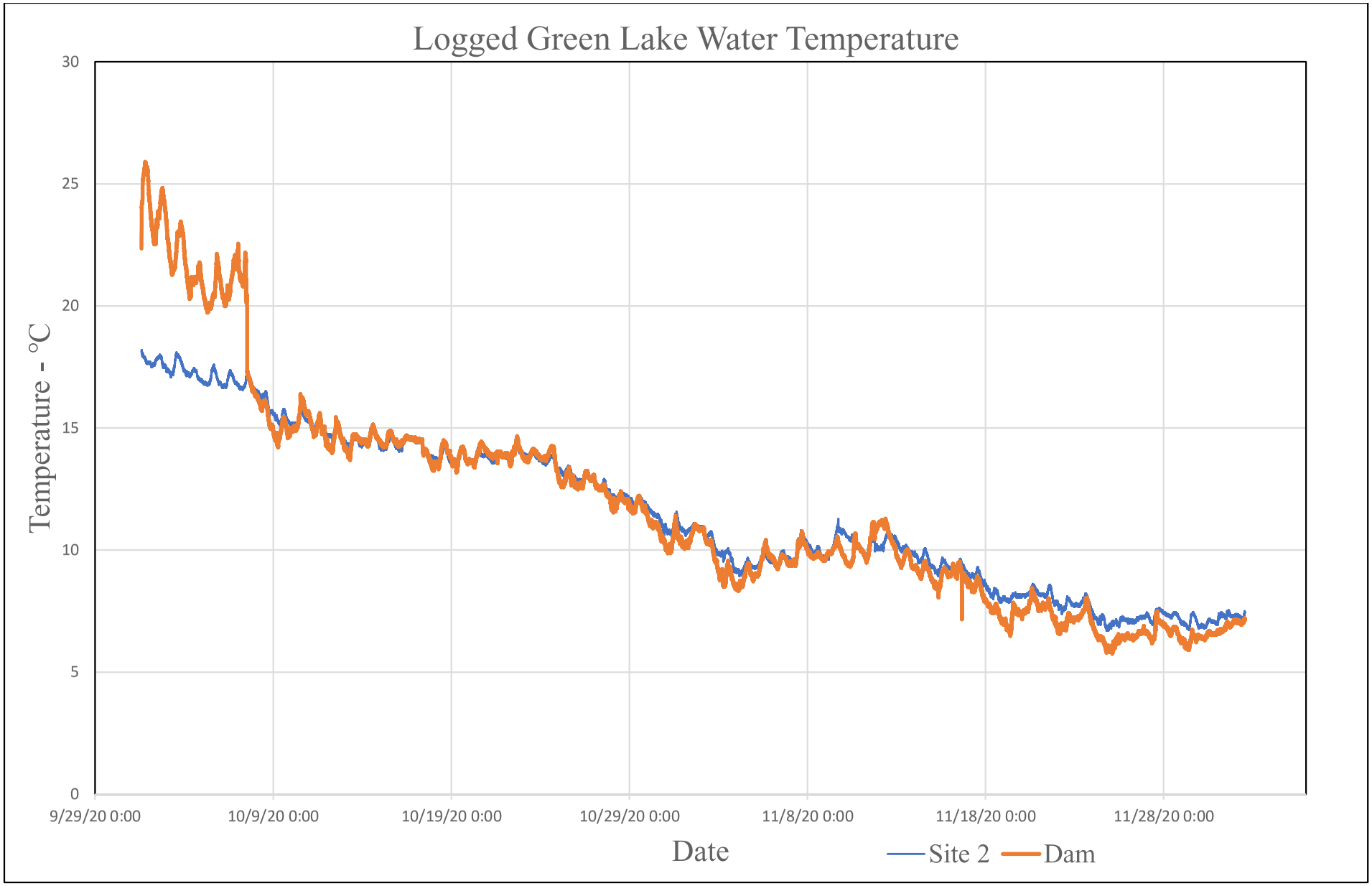
Results:

Lake water temperature dropped below 50°F in first half of November.




Logger 2 (Site 2) Temp °F
80
75
70
65
60
55
50
45
40
31-Aug-20
10-Sep-20
20-Sep-20
30-Sep-20
10-Oct-20
20-Oct-20
30-Oct-20
9-Nov-20
19-Nov-20
29-Nov-20

Temperature at the dam tracked the loggers well.



Questions?

1-4) Downstream Benthic Macroinvertebrate Study

This study is ongoing.

Paul Leeper of Moody Mountain Environmental Service deployed 3 sets of baskets at sites agreed with MDEP on 27-Aug-2020. The baskets were retrieved 24-Sep-2020.

The basket contents were analyzed and the BMI counts sent to MDEP to run through their model. The results of the model are not yet available.

Questions?

1-5) Downstream Dissolved Oxygen and Temperature Study

Dissolved oxygen and temperature (DO/T) readings were taken at 4 sites agreed with MDEP following their Sampling Protocol for Hydropower Studies.

Methodology:

Readings were taken with a YSI Prosolo ODOT meter with a 4m cable/probe. The meter and probe (as a combined unit) were field calibrated at least weekly during the study.

Readings were taken one day per week for ten weeks, from 25-Jul-2020 through 24-Sep-2020. All morning readings were completed before 7:00 am EDT with afternoon readings started after 14:00 of the same day.

None of the sampling locations were 2 meters deep.

Where there was enough water width and depth to allow taking multiple readings no significant variation of DO/T was found across the brook.

Readings were all taken near the middle of the channel at mid-depth.

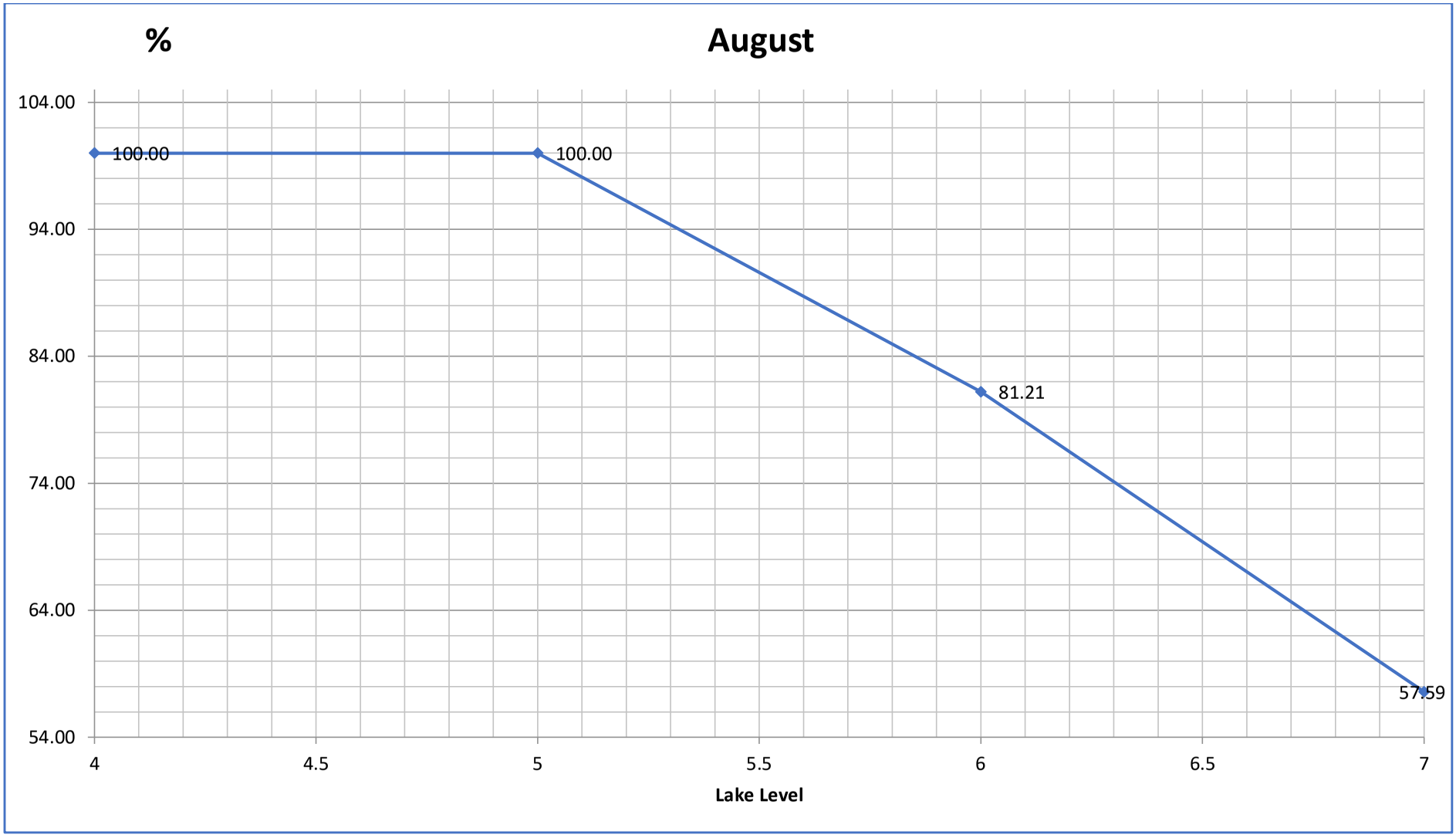
MDEP requires at least five sampling days in which the product of the water temperature (in ℃) times the flow duration at the time of sampling exceeds 1500.

Dam leakage set the flow past the dam into the brook.

Dam leakage varies directly with water level above the dam.

Past water levels were used to calculate monthly flow duration curves.

For example, here is the graph of the percentage of time the lake level exceeds a specified value during August:



Results:

The “1500” requirement was met seven sampling days (both morning and afternoon) using the average of the water temperatures at the four sampling sites for the morning or afternoon sampling time in question:

The two sampling days in July

The four sampling days in August

One sampling day in September

Viewing each site individually, each had at least 5 days when it met the 1500 test both morning and afternoon.

The temperatures readings ranged from 15.5 to 28.0 °C.

The DO readings ranged from 7.5 to 9.14 mg/L.

A table of all readings is included in the ISR.

Questions?