EXHIBIT E

GREEN LAKE PROJECT (P7189)

ENVIRONMENTAL REPORT

REVISION: SEPTEMBER 12, 2022

CONTENTS

APPENDICES – These were submitted as separate files and are not included with this filing.

They can be found with the original Final License Application – filed on March 31, 2022:

APPENDIX A – DLA RESPONSES

APPENDIX B – CONSULTATIONS AND MEETINGS

APPENDIX C – STUDY REPORTS AND DATA

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0.0 INTRODUCTION

Green Lake Water Power Company (GLWP) is using the Federal Energy Regulatory Commission's (FERC or Commission) Integrated Licensing Process (ILP) for the relicensing of the Green Lake Hydroelectric Project (Project). The Licensee is filing a Final License Application (FLA).

0.1 Document Organization

The format of Exhibit E for an FLA produced under the ILP is prescribed by 18 Code of Federal Regulation (CFR) § 5.18(b). This document generally follows FERC's guidelines for preparing Environmental Documents, but where there are differences between the two, 18 CFR § 5.18(b) is followed because, as FERC's guidelines document states in its Preface: "These guidelines… do not set Commission policy or substitute for the Commission's regulations."

Per 18 CFR § 5.18(b), this Exhibit E must meet the following format and content requirements:

Section 0.0 – General Description of the River Basin.

Section 1.0 – Cumulative Effects

Section 3.0 – Applicable Laws

Section 4.0 – Project Facilities and Operation

Section 5.0 – Proposed Action and Action Alternatives

1.0 RIVER BASIN

1.1 Overview

The Green Lake Dam Hydroelectric Project, FERC No. 7189 (GLWP, P7189, or the Project) is located on Green Lake and Reeds Brook near the City of Ellsworth, Hancock County, Maine. The Project intake is at the Green Lake dam and the tailrace discharges into Reeds Brook near Graham Lake. The Green Lake drainage area is part of the Union River watershed.

The Union River watershed has an area of 547 square miles. Within that area, the Green Lake watershed has an area of approximately 46 square miles. Green Lake stretches 6.1 miles from the dam to the northwest end of the lake.

Reeds Brook flows about 2000 feet (about 1800 feet straight line distance) from Green Lake just downstream of the Green Lake dam to Graham Lake, dropping about 45 feet in the process. The elevation difference between Green Lake and Graham Lake is 57.7 feet with both lakes at normal high water.

The Project power station is about 7 miles upriver from the head of tidewater on the Union River at the Ellsworth dam. The tidewater of the Union River flows a further 4.2 miles and enters the Union River Bay, part of the Atlantic Ocean. The power station is therefore about 11.2 miles, and the Green Lake dam about 11.6 miles, upstream of Union River Bay.

The following ponds and associated wetlands drain into Green Lake via streams:

- Hatcase Pond
- Mountainy Pond
- Little Burnt Pond
- Rocky Pond
- Wormwood Pond
- Little Duck Pond
- Little Rocky Pond
- Goose Pond

These ponds and wetlands absorb precipitation and have a large effect on the quantity and timing of rain runoff into Green Lake. Small amounts of precipitation result in little new water in Green Lake beyond that which falls directly on the lake. Larger amounts of precipitation cause disproportionately larger amounts of runoff—the actual amount depending on season, weather, and prior precipitation.

Ellsworth Hydroelectric's Union River Watershed map includes Phillips Lake. USGS maps show both Mann Brook and Mill Stream as possible outlets for Phillips Lake. GLWP conducted a field survey and determined that there was a large flow of water north from Phillips Lake into Mill Stream and, on the ground, Mann Brook does not connect with Phillips Lake. Because of this GLWP concluded Phillips lake drains to the north, away from the Union river, and is not part of the Green Lake Watershed.

1.2 Project Drainage Basin Tributary Streams

Most of the streams in the Project drainage basin are quite small, traveling one or two miles before entering the lake. The larger streams are the following:

- Great Brook, which drains Rocky Pond and Little Burnt Pond directly, and Mountainy Pond and Hatcase Pond via Mountainy Pond Brook. With all major forks included, this system of ponds and brooks runs about 11 miles before entering Green Lake.

Source of all photos: GLWP 2019 or as marked

Photo 1-1 – Great Brook at Scott's Neck Road

Photo 1-2 – Mountainy Pond Brook at Beech Hill Pond Road

- Mann Brook drains Goose Pond, Mann Bog, Coon Bog. It runs about 6.5 miles including all of its branches.

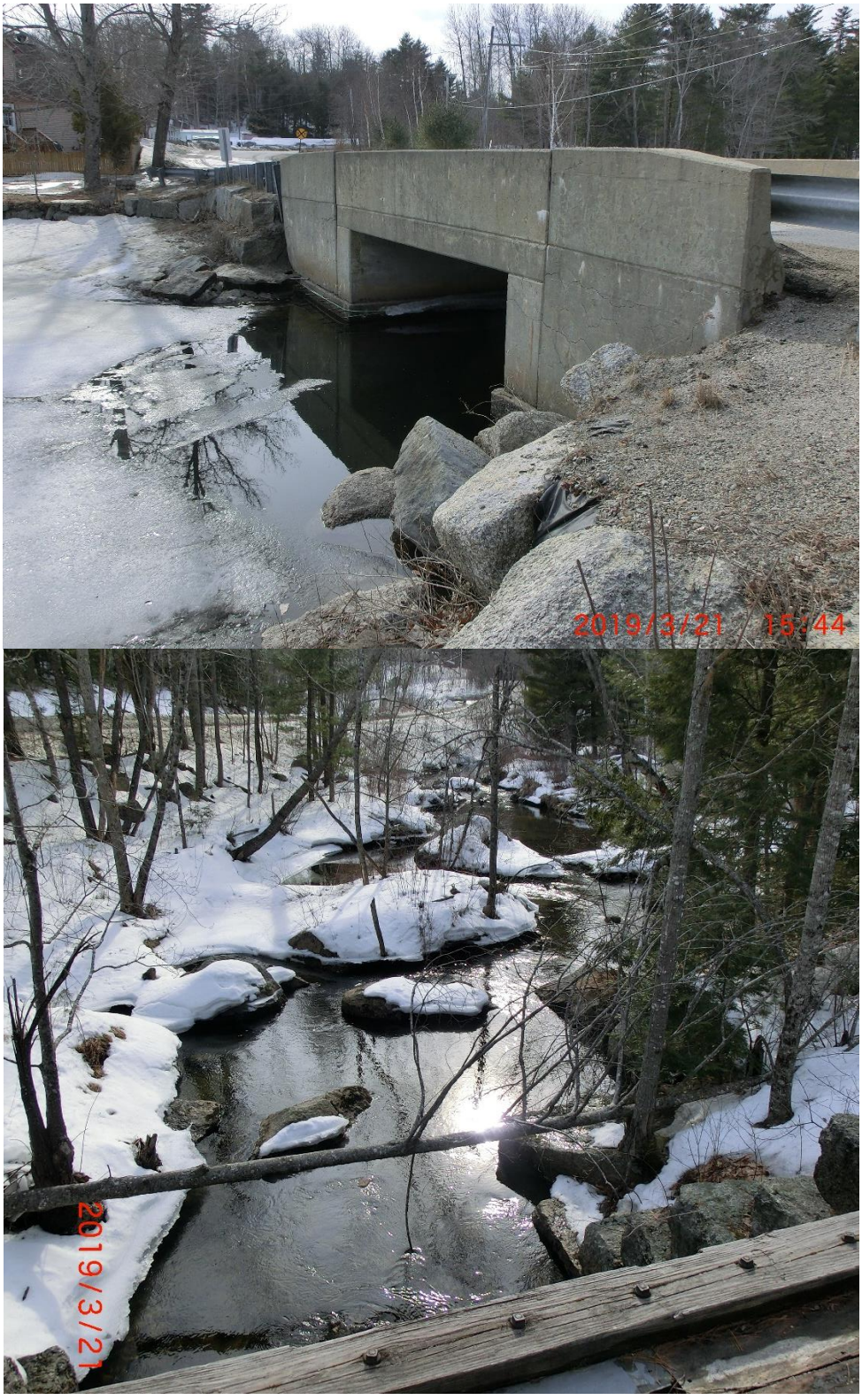


Photo 1-3 – Mann Brook at Green Lake Road

- Jellison Brook runs about 4 miles to Green Lake. It does not drain any ponds.

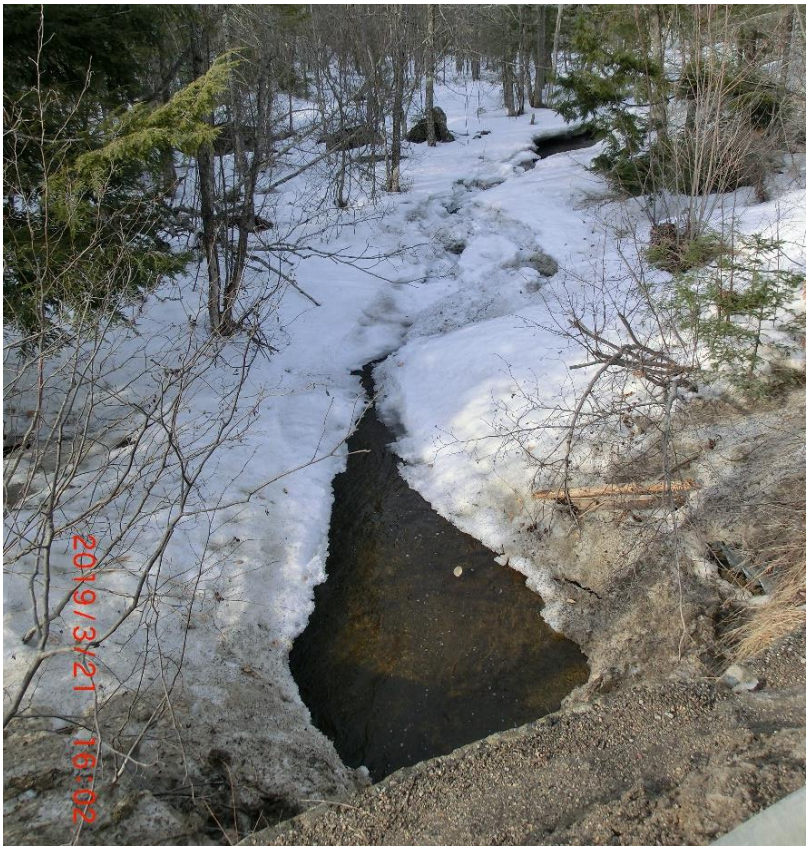
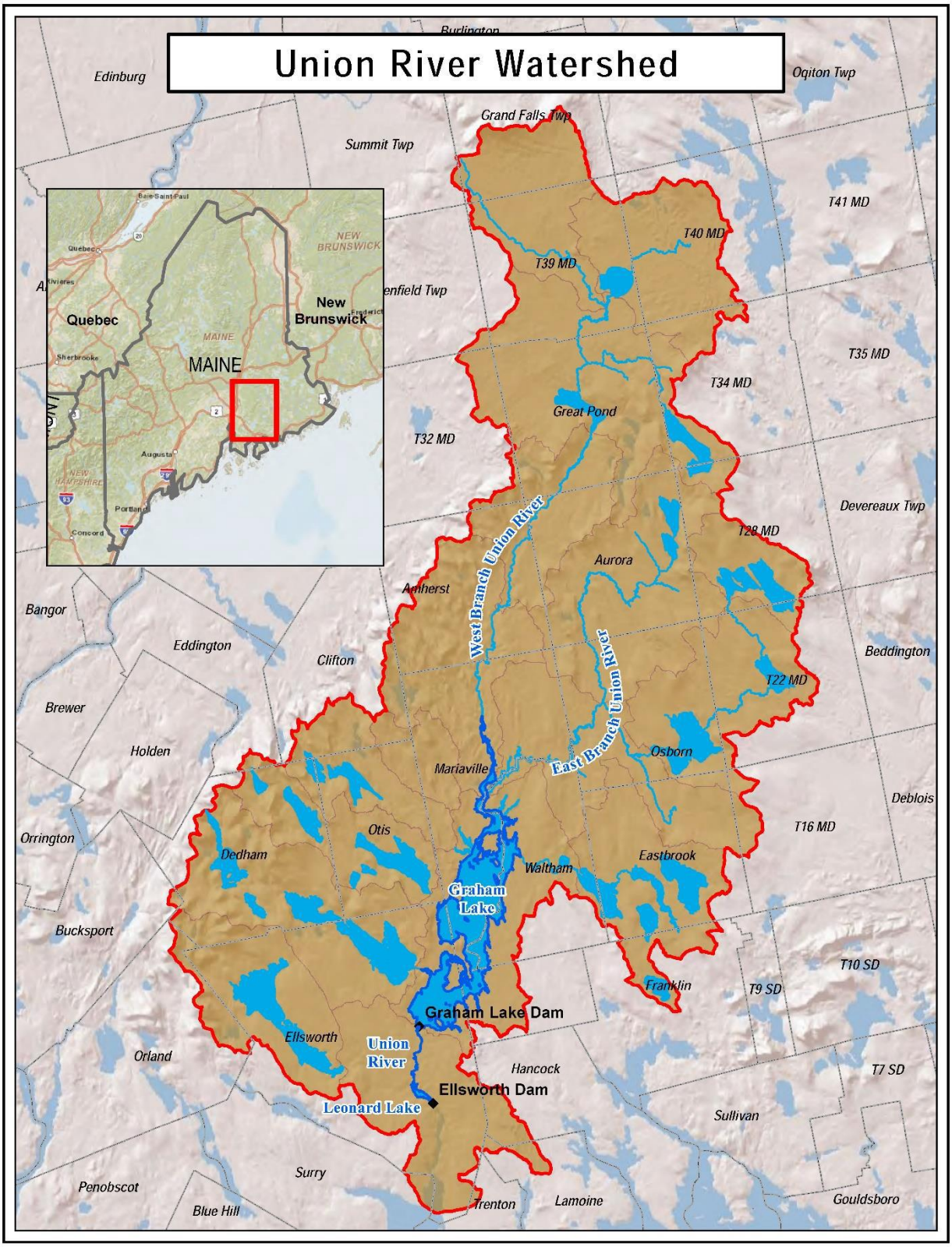


Photo 1-4 – Jellison Brook at Green Lake Road

- Boggy Brook runs about 3 miles to Green Lake. It does not drain any ponds.

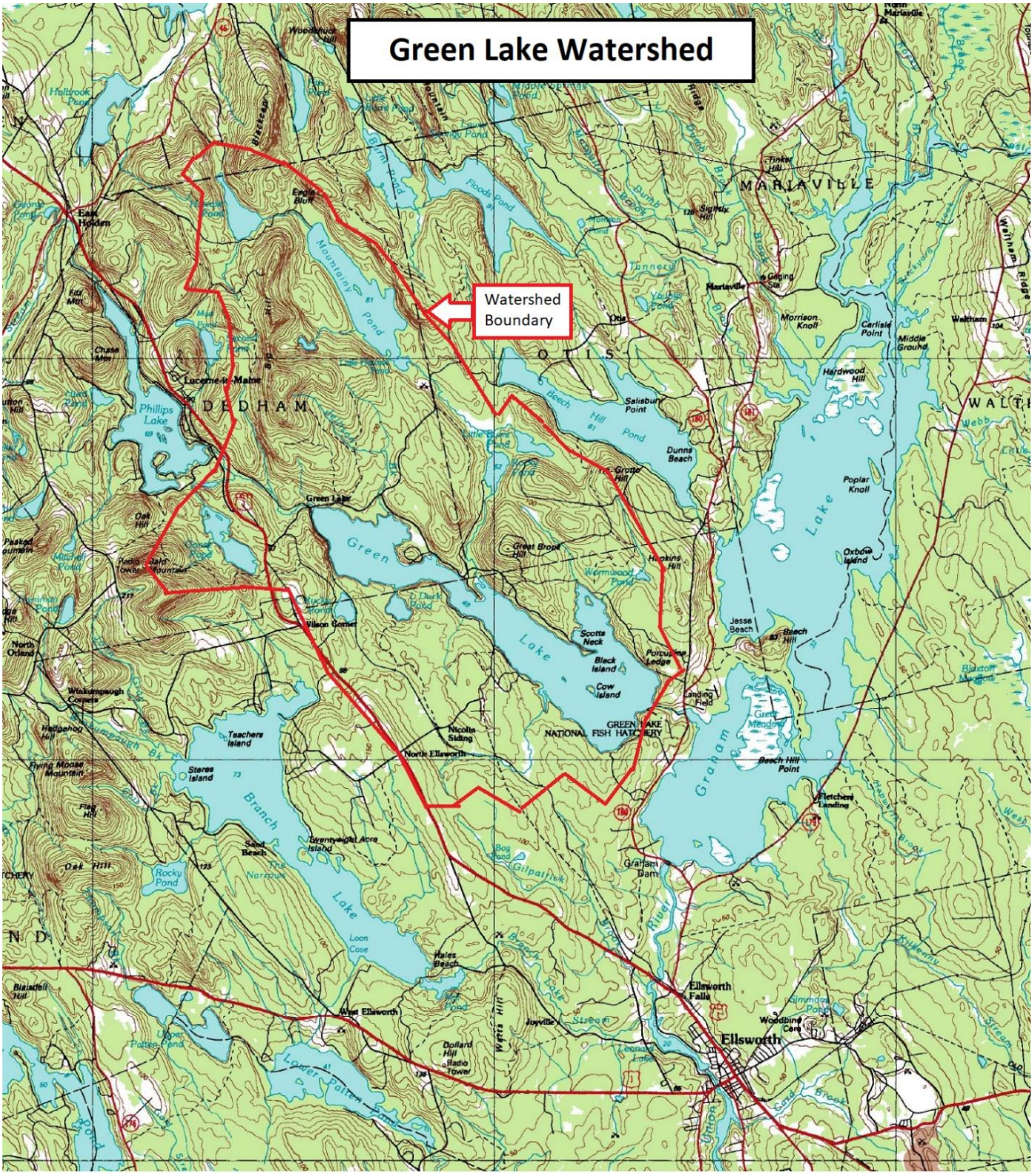
Photo 1-5 – Boggy Brook at Upper Boggy Brook Road

Figure 1–1 – Union River Basin



Source: Ellsworth Hydroelectric Project (FERC No. 2727) License application, Dec-2015

Figure 1–2 – Project Drainage Area



Source: GLWP and USGS Map 44068-E1-TM-100, "Bangor, Maine", 1994 Revision

1.3 Topography

The land around Green Lake is characterized by hills to the north and broad ridges of moderate height to the south. The hills to the north within the project drainage area rise to a maximum elevation of just over 1100 feet. See Figure 1–2 *Project Drainage Area* above.

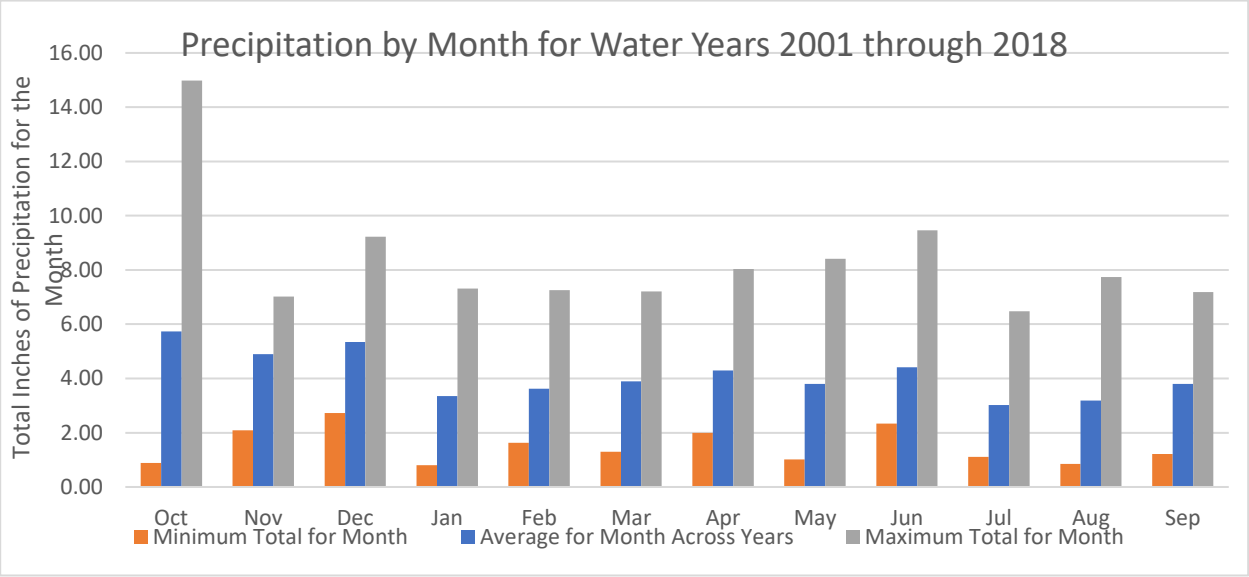
1.4 Climate

The climate of the Green Lake area is quite varied. Summer and fall can be anything from a severe, extended dry period to a period of frequent, heavy rain. Hurricanes and tropical depressions traveling northeast near the coast can spiral large amounts of moisture inland from the Gulf Stream. With Green Lake located about 30 miles from the ocean, winters are a battle between cold air masses traveling westward from the middle of the country and moist, warm onshore flows from storms. Resulting winter weather can bring snow which accumulates until spring; or snow followed by rain which results in a shallow, dense snow pack; or mostly rain, which results in negligible snow pack, but icy conditions between storms.

A "typical" water year would be damp in the late fall with rain and some snow. Snow starts accumulating from late December. Snow and frost melt and run off into Green Lake around mid-April. Spring rain is intermixed with sunny periods into June, which kicks the trees on the land surrounding Green Lake into full growth. From July through September precipitation is reduced from spring levels--trees are absorbing much of the precipitation that falls on the land surrounding Green Lake. Individual years can vary greatly from this typical scenario.

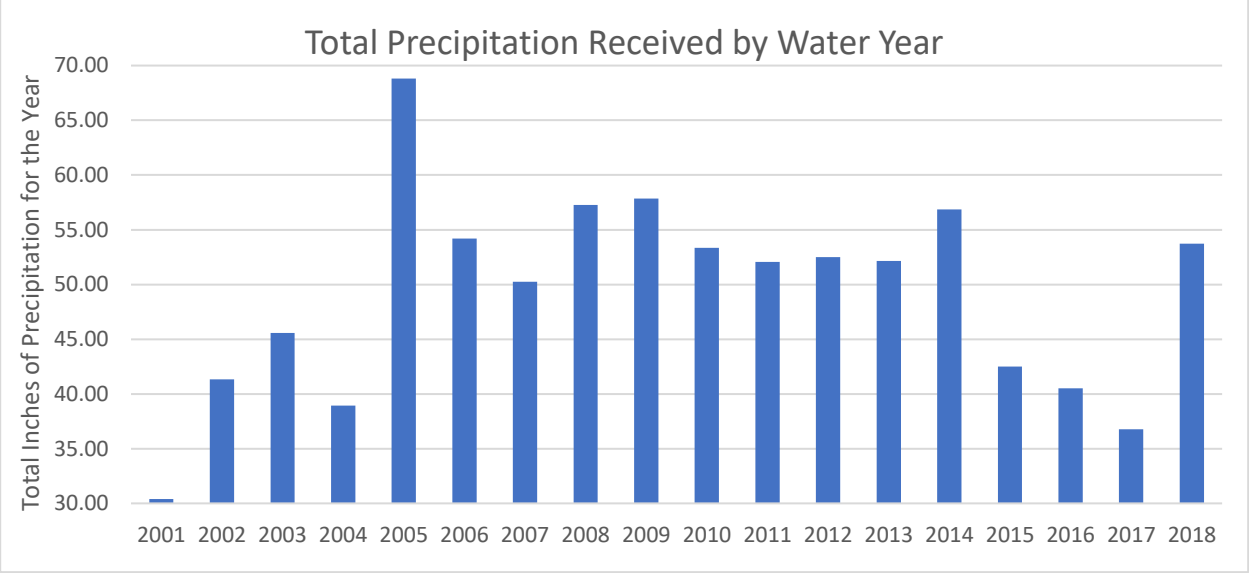
The hills to the northwest of Green Lake affect the climate of the Green Lake Watershed. Low pressure areas that track northeast near Maine cause a moist airflow from the southeast which condenses and forms rain/snow as it cools from being forced to rise over the hills. The Green Lake Watershed often receives more precipitation from large storms than surrounding areas and than the National Weather Service (NWS) predicts. Even though the Green Lake Watershed is located between two NWS monitoring and recording stations (the Bar Harbor and Bangor Airports), forecasts and records for these locations are not necessarily a good prediction of Green Lake Watershed precipitation. During the summer, Project experience has been that actual precipitation amounts are often quite a bit less than amounts called for by NWS forecasts 2 to 3 days before the rain.

GLWP recorded the following precipitation amounts by month and year over the last eighteen years: (Sources: GLWP Daily Hydrological Logs, 2000 to 2018)



Source: GLWP Daily Hydrological Logs, 2000 to 2018

Figure 1–3 – Graph of precipitation range recorded by month



Source: GLWP Daily Hydrological Logs, 2000 to 2018

Figure 1–4 – Graph of total precipitation recorded by year

1.5 Major Land Uses

Most of the land in the Green Lake watershed is used for tree growth. Some rural residential, seasonal recreational and commercial uses are also found within the drainage area.

1.6 Economic Activities

Much of the land in the Project vicinity is used for tree growth, with scattered residential and recreational uses. There are also a few businesses (small mechanics, stores, commercial beaches, rental properties, etc.)

1.7 References

U.S. Geological Survey (USGS) maps, https://store.usgs.gov/maps

Bangor, Maine, 1:100k, 1994

Bar Harbor, 1:100k, 1991

Beech Hill Pond, 1:24k, 1981

Branch Lake, 1:24k, 1981

Brewer Lake, 1:24k, 1982

Chemo Pond, 1:24k, 1988

Ellsworth, 1:24k, 1981

Green Lake, 1:24k, 1982

Hopkins Pond, 1:24k, 1988

Veazie, 1:24k, 1988

Ellsworth Hydroelectric Project (FERC No. 2727) License application, Dec-2015,

https://www.ferc.gov/docs-filing/elibrary.asp

Lakes of Maine, https://www.lakesofmaine.org/lake-overview.html?m=4294

2.0 CUMULATIVE EFFECTS

2.1 Introduction

According to the Council on Environmental Quality's regulation for implementing the National Environmental Policy Act (NEPA) (40 C.F.R. § 1508.7), a cumulative effect is the effect on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time, including hydropower and other land and water development activities.

2.2 Resources Identified

The following potentially cumulatively affected resources were identified in the Commission's Scoping Document, consultation and study results:

- Migratory fish (i.e., alewife, American eel, American shad, Atlantic salmon, blueback herring, and sea lamprey)
- Lake wildlife (loons and arctic char)
- Aquatic habitat

2.3 Geographic Scope

The geographic scope chosen for migratory fish analysis is from the upstream extent of the Green Lake Project to the Graham Lake Development of the Ellsworth Project No. 2727 (Ellsworth Project), and the Union River from the Ellsworth Project downstream to the Union River Bay. This geographic scope was chosen because the operation and maintenance of the Green Lake Project, in combination with several other dams on the Union River, may affect migratory fish. GLWP notes that the population of Atlantic salmon at the Green Lake National Fish Hatchery (GLNFH, or the Hatchery) is also affected by the Project (in addition to the obvious effects from the Hatchery) and believes the Hatchery should be included in the geographic scope for cumulative effects analysis.

The geographic scope chosen for lake wildlife analysis is Green Lake. This geographic scope was chosen because Project operation, combined with development around the lake and/or Hatchery operation, may affect lake wildlife.

The geographic scope chosen for aquatic habitat is from the upstream extent of the Green Lake Project to Graham Lake. This includes Green Lake, Reeds Brook and the Hatchery. This geographic scope was chosen because the operation of the Green Lake Project, combined with the operation of the Green Lake National Fish Hatchery and development around Green Lake could affect aquatic habitat.

2.4 Temporal Scope

The temporal scope for cumulative effects analysis includes a discussion of past, present, and reasonably foreseeable future actions and their effects on each resource that could be cumulatively affected. Based on the potential term of a new license, the temporal scope will look 30 to 50 years into the future, concentrating on the effect on the resources from reasonably foreseeable future actions.

2.5 References

Scoping document 2 – 20190913-3000 – under Docket P-7189-014 on the FERC site https://elibrary.ferc.gov/eLibrary/search

Hatchery Populations of Atlantic Salmon - NOAA's *Endangered and Threatened Species: Determination of Endangered Status for the Gulf of Maine Distinct Population Segment of Atlantic Salmon"* (Federal Register/ Vol. 74, No. 117/Friday, June 19, 2009, page 29344)

40 C.F.R. § 1508.7 - CEQ Regulations for Implementing the Procedural Provisions of NEPA (energy.gov)

3.0 STATUTORY AND REGULATORY REQUIREMENTS

See the end of this section for a list of agencies and others consulted with respect to the following laws applicable to the Project.

Issues related to the following statutory and regulatory requirements are discussed in the Proposed Action and Action Alternatives section below.

3.1 Federal Power Act

3.1.1 Section 4(e) FERC Can Issue Licenses

Section 4(e) of the Federal Power Act specifies that the Commission is authorized and empowered:

"(e) To issue licenses to citizens of the United States, or to any association of such citizens, or to any corporation organized under the laws of the United States or any State thereof, or to any State or municipality for the purpose of constructing, operating, and maintaining dams, water conduits, reservoirs, power houses, transmission lines, or other project works necessary or convenient for the development and improvement of navigation and for the development, transmission, and utilization of power across, along, from or in any of the streams or other bodies of water over which Congress has jurisdiction under its authority to regulate commerce with foreign nations and among the several States, or upon any part of the public lands and reservations of the United States (including the Territories), or for the purpose of utilizing the surplus water or water power from any Government dam, except as herein provided: Provided, That licenses shall be issued within any reservation only after a finding by the Commission that the license will not interfere or be inconsistent with the purpose for which such reservation was created or acquired, and shall be subject to and contain such conditions as the Secretary of the department under whose supervision such reservation falls shall deem necessary for the adequate protection and utilization of such reservation: {See Note 5 below} Provided further, That no license affecting the navigable capacity of any navigable waters of the United States shall be issued until the plans of the dam or other structures affecting navigation have been approved by the Chief of Engineers and the Secretary of the Army. Whenever the contemplated improvement is, in the judgment of the Commission, desirable and justified in the public interest for the purpose of improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, a finding to that effect shall be made by the Commission and shall become a part of the records of the Commission: Provided further, That in case the Commission shall find that any Government dam may be advantageously used by the United States for public purposes in addition to navigation, no license therefor shall be issued until two years after it shall have reported to Congress the facts and conditions relating thereto, except that this provision shall not apply to any Government dam constructed prior to June 10, 1920: And provided further, That upon the filing of any application for a license which has not been preceded by a preliminary permit under subsection (f) of this section, notice shall be given and published as required by the proviso of said subsection. In deciding whether to issue any license under this Part for any project, the Commission, in addition to the power and development purposes for which licenses are issued, shall give equal consideration to the purposes of energy

conservation, the protection, mitigation of damage to, and enhancement of, fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality.

"Note 5: The amendment made by section 241(a) of Public Law 109–58 to insert after ''adequate protection and utilization of such reservation.'' at the end of the first proviso the following: ''The license applicant and any party to the proceeding shall be entitled to a determination on the record, after opportunity for an agency trial-type hearing of no more than 90 days, on any disputed issues of material fact with respect to such conditions. All disputed issues of material fact raised by any party shall be determined in a single trial-type hearing to be conducted by the relevant resource agency in accordance with the regulations promulgated under this subsection and within the time frame established by the Commission for each license proceeding. Within 90 days of the date of enactment of the Energy Policy Act of 2005, the Secretaries of the Interior, Commerce, and Agriculture shall establish jointly, by rule, the procedures for such expedited trial-type hearing, including the opportunity to undertake discovery and cross-examine witnesses, in consultation with the Federal Energy Regulatory Commission.'' could not be executed because the instruction probably should not have included a period in the quoted matter relating to the place where such language is to be inserted. Also, the period that appears at the end of the matter purported to be inserted should not include a period."

3.1.2 Section 18 Fishway Prescriptions

"SEC. 18. The Commission shall require the construction, maintenance, and operation by a licensee at its own expense of such lights and signals as may be directed by the Secretary of the Department in which the Coast Guard is operating, and such fishways as may be prescribed by the Secretary of Commerce. The license applicant and any party to the proceeding shall be entitled to a determination on the record, after opportunity for an agency trial-type hearing of no more than 90 days, on any disputed issues of material fact with respect to such fishways. All disputed issues of material fact raised by any party shall be determined in a single trial-type hearing to be conducted by the relevant resource agency in accordance with the regulations promulgated under this sub section and within the time frame established by the Commission for each license proceeding. Within 90 days of the date of enactment of the Energy Policy Act of 2005, the Secretaries of the Interior, Commerce, and Agriculture shall establish jointly, by rule, the procedures for such expedited trial-type hearing, including the opportunity to undertake discovery and cross-examine witnesses, in consultation with the Federal Energy Regulatory Commission. The operation of any navigation facilities which may be constructed as a part of or in connection with any dam or diversion structure built under the provisions of this Act, whether at the expense of a licensee hereunder or of the United States, shall at all times be controlled by such reasonable rules and regulations in the interest of navigation, including the control of the level of the pool caused by such dam or diversion structure as may be made from time to time by the Secretary of the Army, and for willful failure to comply with any such rule or regulation such licensee shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished as provided in section 316 hereof."

3.1.3 Section 10(j) Recommendations

"Sec. 10. All licenses issued under this Part shall be on the following conditions:"

...

"(i) In issuing licenses for a minor part only of a complete project, or for a complete project of not more than two thousand horsepower installed capacity, the Commission may in its discretion waive such conditions, provisions, and requirements of this Part, except the license period of fifty years, as it may deem to be to the public interest to waive under the circumstances: Provided, That the provision hereof shall not apply annual charges for use of lands within Indian reservations.

"(j)(1) That in order to adequately and equitably protect, mitigate damages to, and enhance, fish and wildlife (including related spawning grounds and habitat) affected by the development, operation, and management of the project, each license issued under this Part shall include conditions for such protection, mitigation, and enhancement. Subject to paragraph (2), such conditions shall be based on recommendations received pursuant to the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.) from the National Marine Fisheries Service, the United States Fish and Wildlife Service, and State fish and wildlife agencies.

(2) Whenever the Commission believes that any recommendation referred to in paragraph (1) may be inconsistent with the purposes and requirements of this Part or other applicable law, the Commission and the agencies referred to in paragraph (1) shall attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agencies. If, after such attempt, the Commission does not adopt in whole or in part a recommendation of any such agency, the Commission shall publish each of the following findings (together with a statement of the basis for each of the findings):

(A) A finding that adoption of such recommendation is inconsistent with the purposes and requirements of this Part or with other applicable provisions of law.

(B) A finding that the conditions selected by the Commission comply with the requirements of paragraph (1).

3.2 Section 401 of the Clean Water Act

The Project is subject to Water Quality Certification under Section 401(a)(1) of the federal Clean Water Act of 1977. The Maine Department of Environmental Protection (MDEP) establishes water quality standards and criteria required to be met to demonstrate attainment of these standards. MDEP is charged to do this by Maine state law under Title 38, Chapter 3.

Maine Title 38, Chapter 5 § 631 states: "**2. Policy and purpose**. The Legislature declares that hydropower justifies singular treatment. The Legislature further declares that it is the policy of the State to support and encourage the development of hydropower projects by simplifying and clarifying requirements for permits, while assuring reasonable protection of natural resources and the public interest in use of waters of the State…"

3.3 Endangered Species Act (ESA)

Section 7(a)(2) of the ESA specifies that a Federal agency that authorize activities must ensure that such activities are not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species. Determination of the significance of effects on species and habitat are determined by the U.S. Fish and Wildlife Service (FWS) after consultation with the affected States.

Section 7(a)(3) of the ESA specifies that a Federal agency shall consult the FWS and NMFS on any prospective agency action at the request of, and in cooperation with, the prospective permit or license applicant if the applicant has reason to believe that an endangered species or threatened species may be present in the area affected by this project and that implementation of such action will likely affect such species.

Section 4(b)(2) of the ESA states: "The Secretary may exclude any area from critical habitat if he determines that the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat, unless he determines, based on the best scientific and commercial data available, that the failure to designate such area as critical habitat will result in the extinction of the species concerned." This section may apply to this Project when cumulative effects involving the Green Lake National Fish Hatchery are considered.

The Graham Lake watershed has been determined to be critical habitat for the Gulf of Maine Distinct Population Segment of Atlantic Salmon (GOM DPS). A federally listed threatened species, the northern long eared bat, could also exist in the Project area.

3.4 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) is the primary law that governs marine fisheries management in U.S. federal waters. First passed in 1976, the MSA fosters the long-term biological and economic sustainability of marine fisheries. Its objectives include:

- Preventing overfishing
- Rebuilding overfished stocks
- Increasing long-term economic and social benefits
- Ensuring a safe and sustainable supply of seafood

The MSA created eight regional fishery management councils. The New England Fishery Management Council (NEFMC) covers the Project area. This fishery management councils create management plans, which are covered in section 6 of this Exhibit.

The NEFMC created a fishery management plan for Atlantic Salmon in 1985, which was amended in 1996 to designate Essential Fish Habitat for Atlantic Salmon: "Essential fish habitat for Atlantic salmon is described as all waters currently or historically accessible to Atlantic salmon within the streams, rivers, lakes, ponds, wetlands, and other water bodies of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut and that meet conditions for eggs, larvae, juveniles, adults and/or spawning adults."

The Graham Lake watershed, including the Project area, is included in the EFH for the GOM DPS of Atlantic Salmon.

Included in the endangered GOM DPS are all associated conservation hatchery populations used to supplement the natural populations; currently, hatchery populations are maintained at Green Lake National Fish Hatchery and Craig Brook National Fish Hatchery, both operated by the U.S. Fish and Wildlife Service. Hatchery populations provide a safety net against low fish return rates in the Union River, and as such the Hatcheries should be considered EFH for Atlantic Salmon regardless of potential sematic arguments to the contrary.

3.5 Coastal Zone Management Act (CZMA)

Congress enacted the Coastal Zone Management Act (CZMA) (16 U.S.C. 1451 et seq.) to protect the coastal environment from growing demands associated with residential, recreational, commercial, and industrial uses (e.g., State and Federal offshore oil and gas development). The CZMA provisions help States develop coastal management programs (Programs) to manage and balance competing uses of the coastal zone. Federal Agencies must follow the Federal Consistency provisions as delineated in 15 CFR part 930.

Maine's coastal zone includes all municipalities with tidal waters in their jurisdiction. Ellsworth, one of the municipalities in which the project is located, includes tidal waters (the Union River downstream of the Ellsworth dam.) GLWP will, subsequent to the FERC issuance of the Ready for Environmental Analysis public notice (REA), submit a certificate of consistency to the Maine Coastal Program in the Maine Department of Marine Resources for their review and concurrence.

3.6 National Historic Preservation Act (NHPA)

The National Historic Preservation Act (NHPA) directs federal agencies to take into account the effect of any undertaking (a federally funded or assisted project) on historic properties.

Historic property means any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria.

3.7 Maine Title 5, §9055. Ex parte communications; separation of function

1. Communication prohibited. In any adjudicatory proceeding, no agency members authorized to take final action or presiding officers designated by the agency to make findings of fact and conclusions of law may communicate directly or indirectly in connection with any issue of fact, law or procedure, with any party or other persons legally interested in the outcome of the proceeding, except upon notice and opportunity for all parties to participate.

2. **Communication permitted.** This section shall not prohibit any agency member or other presiding officer described in subsection 1. from:

A. Communicating in any respect with other members of the agency or other presiding officers; or

B. Having the aid or advice of those member of his own agency staff, counsel or consultants retained by the agency who have not participated and will not participate in the adjudicatory proceeding in an advocate capacity.

3.8 Consultation

The following agencies and individuals have been consulted during the Project licensing process to date. Many consultations were inherent in the FERC'S Integrated Licensing Process, but some consisted of other meetings, phone calls, or email exchanges. This list includes everyone we have consulted with, in the capacity they had when the consultation occurred; plus others who are on FERC's mailing list. Consultation details are included in Appendix B.

Federal Energy Regulatory Commission		
Dr. Nicholas Palso	FERC Coordinator	*
Bill Connelly	Fisheries Lead	*
National Marine Fisheries Service		
Dan Tierney	Protected Resources Division	*
Sean McDermott	Marine Habitat Resource Specialist	
Indian Tribes		
Susan Young, A/THPO	Houlton Band of Maliseet Indians	
Isaac St. John THPO	Houlton Band of Maliseet Indians	*
Jennifer Pictou, THPO	Aroostook Band of Micmacs	
Chris Sockalexis THPO	Penobscot Indian Nation	
Kirk Francis, Chief	Penobscot Indian Nation	
Donald Soctomah THPO	Passamaquoddy Tribe	
Pleasant Point Reservation	Passamaquoddy Tribe	
Indian Township Reservation	Passamaquoddy Tribe	
Local Government		
Glenn Moshier	Ellsworth City Manager / Police Chief	
David A. Cole	Ellsworth Prior City Manager	
Town Office	Town of Dedham	
U.S. Fish & Wildlife Service		
Oliver Cox	Green Lake National Fish Hatchery Manager	
Steve Shepard	Maine Hydro Licensing Coordinator	*
Anna Harris	Maine Field Office Project Leader	
Bryan Sojkowski, P.E.	Hydraulic Engineer – Fish Passage	
Julianne Rosset	Biologist - Migratory Fish/Hydropower	*
Corbin Hilling	Fish and Wildlife Biologist	*
Peter Lamothe	Program Manager	
	Regional Director	

Maine Dept of Environmental Protection		
Kathy Howatt	Hydro Coordinator	*
Christopher Sferra	Environmental Specialist III, Hydropower Unit	*
Jeanne DiFranco	Biological Monitoring Program Manager, Aquatic Biologist	*
MDEP Bureau of Water Quality, Division of Environmental Assessment		
Linda Bacon	Lake Assessment Biologist III	*
Doug Suitor	Biologist	*
Maine Dept of Inland Fisheries & Wildlife		
John Perry	Environmental Review Coordinator	*
Gregory Burr	Regional Fisheries Biologist – Region C	*
Steve Dunham	Regional Biologist	*
Danielle D'Auria	Wildlife Biologist	*
Susan Bard	Regional Fisheries Biologist	
Maine Dept of Marine Resources		
Casey Clark	Resource Management Coordinator	*
Gail Wippelhauser	Marine Resources Scientist	*
Maine Historic Preservation Commission		
Kirk F. Mohney	State Historic Preservation Officer	
Megan Rideout	Review & Compliance/CLG Coordinator	
Dr. Arthur Speiss	Chief Historic Preservationist	
Green Lake Association		
Audrey Tunney	President	*
Dale Jellison		*
David Megquier		
Donna Megquier		*
Harry Moore		
Jenkin's Beach		
Raymond L. Jenkins Jr		
Advisory Council on Historic Preservation		
John T Eddins		
Dewey & LeBoeuf, LLP		
Thomas Mark		
MDEP Bureau of Land and Water Quality		
Brian Kavanah, Director		
Jim Beyer		
Maine Department of Conservation	Land Use Regulation Commission	
Nixon Peabody LLP		
Celeste Ward		
Elizabeth Whittle, Partner		
NPS Hydro Program Coordinator		
Kevin Mendik, ESQ		
U.S. Army Corp of Engineers		
Jay Clement	Divisional Office, Regulatory	
U.S. Department of Interior, Attorney		
Andrew Tittler		

U.S. Environmental Protection Agency	
Ralph Abele	
	Director Water Quality Control Branch
U.S. National Park Service	North Atlantic Region
Union River Watershed Coalition	
Elsie Hemmings	
Union Salmon Association	
Barb Watham	
Charles L Kelly, Jr	
Atlantic Salmon Federation	Atlantic Office
Downeast Salmon Federation	
Dwayne Shaw	Executive Director
Hancock County Commissioners Office	
Stinson Leonard Street LLP	

Table 3-1 – Consultation Table

3.8.1 Comments on the Draft License Application (DLA)

On November 1, 2021, the DLA was provided to the participating federal and state agencies, tribes, NGOs, local governments, and members of the public in the Project distribution list. Comments on the DLA were received from the National Marine Fisheries Service (NMFS); the U.S. Fish and Wildlife Service (USFWS), the Downeast Salmon Federation (DSF), the Maine Department of Environmental Protection (MDEP), and the Maine Department of Marine Resources (MDMR). GLWP has addressed, to the extent possible, the comments received on the DLA in this Final License Application (FLA). In addition, GLWP has developed a DLA comment and response summary which is provided in the previously filed Appendix A to the Exhibit E of March 31, 2022.

3.9 References

Federal Power Act – federal_power_act.pdf (ferc.gov)

Section 401 of the Clean Water Act – Clean Water Act Section 401: State Certification of Water Quality | US EPA

Maine Title 38, Chapter 3 - Title 38, Chapter 3: PROTECTION AND IMPROVEMENT OF WATERS (mainelegislature.org)

Maine Title 38, Chapter 5 § 631 - Title 38, §631: Purposes (mainelegislature.org)

Endangered Species Act - Endangered Species Act of 1973 (fws.gov)

Critical habitat for the GOM DPS of Atlantic salmon - 50 CFR § 226.217(b)(2)(iii)

Magnuson-Stevens Fishery Conservation and Management Act - Laws & Policies: Magnuson-Stevens Act | NOAA Fisheries, Partners: Regional Fishery Management Councils | NOAA Fisheries

Essential Fish Habitat for Atlantic Salmon - USFWS/NCTC - Atlantic Salmon

Atlantic Salmon Hatchery Populations - Maine Field Office (fws.gov)

Coastal Zone Management Act - Coastal Zone Management Act | Bureau of Ocean Energy Management (boem.gov)

Maine Guide to Federal Consistency Review – 5th Edition – Update 4 – January 2022 – https://www.maine.gov/dmr/mcp/federal-consistency-review/documents/Final_Maine_Guide-Federal_Consistency_Review_5thed_update4_1.3.22.pdf

National Historic Preservation Act – National Historic Preservation Act | FEMA.gov

Historic Property - eCFR :: 36 CFR 800.16 -- Definitions.

FERC, 2008. Preparing Environmental Documents Guidelines for Applicants, Contractors and Staff. [Online] URL: https://www.ferc.gov/industries/hydropower/geninfo/guidelines/eaguide.pdf

4.0 PROJECT FACILITIES AND OPERATION

This information is provided in Exhibit A.

5.0 PROPOSED ACTION AND ACTION ALTERNATIVES

5.1 Background

The Green Lake dam has a long history. It was originally authorized (as Reeds Pond dam to be built by the Great Brook and Reeds Pond Dam Company) in February of 1869, "on or near the dam of Benjamin Franklin and Sons, in the town of Ellsworth" for the purpose of running logs down Reeds Brook. Per this, it appears that some sort of dam has been on Green Lake since at least before 1865. The dam with its current height and configuration is believed to have been built in the early 1900's. Bangor Hydro Electric Company (BHE) construction drawings were found by GLWP dating from 1943 which show some details of the dam. These drawings pertain to rebuilding the fish screens and contain a note as follows: "Present screens to be altered to fit new frame" indicating fish screens have been used on the gates at the Green Lake dam to prevent landlocked salmon from leaving the lake since before 1943. A BHE drawing from 1959 shows fish screens on the Green Lake dam spillway. It is not clear from the drawings if spillway fish screens were in place before 1943, but it is likely they were because fish screens were used on the gates. The Green Lake dam raises the water level about 7.5 ft from its original level.

BHE managed the dam before GLWP acquired the dam and created the Project in 1984. GLWP has copies of BHE level logs from1957 through mid-1981. BHE managed the lake level over a range of 3.0 to 8.0 feet on the staff gauge (156.5 – 161.5 NGVD29 datum), with unusual levels as low as 2.4 feet and as high as 9.5 feet. They appear to have used a management approach based on moderately stable, mostly full levels during the summer, with a drawdown in the fall or winter for spring runoff. GLWP, under the current license, manages the lake to a smaller level fluctuation (4.0 – 7.2 feet on the staff gauge) than BHE did historically (3.0 – 8.0 feet on the staff gauge).

5.2 Geology and Soils Resources

5.2.1 Existing Geological Features

The project is approximately six miles north of the City of Ellsworth in Hancock County, Maine. The project involves Green Lake and its outlet, Reeds Brook, which flows into Graham Lake. Both lakes are located within the Union River drainage basin, which drains a large percentage of Hancock County. The main stem of the Union River forms at the upper end of Graham Lake where the east and west branches of the Union River merge. From the outlet of Graham Lake (Graham Dam) the Union River flows south approximately four miles to a hydroelectric facility in the City of Ellsworth, and then to Blue Hill Bay on the Atlantic Ocean.

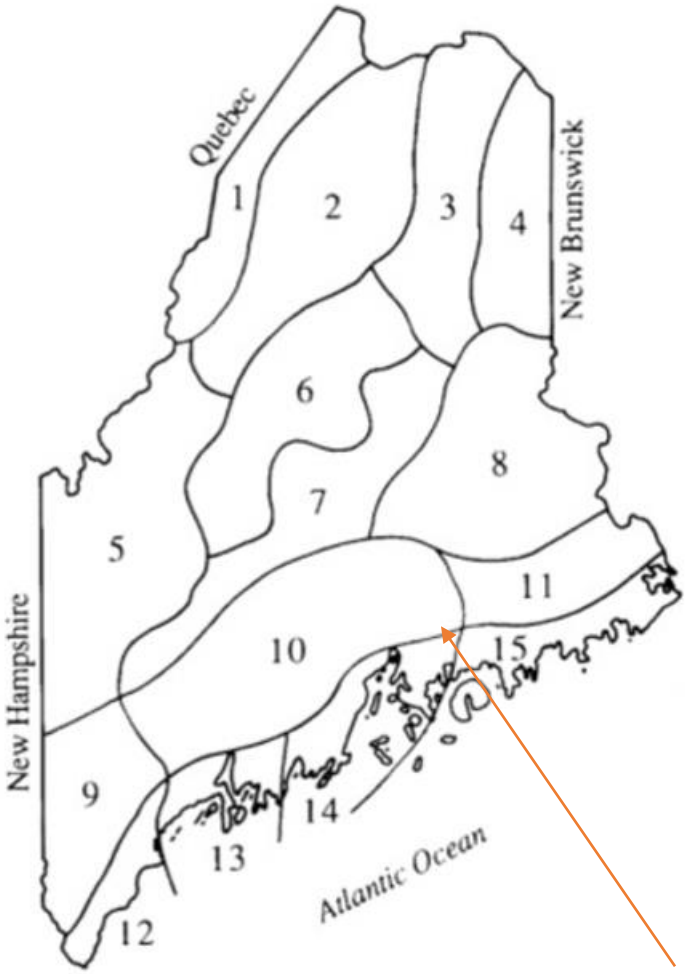
The watershed of Green Lake includes lands in the City of Ellsworth, and the towns of Otis and Dedham.

Hancock County encompasses 1,093,000 acres, of which 64,000 are fresh water lakes. The topography of the county is characterized by rolling hills, low ridges, coastal mountains, rugged coastline, forests, and numerous lakes, streams and brooks. Several areas have slopes exceeding 25 percent; however, the majority of the land has slopes ranging from 0 to 15 percent.

The geology of the region consists of gneiss, schist, and metamorphic slate, with numerous weathered rock and ledge outcroppings. The bedrock throughout most of the Hancock County is hard, impermeable, and near the surface, and is usually covered by surficial deposits of glacial origin. Surficial deposits include till, glacial meltwater deposits, marine sediments, alluvium, and organic swamp deposits. Green Lake is a glacially formed lake with the deepest portion being below mean sea level.

The climate in Hancock County is characterized by rapid changes and well defined seasonal variations in temperature and precipitation. Coastal storms which affect the area often generate strong winds with accompanying heavy rain and snow (GLWP, 1983). The average annual precipitation is approximately 47 inches and is fairly evenly distributed throughout the year (3-4 inches per month). The mean minimum temperature in January is about 11°F, and the mean maximum temperature in July is about 78°F (USCD, 2019).

Figure 5-1 – Geographical Provinces of Maine

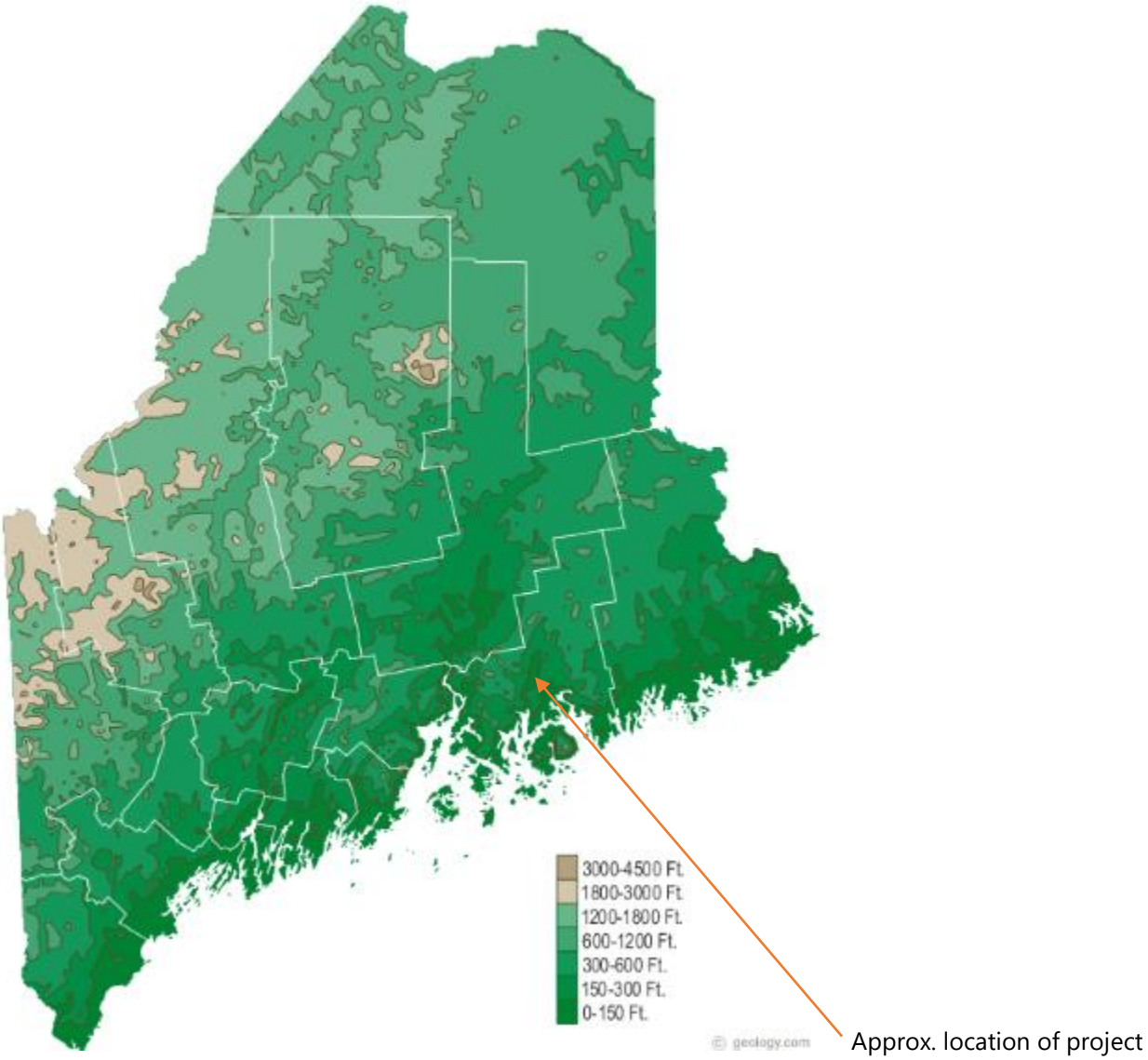


1. Boundary Plateau
2. Saint John Uplands
3. Aroostook Hills
4. Aroostook Lowlands
5. Western Mountains
6. Central Mountains
7. West Foothills
8. Eastern Lowlands
9. Southwest Interior
10. Central Interior

Approximate location of project

Source: Wilson, 2017, modified

Figure 5-2 – General Topography of Maine



Source: GNI, 2018

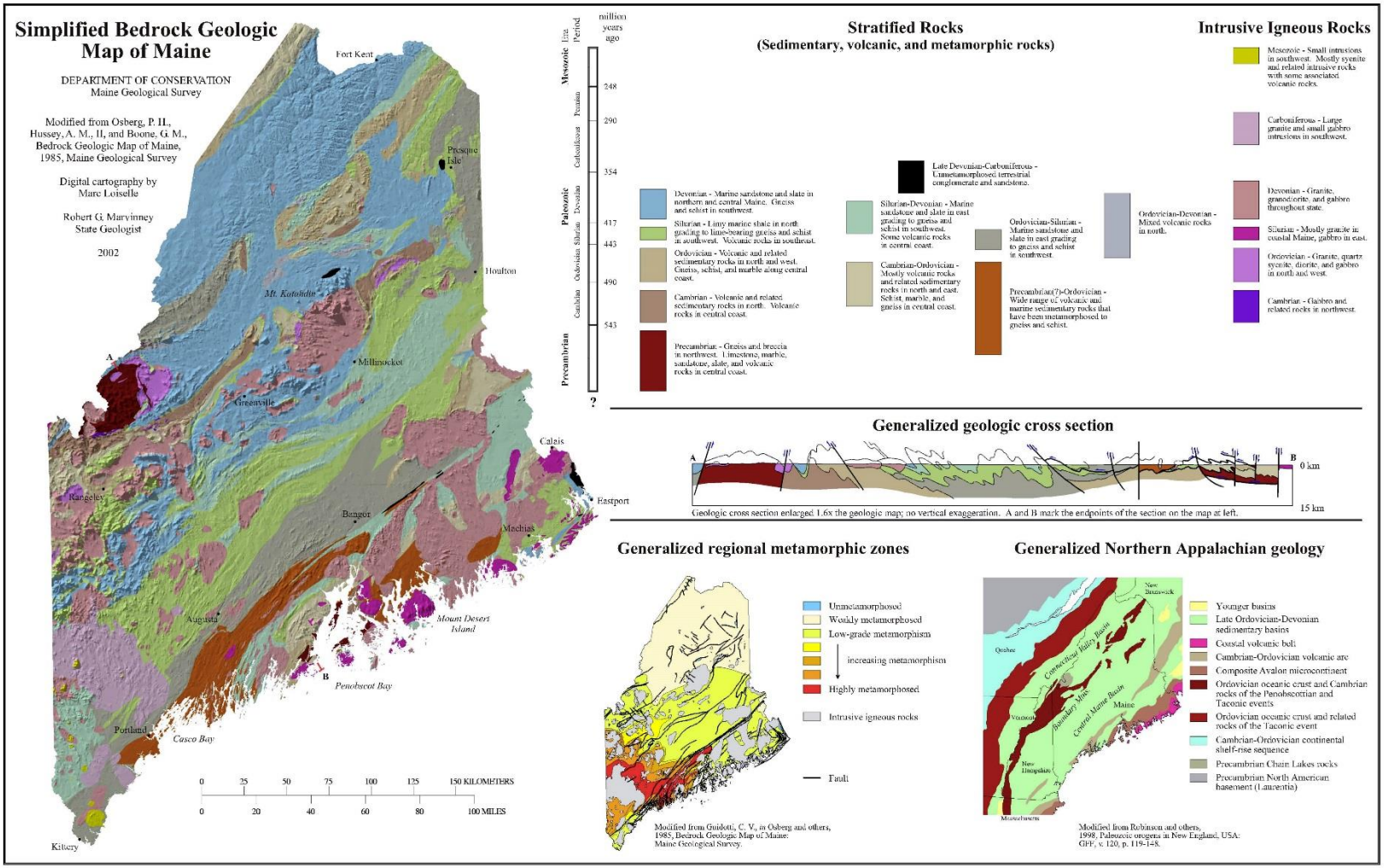
5.2.2 Bedrock Geology

Bedrock near the Project is composed of two stratified rock formations, Silurian and Ordovician-Silurian (MDACF, 2018).

STRATIFIED ROCKS	DEFINITION
Silurian	Limy marine shale in north grading to lime-bearing gneiss and schist in southwest, volcanic rocks in southeast.
Ordovician-Silurian	Marine sandstone and slate in east grading to gneiss and schist in southwest.

Source: MDACF, 2018

Figure 5-3 – Bedrock geology of Maine



Source: MDACF, 2018

5.2.3 Soils

Maine soils were formed when the last glacier in Maine melted approximately 12,500 years ago and moved across the state in a northwest to southeasterly direction. Rock fragments and soil material were deposited as till, or as water-sorted sediments in streams, rivers, lake and the ocean. Land, depressed by the glacier, rebounded slowly, creating a complex pattern of soils derived from till, sediments, sands, and gravel (Ferwerda et. al, 1997).

Hancock County is composed of soils shown in Table 5-1.

Table 5-1 – Soils Types in Hancock County, Maine

SOIL TYPE	COMPOSITION	PERCENTAGE IN MAINE
Dixfield-Colonel-Lyman-Brayton	Loamy soils formed in till derived mainly from schist, granite, phyllite and gneiss	23%
Lyman-Tunbridge-Dixfield	Loamy soils formed in till derived mostly from granite, gneiss, schist, and phyllite	4%
Hermon-Brayton-Dixfield	Sandy and loamy soils formed in till derived mainly from granite, gneiss, schist, and phyllite	4%
Scantic-Lamoine-Buxton-Lyman	Clayey and loamy soils formed in clayey glaciomarine or glaciolacustrine sediments and loamy till.	7%

Source: Ferwerda et. al, 1997

Figure 5-4 – Soils Within an Approximate 1-mile Radius of the Project

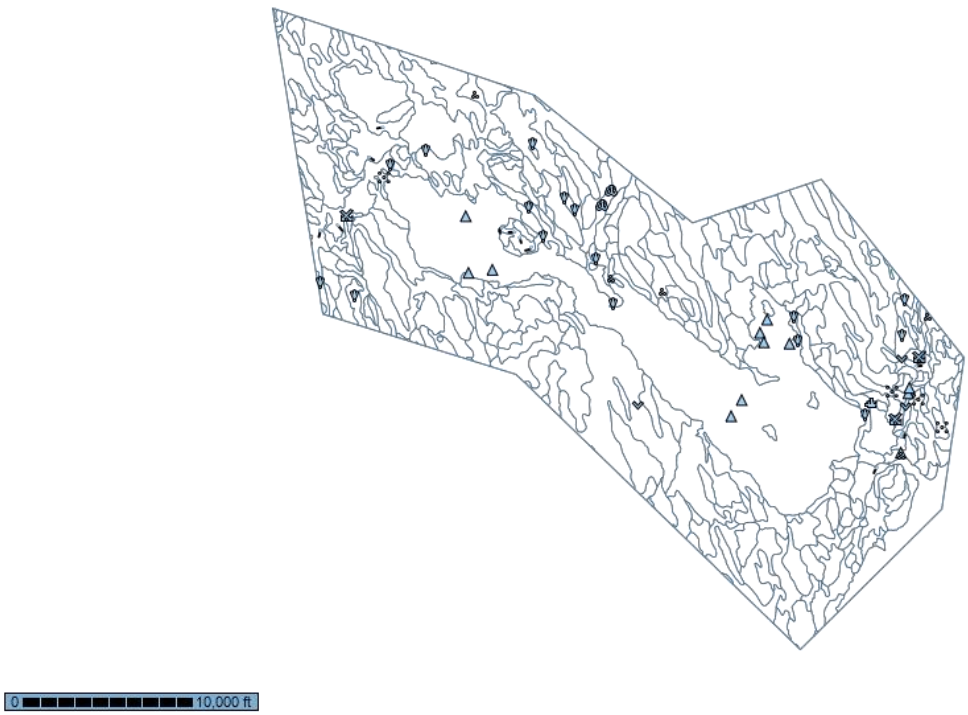


Table 5-2 – List of Soils by Type, Size (Acres), and Percent within an Approximate 1-mile Radius of the Project

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI	K-Factor, Whole Soil
BSB	Brayton-Colonel association, 0 to 8 percent slopes, very stony	1,448.9	8.7%	n/a
BTB	Brayton-Colonel association, gently sloping, rubbly	440.2	2.6%	n/a
BwC	Buxton silt loam, 8 to 15 percent slopes	75.7	0.5%	0.37
CSC	Colton-Adams-Sheepscot association, 0 to 15 percent slopes	124.6	0.7%	n/a
DtB	Peru-Colonel complex, 3 to 8 percent slopes, very stony	291.1	1.8%	n/a
HtC	Hermon and Monadnock soils, 8 to 15 percent slopes, very stony	85.0	0.5%	n/a
HVC	Hermon-Monadnock-Peru complex, 8 to 15 percent slopes, very stony	410.2	2.5%	n/a

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI	K-Factor, Whole Soil
HVE	Hermon-Monadnock-Peru complex, 15 to 45 percent slopes, very stony	94.7	0.6%	n/a
LaB	Lamoine silt loam, 3 to 8 percent slopes	333.9	2.0%	0.37
LCB	Lamoine-Scantic-Buxton complex, 0 to 15 percent slopes	101.0	0.6%	n/a
LsE	Lyman-Schoodic complex, 15 to 35 percent slopes, rocky	110.6	0.7%	n/a
LTE	Lyman-Schoodic-Rock outcrop complex, 15 to 35 percent slopes, very stony	230.3	1.4%	n/a
LuC	Lyman-Tunbridge complex, 0 to 15 percent slopes, very stony	379.3	2.3%	n/a
LWC	Lyman-Tunbridge-Schoodic complex, 8 to 15 percent slopes, very stony	496.9	3.0%	n/a
MbC	Marlow fine sandy loam, 8 to 15 percent slopes, very stony	290.9	1.8%	n/a
McC	Marlow fine sandy loam, 3 to 15 percent slopes, extremely bouldery	111.7	0.7%	n/a
MDC	Marlow-Peru association, 3 to 15 percent slopes, very stony	2,283.1	13.7%	n/a
MDE	Marlow-Peru association, 15 to 45 percent slopes, very stony	615.2	3.7%	n/a
MGC	Marlow-Peru association, 3 to 15 percent slopes, extremely bouldery	565.6	3.4%	n/a
MGE	Marlow-Peru association, 15 to 60 percent slopes, extremely bouldery	260.0	1.6%	n/a
MhC	Monadnock-Hermon complex, 3 to 15 percent slopes, extremely bouldery	369.9	2.2%	n/a
MhE	Monadnock-Hermon complex, 15 to 45 percent slopes, extremely bouldery	96.8	0.6%	n/a
MXC	Monadnock-Hermon-Peru complex, 0 to 15 percent slopes, extremely bouldery	1,274.1	7.7%	n/a
MXE	Monadnock-Hermon-Peru complex, 8 to 45 percent slopes, extremely bouldery	582.5	3.5%	n/a
Sa	Scantic silt loam, 0 to 3 percent slopes	174.2	1.0%	0.28

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI	K-Factor, Whole Soil
SdB	Scantic-Lamoine complex, 0 to 8 percent slopes, very stony	92.3	0.6%	0.28
SEB	Scantic-Lamoine-Peru complex, 0 to 8 percent slopes, very stony	539.5	3.2%	n/a
SGE	Schoodic-Rock outcrop-Lyman complex, 15 to 60 percent slopes	84.2	0.5%	n/a
W	Water bodies	3,578.7	21.5%	n/a
WT	Wonsqueak, Bucksport, and Sebago soils	188.4	1.1%	n/a
	Other soils[a]	893.4	5.4%	n/a
Totals for Area of Interest		**16,622.9**	**100.0%**	

[a]Other soils (of less than 0.5% individually) include Adams loamy sand, Brayton fine sandy loam, other Colton gravelly sandy loams and Colton-Adams complex, Peru fine sandy loams and Peru-Colonel complex, Monadnock and Hermon soils, Kinsman loamy sand and Kinsman-Wonsqueak association, other Marlow fine sandy loams, Naskeag-Schoodic-Lyman complex, Nicholville very fine sandy loams, gravel and sand pits, other Scantic complexes, other Schoodic-Rock outcrop complexes, Sheepscot sandy loam soils, Tunbridge-Lyman complex soils, other Wonsqueak and Wonsqueak/Bucksport soils.

Source: USDA NRCS, 2018

Table 5-3 – List of Soils by Type, Size (Acres), and Percent within Hancock County, Maine

Map Unit Symbol	Map Unit Name	Acres in AOI	% of AOI
BgB	Brayton fine sandy loam, 0 to 8 percent slopes, very stony	12,933.1	1.2%
BSB	Brayton-Colonel association, 0 to 8 percent slopes, very stony	34,950.7	3.2%
BTB	Brayton-Colonel association, gently sloping, rubbly	5,955.7	0.5%
BwC	Buxton silt loam, 8 to 15 percent slopes	5,842.3	0.5%
BwD	Buxton silt loam, 15 to 25 percent slopes	843.5	0.1%
Ch	Charles silt loam, 0 to 2 percent slopes, occasionally flooded	1,153.2	0.1%
CoB	Colton gravelly sandy loam, 0 to 8 percent slopes	5,304.7	0.5%
CoC	Colton gravelly sandy loam, 8 to 15 percent slopes	3,043.6	0.3%
CoE	Colton gravelly sandy loam, 15 to 45 percent slopes	1,648.6	0.1%

Map Unit Symbol	Map Unit Name	Acres in AOI	% of AOI
CRE	Colton-Adams complex, 15 to 45 percent slopes	642.8	0.1%
CSC	Colton-Adams-Sheepscot association, 0 to 15 percent slopes	7,631.2	0.7%
DbC	Peru fine sandy loam, 8 to 15 percent slopes, very stony	6,828.3	0.6%
DsB	Peru-Colonel complex, 3 to 8 percent slopes	8,503.0	0.8%
DtB	Peru-Colonel complex, 3 to 8 percent slopes, very stony	22,742.4	2.1%
DWB	Peru-Colonel-Tunbridge complex, 3 to 8 percent slopes, very stony	9,147.6	0.8%
HcC	Hermon-Colton-Rock outcrop complex, 3 to 15 percent slopes, very stony	5,251.1	0.5%
HtC	Hermon and Monadnock soils, 8 to 15 percent slopes, very stony	7,861.3	0.7%
HVC	Hermon-Monadnock-Peru complex, 8 to 15 percent slopes, very stony	27,698.0	2.5%
LaB	Lamoine silt loam, 3 to 8 percent slopes	24,811.9	2.3%
LbB	Lamoine-Scantic complex, 0 to 8 percent slopes	5,379.4	0.5%
LCB	Lamoine-Scantic-Buxton complex, 0 to 15 percent slopes	24,853.9	2.3%
LsE	Lyman-Schoodic complex, 15 to 35 percent slopes, rocky	8,313.3	0.8%
LTE	Lyman-Schoodic-Rock outcrop complex, 15 to 35 percent slopes, very stony	12,320.6	1.1%
LuC	Lyman-Tunbridge complex, 0 to 15 percent slopes, very stony	32,886.0	3.0%
LWC	Lyman-Tunbridge-Schoodic complex, 8 to 15 percent slopes, very stony	28,943.1	2.6%
MbC	Marlow fine sandy loam, 8 to 15 percent slopes, very stony	7,205.2	0.7%
MDC	Marlow-Peru association, 3 to 15 percent slopes, very stony	46,251.1	4.2%
MDE	Marlow-Peru association, 15 to 45 percent slopes, very stony	8,913.9	0.8%
MhC	Monadnock-Hermon complex, 3 to 15 percent slopes, extremely boulder	5,140.2	0.5%
MXC	Monadnock-Hermon-Peru complex, 0 to 15 percent slopes, extremely boulder	19,300.7	1.8%
MXE	Monadnock-Hermon-Peru complex, 8 to 45 percent slopes, extremely boulder	5,590.9	0.5%

Map Unit Symbol	Map Unit Name	Acres in AOI	% of AOI
NaB	Naskeag-Schoodic complex, 0 to 8 percent slopes, very stony	14,686.0	1.3%
NBB	Naskeag-Schoodic-Lyman complex, 0 to 8 percent slopes, rocky	10,791.4	1.0%
Sa	Scantic silt loam, 0 to 3 percent slopes	19,717.4	1.8%
SB	Scantic-Biddeford complex, 0 to 3 percent slopes	14,194.9	1.3%
SdB	Scantic-Lamoine complex, 0 to 8 percent slopes, very stony	9,483.8	0.9%
SEB	Scantic-Lamoine-Peru complex, 0 to 8 percent slopes, very stony	21,147.4	1.9%
SfC	Schoodic-Rock outcrop complex, 0 to 15 percent slopes	18,585.2	1.7%
SfE	Schoodic-Rock outcrop complex, 15 to 65 percent slopes	8,969.8	0.8%
SGE	Schoodic-Rock outcrop-Lyman complex, 15 to 60 percent slopes	13,417.3	1.2%
SKC	Schoodic-Rock outcrop-Naskeag complex, rolling	11,222.7	1.0%
TuB	Tunbridge-Lyman complex, 3 to 8 percent slopes, rocky	7,753.2	0.7%
W	Water bodies	443,321.9	40.2%
Ws	Wonsqueak and Bucksport mucks, 0 to 2 percent slopes	11,775.6	1.1%
WT	Wonsqueak, Bucksport, and Sebago soils	18,123.6	1.6%
	Other soils[b]	88,796.2	8.1%
Totals for Area of Interest		**1,102,545.2**	**100.0**

[b]Other soils (of less than 0.5% individually) include Adams loamy sand, Biddeford muck peat, beaches, Brayton fine sandy loam, other Buxton silt loam, other Colton gravelly sandy loams and Colton-Adams complex, other Peru fine sandy loams and Peru-Colonel complex, Fort Knox and related soils, other Monadnock and Hermon soils, Kinsman loamy sand and Kinsman-Wonsqueak association, Lyman-Brayton complex soils, Marlow-Peru soils and other Marlow fine sandy loam, other Monadnock-Hermon complex, Nicholville very fine sandy loams, gravel and sand pits, Sheepscot sandy loam soils, Thorndike-Winnecook complex, other Tunbridge-Lyman complex soils, Udorthents-Urban land complex, Waskish and Sebago soils. Winnecook-Thorndike complex, other Wonsqueak soils.

Source: USDA NRCS, 2018

The dominant soil types within a 1-mile radius of the Green Lake Hydroelectric Project are (11) Hermon-Brayton-Dixfield and (5) Dixfield-Colonel-Lyman-Brayton.

5.2.4 Erosion

According to the 2013 State Hazard Mitigation Plan, all areas in Maine are susceptible to erosion, due to farming and crop cultivation throughout the state. The area around the project does not have appreciable farming and crop cultivation. Erosion can also occur in the area because of hurricanes, flooding, and wildfires, among other reasons (MDDVEM, 2013).

The Natural Resources Conservation Service has assessed the susceptibility of the soils surrounding the Project to erosion (i.e., the K Factor) caused by water including rainfall and stormwater run-off. K Factor estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity with values ranging from 0.02 to 0.69; larger values indicate greater susceptibility to sheet and rill erosion by water (USDA NRCS, 2018). The K Factor values for the soils surrounding the Green Lake Project range from 0.02 to 0.37, indicating a moderate susceptibility to erosion from water. However, soils with any K-factor rating are each 2% or less of the soils within 1 mile of Green Lake, and together represent less than 5% of these soils. (USDA NRCS, 2018).

Green Lake was originally a natural lake, but its full pond water level was raised about 7.5 feet about 100 years ago when the current dam was built. Exposing a new, higher area of shore to water and wave action is bound to cause erosion around the lake as the shore adjusts to the new lake level. It has had many years to adjust at this point.

Water sampling for determination of the lake trophic state was done during the summer of 2020. Water clarity was high and total phosphorous levels were low, suggesting soil being washed into the lake is not a problem. (ISR 2021)

An erosion survey was also conducted around the perimeter of Green Lake in 2020. No major or continuing erosion was found. The lake shore was generally covered with natural boulders and large cobble which appear to provide protection against wave action. (ISR 2021)

5.2.5 Construction

No new construction is planned as part of the relicensing. Two areas of project repair involve some earthwork: 1) updating the septic system leaching field, 2) replacing or updating the wood-stave penstock section.

5.2.5.1 Leaching field

The leaching field for the operators quarters and power station is located in a small clearing in the woods. It generally works well, but is susceptible to intrusion by tree roots. After 40 years, it is due for repair or replacement. It is also susceptible to freezing where its pressure line crosses underneath the access road to the dam. This is only occasionally a problem, but if practical it will be addressed as part of the leaching field work. All

necessary permits will be acquired before this work is started, including any necessary agreement from the GLNFH. The leaching field is not near the brook so there is no issue of equipment use in the brook buffer zone. Sediment control should not be a big problem with this work, but where water flows away from the work site, appropriate sediment control measures will be used.

5.2.5.2 Penstock

Engineering and planning for this work will begin if and after the requested new license is issued. The complete scope of the proposed work will not be known until this design and planning work is done. If the wood-stave penstock section is replaced completely, some ground work would be required to prepare and stabilize the existing bed for the new penstock. Even if the penstock is lined, there would likely be some work done to correct any problems with the bed.

The design and plan for the penstock work will be submitted to FERC and any other needed resource or permitting agencies for approval before physical work is begun. This includes gaining approval from the GLNFH that the new penstock meets their needs. The penstock is currently functional, and it has been proven to supply water that is beneficial to the GLNFH. It could be maintained indefinitely, but with an increasingly impractical level of effort and expense.

5.2.6 References

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Wilson, W. Herbert. "The Dynamics of Arrivals of Maine Migratory Breeding Birds: Results from a 24-Year Study". Biology [Waterville] 12 November 2017.

5.3 Aquatic Resources

5.3.1 Drainage Area

The drainage area of Green Lake is approximately 46 square miles. (USGS, 2018b).

5.3.2 Streamflow, Gage Data, and Flow Statistics

There is no active USGS gage associated with the Green Lake project area, so a comparative analysis was completed to estimate the flow into Green Lake. The USGS Gage No. 01021480 Old Stream near Wesley, Maine was used as a surrogate gage. A comparison of the two watersheds was completed to confirm that the Old Stream gage was appropriate. The Old Stream gage has a smaller watershed and slightly less open water, however the characteristics of the watershed are very similar. The table below summarizes the characteristics of each watershed. (Background: Dudley, R. W. 2004).

Table 5-4 – Watershed Characteristics

METRIC	OLD STREAM WATERSHED	GREEN LAKE WATERSHED
Drainage Area (sq. miles)	29.1	47
Mean Annual Temperature (F)	41.8	44.3
Mean Annual Precipitation (in.)	46.25	43.7
% Open Water	3.17%	15.28%
% Low Intensity Residential	0.97%	1.74%
% Commercial	0.20%	0.32%
% Deciduous Forest	10.66%	36.26%
% Evergreen Forest	26.58%	13.49%
% Mixed Forest	32.46%	17.55%
% Other	25.97%	15.36%

Based on our analysis of the two watersheds, we feel that prorating the Old Stream gage using the drainage area ratio method is appropriate to estimate the inflow and flow duration curves for the Green Lake Dam. A proration factor of 1.615 was applied to the Old Stream gage flow data to create annual and monthly flow duration curves (see Appendix C) based on a period of record from August 1998 through December 2018.

Table 5-5 – Mean, Median, Minimum, and Maximum river flows by Month for the Green Lake Project (August 1, 1998 to December 31, 2018).*

MONTH	MEAN/AVERAGE flow (cfs)	MEDIAN FLOW (cfs)	MINIMUM flow (cfs)	MAXIMUM flow (cfs)
January	104	77	9	892
February	84	55	13	862
March	154	110	18	1003
April	252	204	44	1471
May	126	97	15	883
June	74	43	13	704
July	36	19	4	730
August	27	13	3	467

September	27	11	3	809
October	70	30	3	1357
November	125	96	7	1153
December	154	107	9	2358
Annual	102	61	3	2358

Source: Kleinschmidt Group 2019

*River flow data was prorated from USGS Gage # 01021480 based on comparable watershed characteristics.

5.3.3 Existing and Proposed Uses of Water

GLWP currently uses water from Green Lake and discharges it directly into Reeds Brook. Some seasonal residential use occurs from Green Lake waters; in addition, water from the lake is used by the U. S. Fish & Wildlife Service's Green Lake National Fish Hatchery. Hatchery effluent discharges into Reeds Brook. No changes are proposed or likely.

5.3.4 Existing Instream Flow Uses

Inflows are used primarily for water storage, hydroelectric generation and by the fish hatchery. There is also some recreational use and domestic water use at seasonal residences.

5.3.5 Existing Water Rights

A water right may be defined as: "the right of a user to use water from a water source. This right includes the right to use water from any water source like a river, stream, pond and source of groundwater. Rights to water are established by actual use of the water, and maintained by continued use and need" (USLegal, 2016).

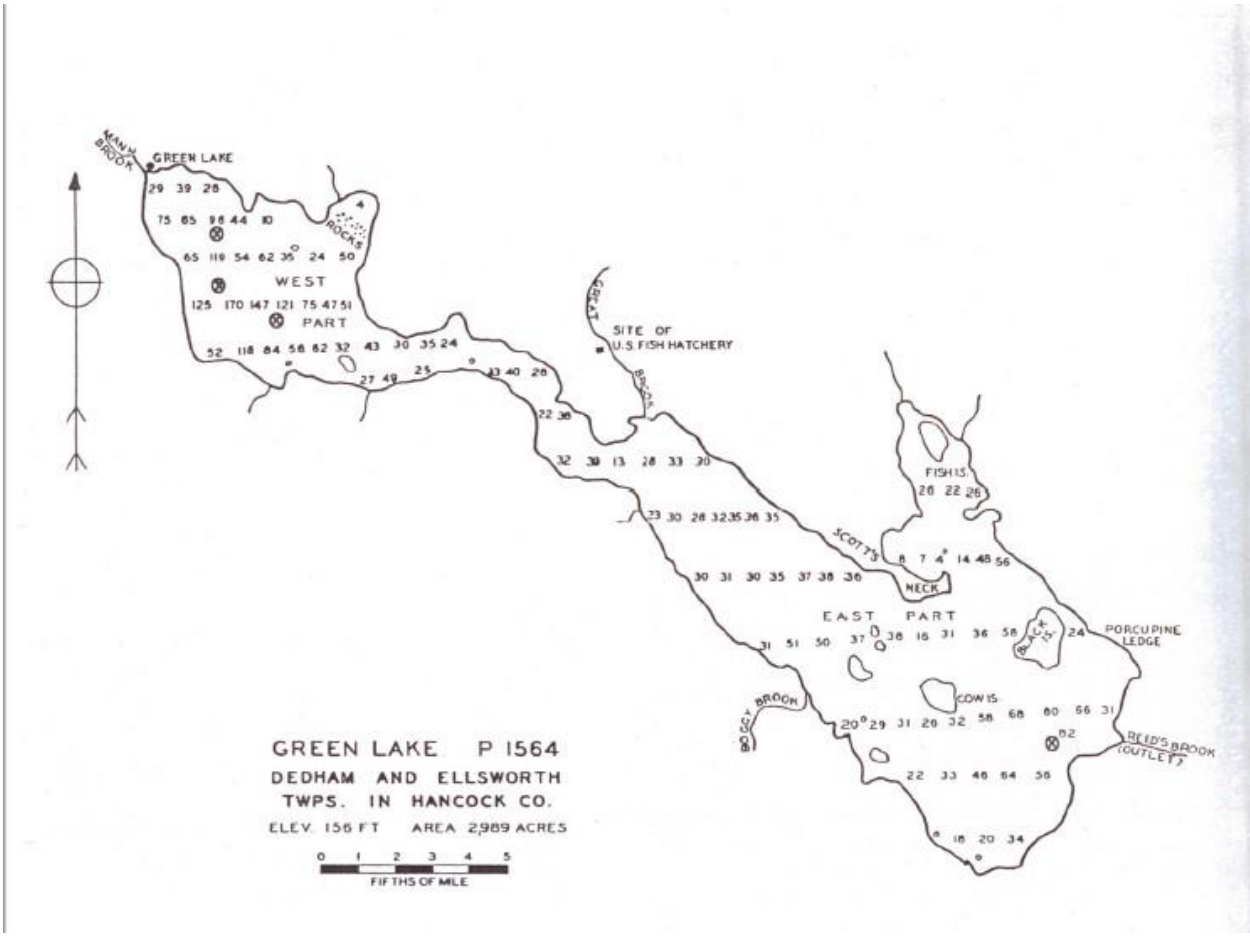
Under the terms of the current FERC license, GLWP is required to provide GLNFH with up to 30 CFS from Green Lake via a penstock tap (Article 29). (FERC, 1984).

5.3.6 Available Reservoir Information

The reservoir is Green Lake, which is wholly within Hancock county, Maine. This lake has a surface area of 3,312 acres and a gross volume of 107,000 acre-feet. The drainage area is approximately 46 square miles. Green Lake is a glacially formed lake with the deepest portion being below mean sea level. The earliest form of the current dam was a dry stone

and timber structure built in the early 1900's for water storage. In the 1960's Bangor Hydroelectric Company added sheet steel to the dam and built a new concrete gate structure. GLWP replaced the main spillway portion of the dam with a concrete structure in the late 1980's. The main spillway has a crest elevation of 160.7 feet NGVD29 datum, and the sill elevation of the gates is 154.0 feet (GLWP, 1983). Neither the spillway nor gate sill elevation has been changed since at least the 1960's. It is believed that the current spillway elevation is the same as when the dam was originally built in the early 1900's.

Figure 5-5 – Bathymetry of Green Lake



Source: MDIFW, rev. 1995

5.3.7 Gradient of Downstream Reaches

The outlet from the Green Lake dam is Reeds Brook, which runs into Graham Lake. This brook has a natural elevation of 150± (NGVD29 datum) feet at the dam, falling over a distance of 2000± feet to an elevation of 104± feet at the tailrace of the powerhouse, and flowing downstream to Graham Lake (USGS, 2018).

5.3.8 Federally-Approved Water Quality Standards

Maine statute 38 MRSA §464-470 establishes the state of Maine's classification system for surface waters. Reeds Brook from the Green Lake dam to Graham Lake is Class B; Green Lake is Class A (MRS, 1989a).

Class A waters are the second highest classification and must be of such quality to support the designated uses of drinking water after disinfection; fishing; agriculture; recreation in and on the water; industrial process and cooling water supply; hydroelectric power generation; navigation; and habitat for fish and other aquatic life (MRS, 1989b).

Class B waters must be of such quality that they are suitable for the designated used of drinking water supply after treatment; fishing; agriculture; recreation in and on the water; industrial process and cooling water supply; hydroelectric power generation; navigation; and as habitat for fish and other aquatic life (MRS, 1989b).

The state of Maine has established Class A and Class B water quality standards for DO, iron, chloride, and aluminum, and has developed draft nutrient criteria for total phosphorus, chlorophyll-a, pH, and water transparency (i.e., Secchi disk depth)

Table 5-6 – Established and Proposed Maine Water Quality Standards for Select Parameters[a]

PARAMETER	CRITERIA	WATER CLASSIFICATION
Dissolved Oxygen[a]	The greater of: >=7 ppm or 75% of saturation[d]	Class A
	The greater of: >=7 ppm or 75% of saturation[d]	Class B
Iron[b]	1000 µ/L (ppb)	Freshwater
Chloride[b]	230,000 µ/L (ppb)	Freshwater
Aluminum[b]	87 µ/L (ppb) at pH 6.5-9.0	Freshwater
Total Phosphorus[c]	<=18.0 µ/L (ppb)	Class A
	<=30.0 µ/L (ppb)	Class B
Water Column Chlorophyll-a[c]	<=3.5 µ/L (ppb)	Class A
	<=8.0 µ/L (ppb)	Class B
Secchi Disk Depth[c]	>=2.0 m	All
pH[c]	6.0-8.5	All

[a]MRS, 1989b

[b]MDEP, 2012a values refer to the criterion continuous concentration (CCC) which is an estimate of the highest concentration of the substance in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect.

[c]MDEP, 2012b

[d]Except that for the period from October 1st to May 14th, in order to ensure spawning and egg incubation of indigenous fish species, the 7-day mean dissolved oxygen concentration may not be less than 9.5 parts per million and the one-day minimum dissolved oxygen concentration may not be less than 8.0 parts per million in identified fish spawning areas (MRS, 1989b).

5.3.9 Water Quality Monitoring

The Green Lake Association (GLA), the association of property owners surrounding Green Lake, performs regular water quality monitoring during the summer (See 7.2 below).

The data is available online at the Lakes of Maine website: https://www.lakesofmaine.org/lake-monitoring.html?m=4294

5.3.10 Benthic Macroinvertebrates

Benthic macroinvertebrates include aquatic insects (e.g., mayflies, stoneflies), annelids (e.g., worms), arthropods (e.g., crayfish), and mollusks (e.g., freshwater mussels, snails). The abundance of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) (EPT) is a useful indicator of water quality because these species have a low tolerance to pollution; EPT richness values greater than 10 are indicative of excellent water quality. Furthermore, EPT are high-quality forage for freshwater fish species, including trout and salmon. The Hilsenhoff Biotic Index (HBI) is another indicator of the level of pollution-sensitive macroinvertebrates in a surface water body; the HBI ranges from 0 to 10 with lower values indicating a higher abundance of pollution sensitive macroinvertebrates (Hilsenhoff, 1987).

For Class A waters, the aquatic life and bacteria content must be as naturally occurs (MRS, 1989b). For Class B waters, MRS 1989b merely states discharges to these waters may not cause adverse impact to aquatic life in that the receiving waters must be of sufficient quality to support all aquatic species indigenous to the receiving water without detrimental changes in the resident biological community.

MDEP has a Biological Monitoring Program that includes macroinvertebrate sampling in rivers and streams. Statistical models are used to determine if water bodies are attaining biological goals as described by water classifications, such as Class A, Class B, Class C.

Indicator species for Class A:

- *Brachycentrus* (Trichoptera: Brachycentridae)
- *Serratella* (Ephemeroptera: Ephemerellidae)
- *Leucrocuta* (Ephemeroptera: Heptageniidae)
- *Glossosoma* (Trichoptera: Glossosomatidae)
- *Paragnetina* (Plecoptera: Perlidae)

- *Eurylophella* (Ephemeroptera: Ephemerellidae)
- *Psilotreta* (Trichoptera: Odontoceridae)

There appear to be no specific standards for Class B waters concerning benthic macroinvertebrates.

(MDEP, 2018)

5.3.11 References

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5.4 Fish and Aquatic Resources

5.4.1 Existing Fish and Aquatic Communities

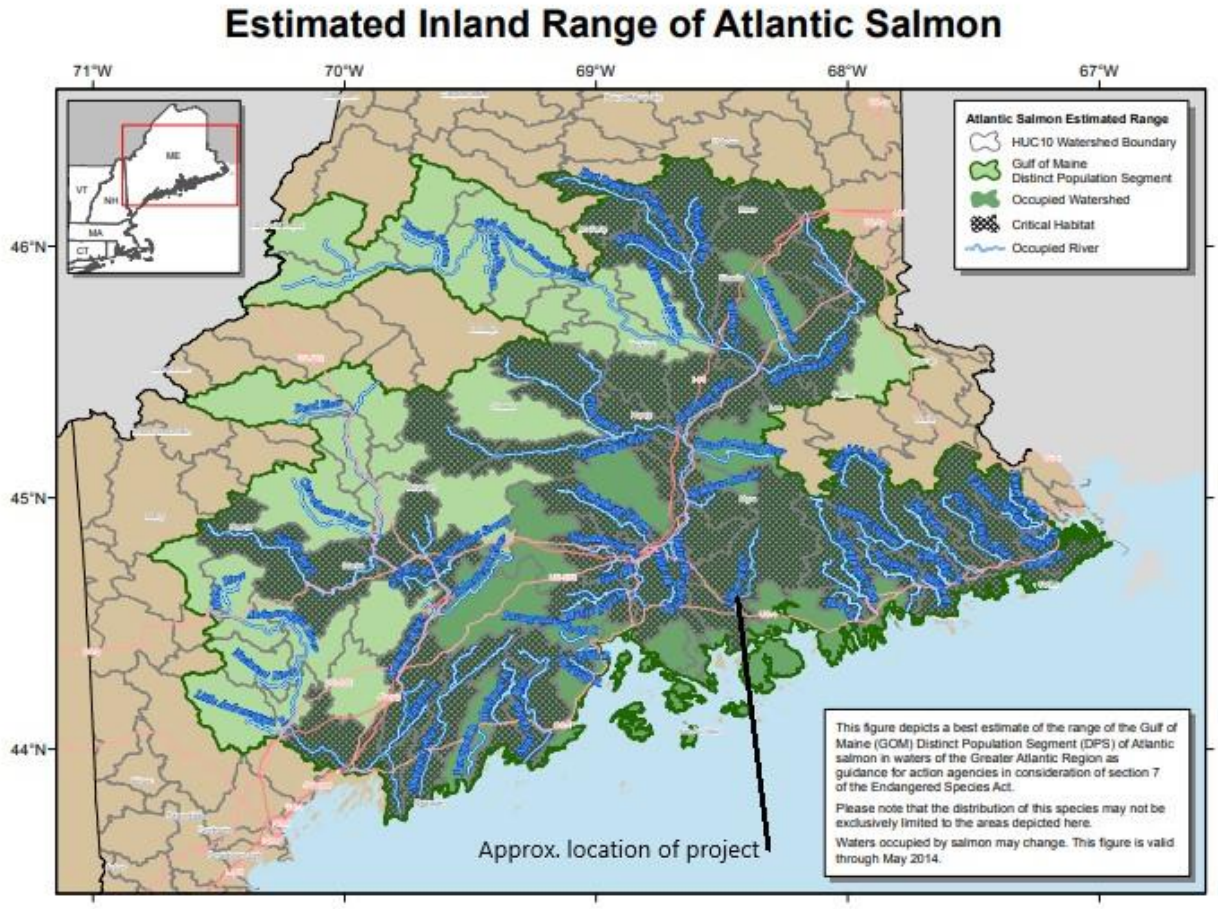
Table 5-7 – Fish Species in Green Lake

COMMON NAME	SCIENTIFIC NAME
Landlocked salmon	*Salmo salar*
Lake trout (togue)	*Salvelinus namaycush*
Brook trout	*Salvelinus fontinalis*
Sunapee charr	*Salvelinus alpinus*
Rainbow smelt	*Osmerus mordax*
Smallmouth bass	*Micropterus dolomieui*
White perch	*Roccus americanus*
Yellow perch	*Perca flavescens*
Chain pickerel	*Esox niger*
Common shiner	*Notropis cornutus*
Creek chub	*Semotilus atromaculatus*
Fallfish (chub)	*Semotilus corporalis*
White sucker	*Catostomus commersoni*
Hornpout (bullhead)	*Ictalurus nebulosus*
Banded killifish	*Fundulus diaphanus*
Threespine stickleback	*Gasterosteus aculeatus*
Pumpkinseed sunfish	*Lepomis gibbosus*
American eel	*Anguilla rostrata*

Source: MDIFW, rev. 1995

5.4.1.1 Diadromous Fish Species

Figure 5-6 – Estimated Inland Range of Atlantic Salmon



Source: NMFS, 2014

The Maine Department of Inland Fisheries and Wildlife (MDIFW) in its stakeholder response noted: "[a]rctic char occur in the lake. In addition, our Agency stocks both landlocked salmon and lake trout. Lake trout do not spawn in the lake, but there is a large contribution of wild landlocked salmon from the tributaries. There is also a smallmouth bass fishery" (Appendix B).

In its stakeholder response, the National Marine Fisheries Service (NMFS) noted that "Green Lake is located within the GOM [Gulf of Maine] DPS [distinct population segment] for federally endangered Atlantic salmon, and occurs within the designated critical habitat for that species. Other diadromous fish species (including alewives, blueback herring, American shad, sea lamprey, and American eels) also use the habitat within the Union River watershed for a portion of their life cycles" (Appendix B).

The U. S. Fish and Wildlife Service (USFWS) operates the Green Lake National Fish Hatchery. In their stakeholder response, it was noted that one of the 14 U.S. populations of arctic char occur in Green Lake (Appendix B).

NMFS further noted "[t]he Green Lake Project does not currently have safe, timely, and effective passage for diadromous fish, including federally listed Atlantic salmon." However, MDIFW in its stakeholder response stated: "Currently there is no fishway at the dam. If a fishway is constructed, our Agency would have concerns for possible impacts to the existing fisheries resulting from the upstream passage of certain species, such as largemouth bass, that could access the lake from Graham Lake downstream."

GLWP's current license contains discussion and requirements related to *preventing* fish passage. Discussion in the license document has the following:

> Fish Passage Barriers
>
> Fish passage is not recommended by Interior because of the possibility of alewife being introduced into Green Lake and contaminating water withdrawn for the Green Lake National Fish Hatchery (GLNFH) with alewife-borne diseases. To prevent fish from migrating upstream over the dam into Green Lake, GLWP proposed, with concurrence from Interior and MDEP, to maintain the existing fish screens at the crest of the project dam. GLWP also proposed, at the request of Interior and MDEP, to install screens at the project intake with a maximum mesh size of 2 inches to prevent adult salmonids from moving out of Green Lake.
>
> Article 28 requires the Licensee to install screens at the project intake to minimize mortality due to entrainment and to prevent out-migration of adult salmonids from Green Lake. (FERC, 1984)

GLWP's current license contains the following requirement *specifically limiting* fish passage in both directions:

> Article 28. The Licensee shall continue to consult with the U.S. Fish and Wildlife Service and the Maine Department of Environmental Protection, and within 6 months from the date of issuance of this license, file, for Commission approval, functional design drawings and a schedule for construction of an intake screen that would minimize fish mortality due to entrainment, and prevent downstream movement of adult salmonids from Green Lake. Comments on the drawings from the consulted agencies shall be included in the filing. Further, within 90 days after completion of project construction, Licensee shall file as-built drawings with the Commission. (FERC, 1984)

5.4.1.2 Amphibian and Aquatic Reptile Species

Maine is home to at least 39 species and subspecies of reptiles and amphibians (MDIFW 2018). Sixteen common amphibian species and six common aquatic reptiles are known to occur in the region and have life history requirements that could result in their use of the riverine or lacustrine habitat found within the Green Lake Project area. Seven species of salamander (blue-spotted salamander, spotted salamander, eastern newt, northern dusky salamander, northern redback, four-toed salamander, and northern two-lined salamander) inhabit both aquatic and terrestrial habitat. Nine species of frogs and toads may occur and require use of aquatic habitat. The primarily aquatic or semi-aquatic reptilian species include the snapping turtle, painted turtle, and the wood turtle. Four species of snake (northern redbelly, common garter, and northern ringneck snake) may make limited use of riparian areas for shelter and feeding (DeGraaf and Yamasaki 2001, Hunter et al., 1999).

Table 5-8 – Amphibian and aquatic reptile species with the potential to occur in vicinity of the Green Lake Hydroelectric Project

COMMON NAME	SCIENTIFIC NAME
Amphibians	
Blue-spotted salamander	*Ambystoma laterale*
Spotted salamander	*Ambystoma maculatum*
Eastern newt	*Notophthalmus v. viridescens*
Northern dusky salamander	*Desmognathus fuscus*
Northern redback salamander	*Plethodon cinereus*
Four-toed salamander	*Hemidactylium scutatum*
Northern two-lined salamander	*Eurycea bislineata*
Eastern American toad	*Bufo americanus*
Eastern Spring peeper	*Pseudacris crucifer*
Gray treefrog	*Hyla versicolor*
Bullfrog	*Rana catesbeiana*
Green frog	*Rana clamitans*
Mink frog	*Rana septentrionalis*
Pickerel frog	*Rana palustris*
Wood frog	*Rana sylvatica*

COMMON NAME	SCIENTIFIC NAME
Northern leopard frog	*Rana pipiens*
Reptiles	
Painted turtle	*Chrysemys picta*
Snapping turtle	*Chelydra serpentine*
Wood turtle	*Clemmys insculpta*
Northern ringneck snake	*Diadophis punctatus*
Northern redbelly snake	*Storeria occipitomaculatum*
Common garter snake	*Thamnophis sirtalis*

Source: Degraaf and Yamasaki 2001, Hunter et al., 1999

5.4.2 Aquatic Habitat

The Maine Department of Inland Fisheries and Wildlife Green Lake (MDIFW) manages Green Lake for cold-water fish. MDIFW stocks both landlocked salmon and lake trout in Green Lake, and notes that arctic char, smallmouth bass are present and wild landlocked salmon are in the lake (Appendix B). Currently, the USFWS's GLNFH raises Atlantic salmon for restocking several river systems in New England (USFWS, 2018). NMFS in its stakeholder response noted "Green Lake is located within the GOM DPS for federally endangered Atlantic salmon, and occurs within the designated critical habitat for that species…" (Appendix B).

5.4.3 Essential Fish Habitat

The Union River watershed is within the Gulf of Maine (GOM) distinct population segment (DPS) for Atlantic salmon.

There is fish passage through the Union River various structures and methods to Graham Lake, into which Reeds Brook flows. Fish using these structures include Atlantic salmon and river herring. Graham Lake is fairly shallow, with a mean depth of 17 feet and a maximum depth of 47 feet, and supports warmwater species such as smallmouth and largemouth bass, chain pickerel, and white perch (Black Bear 2015). (In contrast, Green Lake has a maximum depth of 170 feet (MDIFW, rev. 1995)

The Union River Stakeholders Group (including USFWS and Maine Department of Marine Resources) formed to address fisheries management in the Union River drainage, including the provision of fish passage at the Ellsworth Hydroelectric Project.

Landlocked salmon are native to Green Lake. (Boucher, 2012) Substantial numbers of wild salmon are produced in Great Brook and Jellison Brook. Creel surveys indicate that wild salmon comprise from 30-45% of the salmon harvest in most years. Biologists have also

confirmed the presence of a relic population of Sunapee charr (AKA Arctic charr). Green Lake also produces smallmouth bass. (MDIFW, 1995)

The lake trout fishery is entirely dependent upon stocking. (MDIFW, 1995) Records were found on fish stocking in Green Lake since 2010. Every year from 2010 through 2020 landlocked salmon have been stocked in Green Lake, and lake trout lake trout every other year. (MDIFW, 2020)

Green Lake is one of 14 lakes and ponds in Maine in which arctic charr exist and reproduce. It has never been firmly established that Arctic charr are native to Green Lake as Arctic charr were stocked in the late 1800's, however, Green Lake does now support a wild population of Arctic charr that appears to be genetically distinct from the Floods Pond fish believed to have been used for stocking. (NFC 2019) . Arctic charr have a varied diet which is commonly adapted to feeding on a given prey which is available in a lake or pond. They are a cold water fish that is susceptible to over-harvesting and invasive species. (Charr 2021)

The following migratory fish were identified during scoping: alewife, American eel, American shad, Atlantic salmon, blueback herring, and sea lamprey. With the exception of landlocked salmon and American eel, none of these are currently present in Green Lake. These species are all migratory fish that have potentially been present in the Union River. Atlantic salmon are discussed in the Threatened and Endangered Species section below. The others will be discussed in this section.

5.4.4 Affected environment

The Green Lake dam affects the lake level of Green Lake and the flow in Reeds Brook. The dam also has fish screens to avoid passage of most fish and to stop turbine entrainment of large fish.

5.4.5 Environmental analysis

Fish and wildlife species that are present in Green Lake have at least successfully tolerated the historical conditions in the lake, and some may have benefited from them. This would include all the species listed in Section 5.4.1 above.

Study results demonstrate that Green Lake and Reeds Brook meet the MDEP water quality criteria. Study results are in section 6.0 below.

Aquatic resources, called out by resource agencies for special consideration or identified during scoping, are discussed in the following sections and in sections 5.6 and 5.7 below:

5.4.5.1 Eel

A series of eel surveys were performed during study season one to determine if eels were climbing the Green Lake dam. No eels were found during the surveys. For study results, see section 6.0 below.

During the 16 years that the current team has managed the Project they have encountered three eels in the penstock: two that traveled down the penstock when the turbine was not running and attempted to swim out holes that were flowing water. These holes have since been fixed. In addition, one eel was discovered when the turbine was shut down and opened up to remove debris. This action, which takes about an hour, is performed occasionally. It is most frequent in the fall when sticks that can pass through the trash racks are common in Green Lake.

A GLWP inspection of the trash racks on the penstock intake has revealed a two-inch gap on one side of the trash racks. It is likely that this gap is occasionally used by eels to gain access to the penstock. The two-inch gap is consistent with the current license but is substantially wider than the one inch clear spacing on the remainder of the rack assemblies. The fish screens on the dam gates have a slightly narrower clear spacing of about 0.75 inches.

5.4.5.2 Landlocked salmon

Landlocked salmon are stocked in Green Lake on a regular basis. They also spawn in the lake's tributaries. Fish access to tributaries would depend on the amount of water in the brooks and streams involved. The effect of project operation on landlocked salmon would be from effects to lake water quality and the effect of the drawdown on the littoral zone. Lake trophic state and habitat studies done during the summer of 2020 indicate that Green Lake meets MDEP water quality standards. For study results see section 7 below.

John Perry at MDIFW provided the following data:

Green Lake supports one of the four original 4 wild landlocked salmon strains in Maine. This spawning has historically occurred in these sections of the stream well before the dam was put in and the current lake levels have very little influence on spawning success.

(1) Landlocked salmon spawn in the following tributaries to Green Lake: Mann Brook, Jellison Brook, Great Brook and Sucker Brook.

(2) Landlocked salmon mainly spawn in the lower quadrants of each of those tributaries where the substrate is appropriate (no exact distances, just in the lower reaches of these tributaries). As stated earlier, we do not think that the project operations are impacting landlocked salmon spawning in the tributaries."

(3) Speaking with our regional fisheries biologist (Greg Burr, cc'd), there are no barriers to landlocked salmon spawning in the tributaries at Green Lake within the drawdown zone. An important thing to remember is that the fish spawned in these tributaries before the dams were put in. Finally, we find that landlock salmon can easily jump over a 21-inch elevation change.

These emails are included in the MDIFW-Files.pdf attachment.

5.4.5.3 Lake trout

Lake trout in Green Lake are purely from stocking, rather than from lake trout spawning in the lake. The effect of project operation on lake trout would be from effects to lake water quality and the effect of the drawdown on the littoral zone. Lake trophic state and habitat studies done during the summer of 2020 indicate that Green Lake meets MDEP water quality standards. For study results see section 6.0 below.

5.4.5.4 Arctic charr

Green Lake is a deep, cold-water lake that is a suitable habitat for arctic charr. The fall drawdown could affect arctic char spawning if it were done too late in the year. Arctic char spawn during the fall in water that is 1.5 to 6 feet deep when the water temperature drops below 10°C. (Frost, 2001).) It is likely Arctic charr spawn at depths deeper than 6 feet at Green Lake. (MDIFW 2022) A temperature logging study was performed in the fall of 2020. Through this, it was determined that the water temperature in likely arctic charr spawning locations in Green Lake dropped below 10°C during the first two weeks of November 2020. It was also determined that the water temperature near the bottom, just upstream of the dam (in 1.5-2.0 feet of water) tracked the water temperature at the potential arctic charr spawning sites well. For more study results, see section 6.0 below.

5.4.5.5 Smallmouth bass

Smallmouth bass are not native to Maine. Smallmouth bass are a common game fish, with successful fisheries in almost every U.S. state. As adults, they feed on smaller fish and crayfish. They are flexible in what species they eat, preferring to eat what is available rather than travel long distances for preferred prey. Young smallmouth bass eat a varied diet that changes as they mature—progressing from mainly aquatic microorganisms, small insects and larvae; to larger insects; to tadpoles, frogs, smaller fish and young crayfish. (Hetke 2008)

Smallmouth bass prefer clear, relatively cool water with sufficient levels of dissolved oxygen, but they are adaptable to less than perfect conditions. They are an upper-echelon predator in many natural freshwater ecosystems. Their young are prey for numerous freshwater species (including other smallmouth bass), but once matured they are rarely prey for other fish. Other upper-echelon predator fish (such as lake trout) can be competitors for available prey and for spawning habitat. Largemouth bass are a competitor which will tend to outcompete and extirpate smallmouth bass in small lakes where habitat diversity is low. Generally smallmouth bass prefer a rockier and largemouth bass prefer a weedier littoral habitat. (Hetke 2008), (Cornwell 2020)

Smallmouth bass will winter, summer and spawn in one body of water, using different habitats depending on water temperature. Spawning activity begins when water temperatures reach 59-65°F with nest building in shallow areas with gravel, bedrock, sand

or other hard-bottom surfaces. Smallmouth bass spawning responsibilities vary greatly with gender. The female arrives at the nest shortly before and leaves shortly after the eggs are laid. The male builds and defends the nest. He continues to defend the nest, eggs and hatchlings until they cease schooling. (Hetke 2008)

Green Lake is a good smallmouth bass habitat, with clean, clear water, abundant habitat, and suitable prey. Project operations have not compromised smallmouth bass habitat in Green Lake. For study results, see section 7 6.0 below.

5.4.5.6 River herring (alewife, blueback herring)

River herring are currently captured by the Ellsworth dam fish trap. Some are trucked upstream to Graham Lake, some are harvested, and some are released into Lake Leonard. The MDIFW, in a letter dated June 26, 2019, expressed concern with alewife fish passage upstream into Green Lake because of competition with landlocked smelts. Smelt are an established fishery in Green Lake as well as the preferred forage species of landlocked salmon. (MDIFW 2019)

Blueback herring are captured by the Ellsworth station trap operation along with alewives. Blueback herring typically run up-river later in the season than alewives. The trapped and not harvested late run river herring are released in Lake Leonard which is regarded as more suitable spawning habitat for blueback herring than the larger lakes upstream. Graham lake dam upstream of Lake Leonard does not have fish passage. This means that the majority of the blueback herring in the Union River do not have access to Green Lake Project waters. (Ellsworth FLA 2015) - In May of 2021 NFH staff have observed river herring in Reeds Brook."

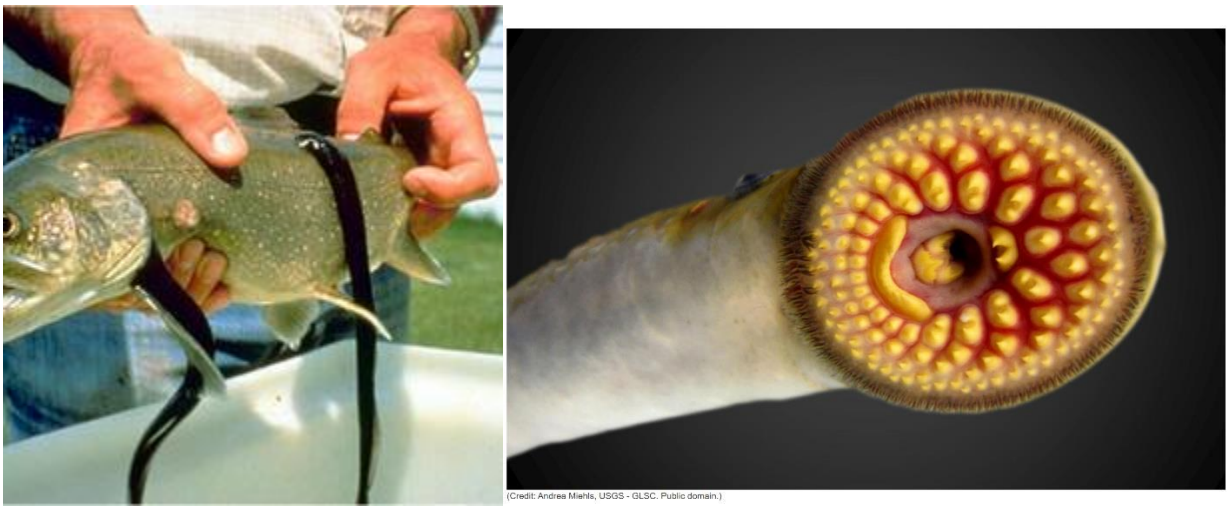
5.4.5.7 American shad

There is no current nor historical habitat of American shad identified in the project area. American shad are not expected to have access to Reeds Brook now, nor in the future. (Ellsworth FLA 2015), (MDMR 2014)

5.4.5.8 Sea lamprey

Sea lamprey have gotten a bit of a bad reputation for a couple of reasons:

1) Their physical appearance bothers many people.
2) They have decimated native fisheries in some lakes where they are an invasive species.



Source: NOAA

#1 is not very surprising given the above Sea Lamprey images.

#2 refers to sea lamprey in the Great Lakes where they are a serious invasive species which has impacted lake trout.

Sea lamprey are native to Maine waters. They may still have a public relations problem in Maine, but in their natural area they do not cause invasive species problems. This is because they are an anadromous fish that feeds in salt water during most of its growth to maturity. During the first 4-8 years of their lives, they burrow into the muddy bottoms of streams, rivers and lakes, filter feeding upon planktonic drift. After emerging from their burrows, they metamorphose into their migration life stage which is similar to the final adult form. Unlike the sea lamprey in the Great Lakes, Maine's sea lamprey do not typically prey on fish while in fresh water. If migrating sea lamprey attach to a fresh water fish, it is rarely fatal for the fish (unlike in salt water). (Kircheis 2004)

Adult sea lamprey that return to fresh water die soon after spawning. Native Maine anadromous sea lamprey cannot survive in freshwater as adults. Sea lamprey are seen as a beneficial part of their native aquatic ecosystem. (Kircheis 2004)

Future fish passage for sea lamprey past the Ellsworth and Graham Lake dams, and even the future presence of these dams, are unknown at this point. (Ellsworth FLA 2015) Downstream fish passage of sea lamprey is facilitated by their lack of a swim bladder. In most situations they can pass through a turbine without suffering decompression damage. (Colotelo 2012)

5.4.6 Proposed environmental measures

5.4.6.1 Eel

There are currently no eel passage provisions on the Graham Lake dam nor on the Ellsworth dam. (Ellsworth FLA 2015) If eel passage is put in at the Graham Lake dam and at the Ellsworth dam, and young eel are found to be climbing or attempting to climb the Green Lake Dam, the need for upstream eel passage should be evaluated. Downstream passage should also be investigated at that time.

The three instances of eel entrainment in the penstock appear to have been allowed by a gap on one side of the intake trash racks. GLWP proposes that the trash rack assemblies be modified to close the two-inch gap at the side of the racks or to reduce it to a maximum opening of one inch. This will make the clear spacing of the trash racks consistent at one inch.

In addition to modifying the trash racks to avoid eel entrainment in the penstock, the fish screens on the dam gates could be modified or rebuilt to remove every other bar. This would result in a two-inch clear spacing. A small structure could also be built and placed below one of the gates to create a hole under the gate large enough to pass eels with the gate closed. This opening could be blocked outside eel migration season.

5.4.6.2 Landlocked salmon

No changes are proposed for landlocked salmon. Landlocked salmon habitat in Green Lake has not been compromised by project operations and no changes are proposed in project operation that would modify this. Potential effects on landlocked salmon and their habitat should be evaluated as part of any fish passage evaluation in the future.

5.4.6.3 Lake trout

No changes are proposed for lake trout. Lake trout habitat in Green Lake has not been compromised by project operations and no changes are proposed in project operation that would modify this. Potential effects on lake trout and their habitat should be evaluated as part of any fish passage evaluation in the future.

5.4.6.4 Arctic charr

No changes are necessarily proposed for arctic charr at this time. Arctic charr habitat in Green Lake has not been compromised by project operations and no changes are proposed in project operation that would modify this. Potential effects on arctic charr and their habitat should be evaluated as part of any fish passage evaluation in the future.

The temperature study performed in Green Lake during the fall of 2020 showed that arctic charr spawning conditions occurred in early November. This indicates that it could be possible to delay the fall drawdown by two weeks so that it ended at the beginning of November. This would leave a minimum of 1.5 feet of water over the spawning locations during the winter.

Basing a long-term drawdown decision on one year's sampling could be risky, though any warming climate trend over time would be likely to make the beginning of November drawdown end more and more conservative. As part of the lake temperature study it was verified that water temperatures near the dam tracked well with water temperatures at likely arctic charr spawning sites. Temperature monitoring at the dam during the fall could be used to verify 2020 temperatures were not unusual. Such temperature monitoring is unlikely to be effective for determining the start of the drawdown during any particular year because the 2020 temperatures reflect water temperatures with the turbine operating part of the time, which is very likely to affect water temperatures at the dam.

If a drawdown change is warranted, GLWP recommends the drawdown start on 15-Sep and end on 31-Oct. Temperature monitoring during the drawdown at the dam and possibly at likely arctic charr spawning locations could be used at GLWP's option to determine if the drawdown period should be delayed further over a period of years. An approval system for such changes would be needed.

5.4.6.5 Smallmouth bass

No changes are proposed for smallmouth bass. Smallmouth bass habitat in Green Lake has not been compromised by project operations and no changes are proposed in project operation that would modify this. Potential effects on smallmouth bass and their habitat should be evaluated as part of any fish passage evaluation in the future.

5.4.6.6 River herring

No changes are proposed for river herring. Alewife passage would risk fish in the lake and blueback herring are not expected to have access to Reeds Brook.

5.4.6.7 American shad

No changes are proposed for American shad. American shad are not expected to have access to Reeds Brook.

5.4.6.8 Sea lamprey

No changes are proposed for sea lamprey. There is currently no fish passage for sea lamprey into Graham Lake. If such fish passage is established in the future, sea lamprey passage past Green Lake dam should be evaluated as to benefits, dangers and costs.

5.4.7 Unavoidable adverse impacts

5.4.7.1 Invasive species

Operation of the Project per the current and any expected future license makes Green Lake more appealing for recreational and habitational uses. With the concomitant launching of small boats, landscaping and access by people who also frequent other

areas there is an increased risk of invasive wildlife species being introduced to the lake. No invasive species are documented as occurring in Green Lake, and the Green Lake Association has a boat inspection program. Invasive species are not considered to be a problem for Green Lake at this time.

The introduction of zebra mussels to a watershed poses a serious threat to native freshwater mussels in the watershed. Zebra mussels out compete native mussels for space and food. Zebra mussels have not been found in Maine as of the writing of this document. (MDIFW 2003a)

5.5 Terrestrial Resources

5.5.1 Upland Wildlife and Botanical Resources

5.5.1.1 Wildlife Habitats in the Project Area and Vicinity

LAND COVER

From the original request for a license (GLWP, 1983):

> The project area is located in the hemlock-white pine-northern hardwoods region of the eastern deciduous forest. Most of the land surrounding the project is forested; both hardwood and spruce-fir forest species are present. Dominant overstory species noted at the project site include red oak, maple, beech, white and yellow birch, hemlock, white pine, spruce, and cedar. The understory consists of saplings of the overstory species along with striped maple, mountain maple, yew, red spruce, hemlock, and hobblebush. Ground layer vegetation is sparse.
>
> …. Mowed lawns and a variety of ornamental shrubs are located around the [GLNFH and the GLWP powerhouse]. Plant species common to disturbed areas are found along the existing gravel road between the hatchery [, powerhouse,] and the Green Lake Dam. The area at the mouth of Reeds Brook contains lowland shrubs and herbaceous plants characteristic of riverine or streamside communities.

URBAN/SUBURBAN

The City of Ellsworth is located approximately 6 miles below the project site; no land in the immediate vicinity of the project boundary is considered Urban/Suburban.

5.5.1.2 Wildlife Resources in the Project Area and Vicinity

From the original request for license (GLWP, 1983):

> The project area supports a variety of wildlife species typical of eastern Maine. Species presumed to exist in the region include deer, fox, mink, otter, skunk, raccoon, muskrat, porcupine, woodchuck, varying hare, grouse, woodcock, and a variety of songbirds, hawks, and owls.
>
> ….

There are two known bald eagle nests on the Green Lake shoreline. One of these nests is on an island near in the northwest section of the lake. When last monitored in 2018 this

nest contained a single adult. The other nest is in the southeast region of the lake on Scott's Neck. When last monitored in 2018 this nest contained a resident pair.

Two other nests are in the project vicinity on Graham Lake. The nearest of these is about 2 miles from the project boundary. Both of these nests contained breeding pairs when last monitored in 2018.

Source: Arcgis.com

https://www.arcgis.com/apps/webappviewer/index.html?id=796b7baa18de43b49f911fe82dc4a0f1 There are several deer wintering areas in the vicinity of Green Lake (MDIFW, 2003). Deer have been observed in the project area during the winter of 2018-2019. It is not anticipated that deer habitat will be affected by project operations.

There are several areas of state-classified inland wading bird and waterfowl habitat in the vicinity of Green Lake (MDIFW, 2003). The MDIFW stakeholder response also discussed these (see Appendix B). These areas occur specifically at the north end of Green Lake and are likely sensitive to water quality and lake levels. GLWP will evaluate these habitats and their wildlife as part of the relicensing process.

5.5.1.3 Invasive Wildlife Species

None are known within the project area.

5.5.1.4 Invasive Plants and Weeds

The Maine Department of Agriculture, Conservation and Forestry considers these species to be currently considered invasive in Maine:

Table 5-9 – Invasive Plants Potentially Occurring within the Project

SCIENTIFIC NAME	COMMON NAME
Alliaria petiolata	Garlic Mustard
Berberis thunbergii	Japanese Barberry
Celastrus orbiculata	Asiatic Bittersweet
Cynanchum louiseae	Black Swallowwort
Elaeagnus umbellata	Autumn Olive
Fallopia japonica	Japanese knotweed
Frangula alnus	Glossy buckthorn
Impatiens glandulifera	Ornamental Jewelweed
Lepidium latifolium	Perennial Pepperwort
Lonicera morrowii	Morrow Honeysuckle
Lonicera tartarica	Tartarian Honeysuckle

SCIENTIFIC NAME	COMMON NAME
Lythrum salicaria	Purple loosestrife
Phragmites australis	Common reed
Rosa multiflora	Multiflora or Rambler rose
Aquatic Species	
Cabomba caroliniana	Fanwort
Egeria densa	Brazilian Elodea
Hydrilla verticillata	Hydrilla
Hydrocharis morsus-ranae	European Frog-bit
Myriophyllum aquaticum	Parrot Feather
Myriophyllum heterophyllum	Variable-leaf milfoil
Myriophyllum spicatum L.	Eurasian Milfoil
Najas minor	European Naiad
Nymphoides peltate	Yellow Floating Heart
Poa nemoralis	Wood Blue Grass
Potamogeton crispus	Curly-leaf Pondweed
Rhamnus cathartica	Common Buckthorn
Trapa natans L.	Water Chestnut

Source: MDACF, 2013; MDEP, 2018

5.5.2 Shoreline Wildlife and Botanical Resources

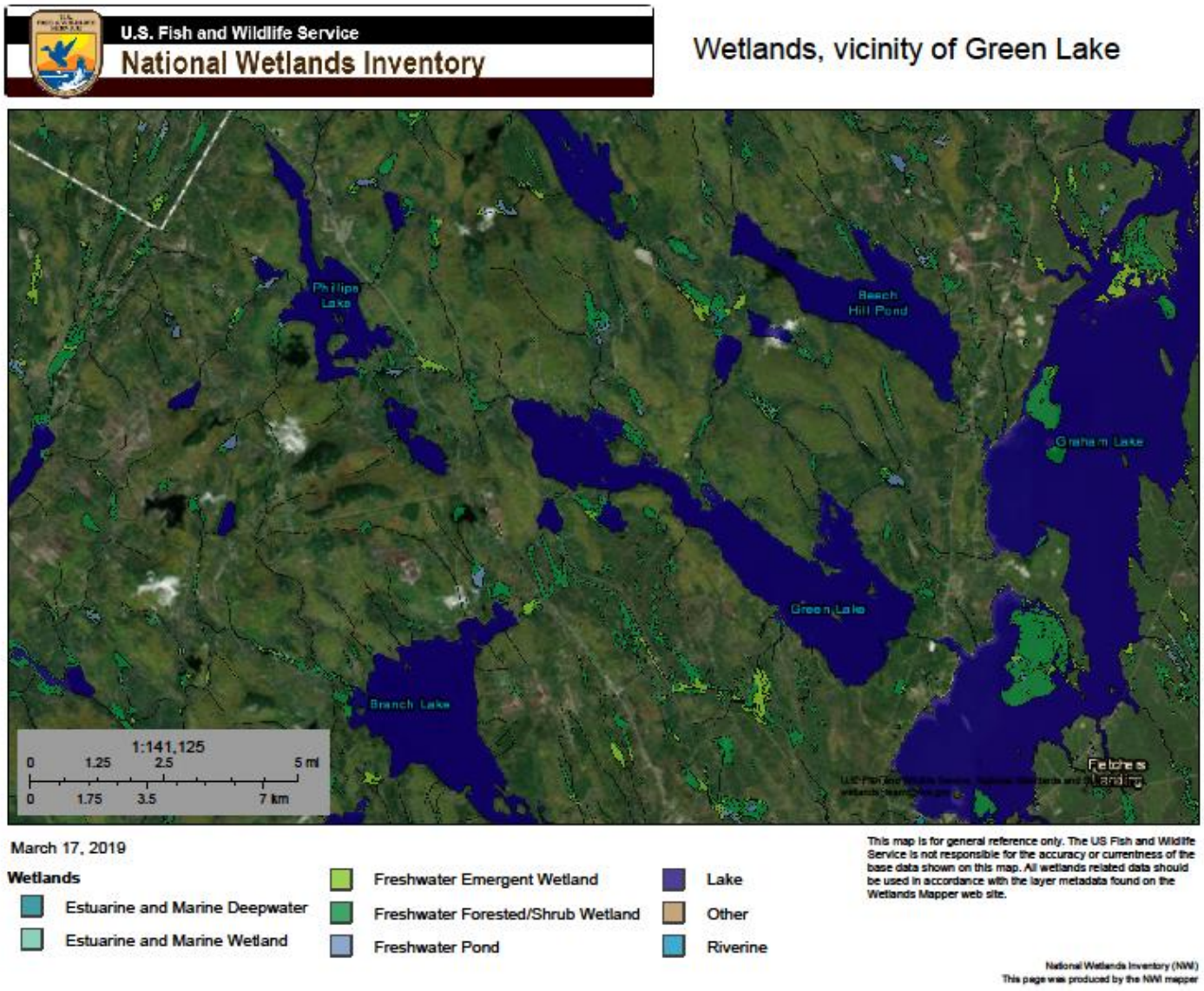
5.5.2.1 Floodplain and Wetland Species and Habitats of the Project Area and Vicinity

The majority of the wetlands in the project area are classified by the National Wetlands Inventory (NWI) as Freshwater Forested/Shrub Wetland.

Wetlands, both freshwater emergent wetland (FEW) and freshwater forested/shrub wetland (FFSW), occur within a mile of Green Lake and Reeds Brook, primarily to the southwest of the lower part of Green Lake. Areas of FFSW occur at or near the shoreline of the lake, mostly at the upper end; the nearest FEW area is approximately 1,500 feet from the lake, in the area between Green and Phillips lakes (USFWS, 2018a).

Within the project boundary there are two areas of Freshwater Forested/Shrub Wetland with a total area of 91.5 acres. No other wetland types or areas are marked within the project boundary.

Figure 5-7 – Wetlands in the Vicinity of the Project



5.5.2.2 Riparian and Littoral Species and Habitats of the Project Area and Vicinity

The Green Lake Hydroelectric Project includes Green Lake and Reeds Brook. Green Lake's shoreline is mostly forested, with some open areas including residential and recreation land uses, wetlands, and islands. The area immediately adjacent to Reeds Brook is mostly forested.

From the original license application (GLWP, 1983), in the discussion about a botanical assessment conducted for the application, these forested areas include:

> Some species common in the spruce-fir forests are mixed in with the northern hardwood species in the study area…
>
> White pine, hemlock, beech, balsam fir, and paper birch are common overstory species… Red spruce, hemlock, and hobblebush were the dominant species in the shrub layer. The ground layer [includes] wild sarsaparilla and starflower … with rock polypody covering several rocks near the forest edge by the dam. Mosses were quite common.
>
> ….
>
> Reeds Brook flows … in a narrow ravine from Green Lake to Graham Lake…. The forest … was characteristic of a northern hardwoods forest… including beech, red oak, white ash, white spruce, birches, and hemlock…lower layers [also included] striped maple, mountain maple, and yew … [and] a few herbaceous species … in the rather sparse ground layer.
>
> At the mouth of Reeds Brook the stream channel broadens. A riverine or streamside community was present along the channel and on slightly elevated areas within the channel …with characteristic lowland shrubs and herbaceous plants. The stream empties into an inlet of Graham Lake. Since the lake has a fluctuating pool elevation (which is at a low level in September), plants have invaded onto exposed gravel bars and mudflats that are probably inundated with water earlier in the year. A sedge, spearwort, and arrowhead were the dominant species on the gravel bars and mudflats in this area. Along the edges of the stream, alder, sweet gale, and inkberry were rather abundant.

The penstock runs alongside Reeds Brook and between it and the road that runs from the hatchery and powerhouse area. Plant species characteristic of disturbed or waste areas are common along the road and between the road and the penstock, such as goldenrods, asters, hop clover, rabbitfoot clover, red and white clovers, and grasses, plus shrubs and tree seedlings from the nearby forested land. (GLWP, 1983)

There have been no major changes to the littoral or upland habitat around Green Lake since 1983.

Two species of birds are mentioned in stakeholder responses: loons (GLA, Appendix B) and bald eagles – directly addressed in the original license (FERC, 1984). The concern with eagles is on preserving nesting sites and habitats for prey/feed species. The current license requires maintaining a 1-cfs flow in Reeds Brook in part because it is where eagles feed, planning and executing construction of the powerhouse and transmission line to minimize disturbance to eagles, and designing and building the powerhouse to allow continued access to Reeds Brook by bald eagles.

The concern with loons is the flooding of nest sites if lake levels rise.

> Common Loons are a classic bird of the North Woods lakes. They are excellent indicators of water quality as they require crystal-clear lakes (which makes it easier for them to see prey underwater) with abundant populations of small fish. Lakes with coves and islands are preferred as they provide cover from predators while resting and nesting. … Loons nest in quiet, protected, hidden spots of lakeshore, typically in the lee of islands or in a sheltered back bay. Loons can't walk well on land, so nests are built close to a bank, often with a steep dropoff that allows the bird to approach the nest from underwater. (Cornell, 2017)

No changes to either the shoreland around Green Lake or the edges of Reeds Brook are anticipated as a result of continued project operation.

The northern long-eared bat and small brown bat, terrestrial resources that may occur in the Project area, are discussed in the Threatened and Endangered Species and Maine State listed species sections below.

5.5.3 Affected environment

Project operation affects the level of the water in Green Lake. Along with the effects on the littoral zone of the lake, this affects the distance from points on the shore (that may be used by nesting loons, for example) to the water in the lake. Given the small range of the summer water level fluctuations (+/- 6 inches) and the small drawdown (3.2 feet of a 55 foot littoral zone) the effects on most terrestrial resources around the lake (from such things as water table variations and accessibility of water by most wildlife species) are unlikely to be greater than effects of natural lake variations.

5.5.3.1 Vegetation Management

The lawn in front of the station is mowed roughly once per week during the summer months.

The non-forest area along the penstock is mowed with a motorized string trimmer or similar twice per year once in mid-summer and once in late summer or early fall. The late fall trim is done largely as a deer tick control measure before penstock patching

work commences in mid-October. Deer ticks bites present a high likelihood of Lyme disease in Maine.

The trees under the overhead part of the 12.47 kV transmission line are trimmed as needed. This area is one pole span from the road.

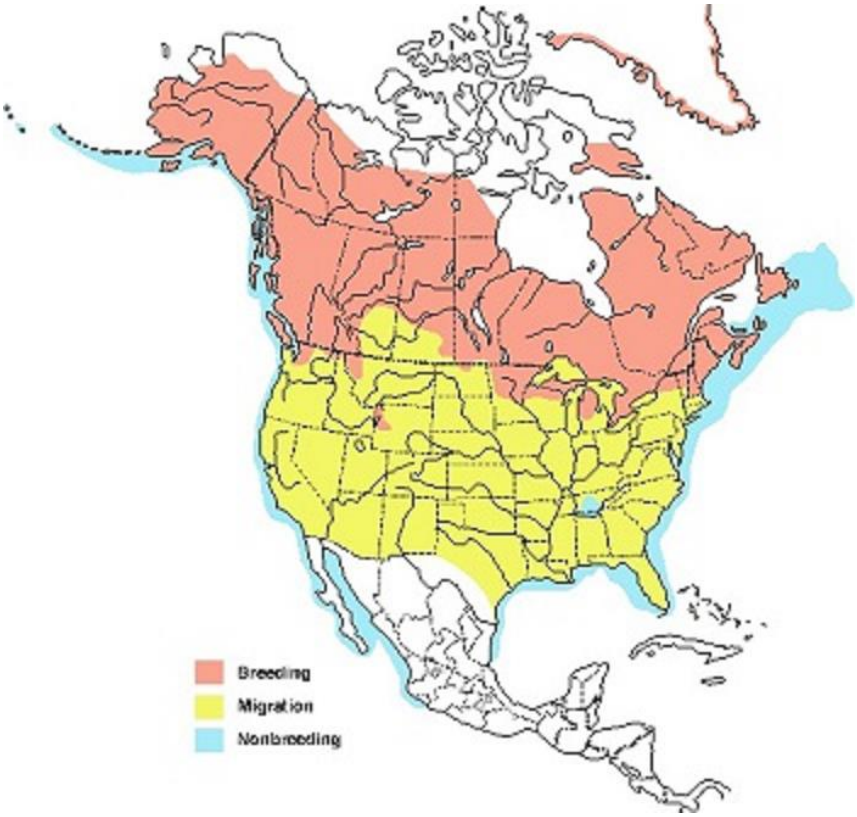
5.5.4 Environmental analysis

5.5.4.1 Acreage of upland vegetation types within the project boundary:

The Project has about 2 acres of upland within the project boundary. The two primary types of upland vegetation are Grass (about 1.2 acre) and Forest (about 0.6 acre). In addition about 0.2 acres of upland area is developed (penstock, power house, driveway).

5.5.4.2 Loon

Common loon information provided by MDIFW in their ISR responses (MDIFW 2021) is overly simplistic: "Maine is home to 75% of the territorial pairs of loons in New England and New York, making it the stronghold for the northeast breeding population. Thus, despite the common loon's relatively stable and secure population within the State, Maine holds a high responsibility in the Northeastern United States for the species' continued conservation." This statement ignores the fact that that New England and New York are in the extreme southern limit of common loon breeding habitat.



From an area of habitat point of view, the Northeastern United States has a relatively small responsibility for the species' continued conservation. It is at the southern extreme of the climactic conditions tolerated by the loon. A continuing summer climate warming trend in North America would likely move the loon's preferred habitat further north.

"Water level management was shown to cause 60-70% of nest failure for loons on three lakes in Voyageur's National Park in Minnesota (Reiser 1988)." (MDIFW 2021) This statement is misleading. The report in question studied two lakes in the Voyageur's National Park that are relatively large, with managed levels, as well as a number of smaller lakes with no level management. The two large lakes studied were Rainy Lake (Rainy) and Namakan Reservoir (Namakan). The two lakes had level management schemes that resulted in Rainy having less level fluctuation than natural, and Namakan more level fluctuation than normal. Loon breeding success was higher than normal on Rainy Lake and lower than normal on Namakan Reservoir. So technically, lake level management both increased and decreased loon nest failure in Voyageur's National Park. Rainy had similar lake level fluctuations during the late spring and summer (the time period of concern for loons) to Green Lake. The recommendation of the cited study is "regulated water levels should peak by the first week of June and remain relatively stable through the second week of July." (Reiser 1988)

Loons may delay nesting until fluctuating water allow access to traditional nesting sites. (Windels 2013) This aligns well with the very high spring melt runoff conditions that occur some years at Green Lake. The maximum Green Lake water level that the Project is allowed to manage to is 160.7 ft NGVD29 datum year round. The absolute minimum level is 157.5 ft during the winter, allowing a 3.2 ft range for the lake, but this is only during the parts of the year that do not affect loon nesting. From the first of June until early September (Labor Day) the minimum level the Project can manage to is 159.7 ft. Typically the lake is near 160.7 on the first of June, reflecting the effects of spring runoff on the lake.

MDIFW's recommendation for the new license is to require the Green Lake water level be maintained with no more than 0.5 vertical feet up and 1 vertical foot down occurring within any 28-day period from 15-May through 31-July. GLWP believes this level maintenance method is impractical, and not necessarily in the best interest of the loons on Green Lake. It has the potential to drop water levels ever lower during the summer without the possibility of restoring water levels when heavy rain occurs. This ignores the fact that loons attempt to use traditional nest sites again. Dropping the lake without restoring the lake level quickly when possible, could leave traditional nest sites difficult for loons to access.

GLWP consulted with MDIFW on 05-May-2021 to work out a more practical solution that would also be less risky for the loons. The opinion of the staff biologist concerned

with waterfowl on the call (Danielle D'Auria) was that the only solution was as stated in the recommendations (range of +0.5/-1.0 ft during any 28 day period for the 11 week period from 15-May to 31-Jul) and that the time range could not be narrowed down more than that by considering the specifics of Green Lake. The MDIFW Environmental Review Coordinator (John Perry) suggested that other projects have recommended a fixed range to manage the lake level to during the loon nesting season.

GLWP notes that MDIFW's statement that "water level management" is responsible for loon difficulties is, at face value, contradictory with their proposed solution: water level management. Perhaps a better statement would be that "water level mismanagement" is responsible for loon difficulties. GLWP does not believe it has been mismanaging water levels with respect to the loons.

GLWP has been operating under the current license with a range of 160.2 NGVD29 datum+/- 0.5 ft from 01-Jun through Labor Day, except for conditions beyond GLWP's control. This summer level range has been in use on Green Lake at least since 1985, so it is likely that traditional loon nesting sites will have been established by the loons based on this range.

5.5.4.3 Bald Eagle

Bald eagles have been reported in the project area. There are two known bald eagle nests on the Green Lake shoreline. One of these nests is on an island near in the northwest section of the lake. When last monitored in 2018 this nest contained a single adult. The other nest is in the southeast region of the lake on Scott's Neck. When last monitored in 2018 this nest contained a resident pair.

Two other nests are in the project vicinity on Graham Lake. The nearest of these is about 2 miles from the project boundary. Both of these nests contained breeding pairs when last monitored in 2018.

There is no major construction, major blasting or large tree felling expected as a result of relicensing.

Source: Arcgis.com

5.5.5 Proposed environmental measures

5.5.5.1 Loons

GLWP recommends the new license maintain the summer level range from the current license. For the protection of the loons, the proposed summer range is 160.2 ft NGVD29 datum plus or minus 0.5 ft from 01-June through at least 31-July.

5.5.5.2 Bald Eagle

Any minor blasting considered as an alternative for the leaching field feed piping work would be conducted during a season that minimize disturbance of eagles. All necessary permits and approvals would be obtained before work began.

5.5.6 Unavoidable adverse impacts

5.5.6.1 Invasive species

Operation of the Project per the current and any expected future license makes the Green Lake area more appealing for recreational and habitational uses. With the concomitant landscaping and access by people who also frequent other areas there is an increased risk of invasive wildlife species being introduced to the area. No invasive species are documented as occurring around Green Lake. Invasive species are not considered to be a problem for the Green Lake area at this time.

5.6 Maine State-listed Species

5.6.1 Species

The following Maine State-listed Species have been identified as potentially in the project area:

- Golden Eagle
- Northern Long-eared Bat
- Little Brown Bat
- Brook Floater Mussel
- Tidewater Mucket Mussel
- Yellow Lampmussel

5.6.2 Affected environment

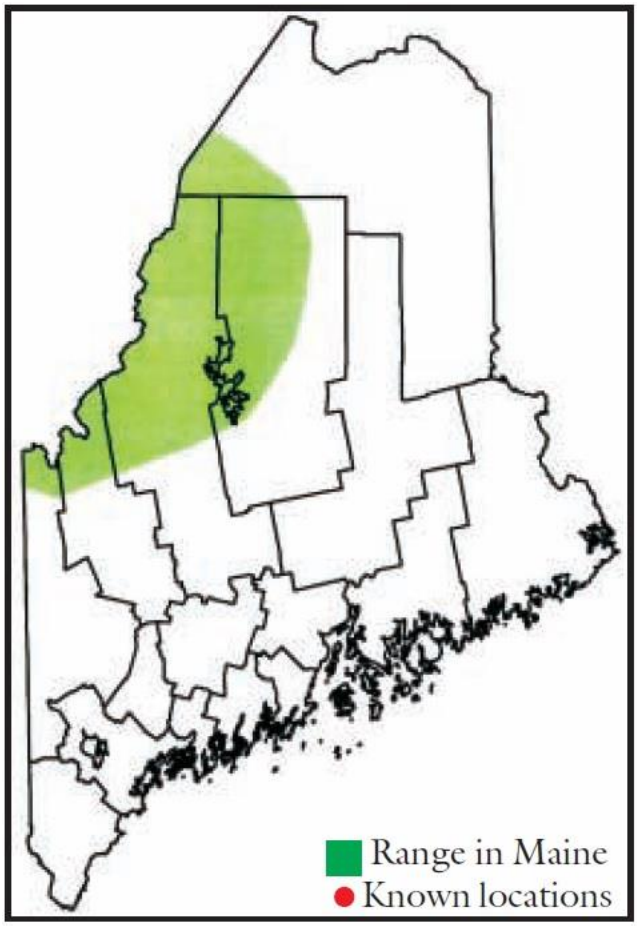
Project operation affects the level of the water in Green Lake. Along with the effects on the littoral zone of the lake, this affects the distance from points on the shore (that may be used by nesting loons, for example) to the water in the lake. Given the small range of the summer water level fluctuations (+/- 6 inches) and the small drawdown (3.2 feet of a 55 foot littoral zone) the effects on most terrestrial resources around the lake (from such things as water table variations and accessibility of water by most wildlife species) are unlikely to be greater than effects of natural lake variations.

Project operation also affects the flows in Reeds Brook. The range of flows in the brook is similar to the natural range, but on the average project operations reduce the yearly

flow down Reeds Brook, which is a cumulative affect with Hatchery water use. On a rough scale, the timing of flows will be similar to natural flows (high flows in the spring and low flows in the late summer, for example), but project operations may affect the timing and duration of such flows on a shorter timescale.

5.6.3 Golden Eagle

Golden eagles are traditionally associated with rugged topography and open country including rangelands, tundra and alpine areas. In Maine, golden eagles have been typically associated with mountainous areas in the western and northwestern portions of the state. Golden eagles have always been rare in Maine. Their range in Maine is shown in the following map:



The golden eagle range in Maine is far removed from the greater project area. No known golden eagle sightings have occurred in the project area.

5.6.4 Northern Long-eared Bat

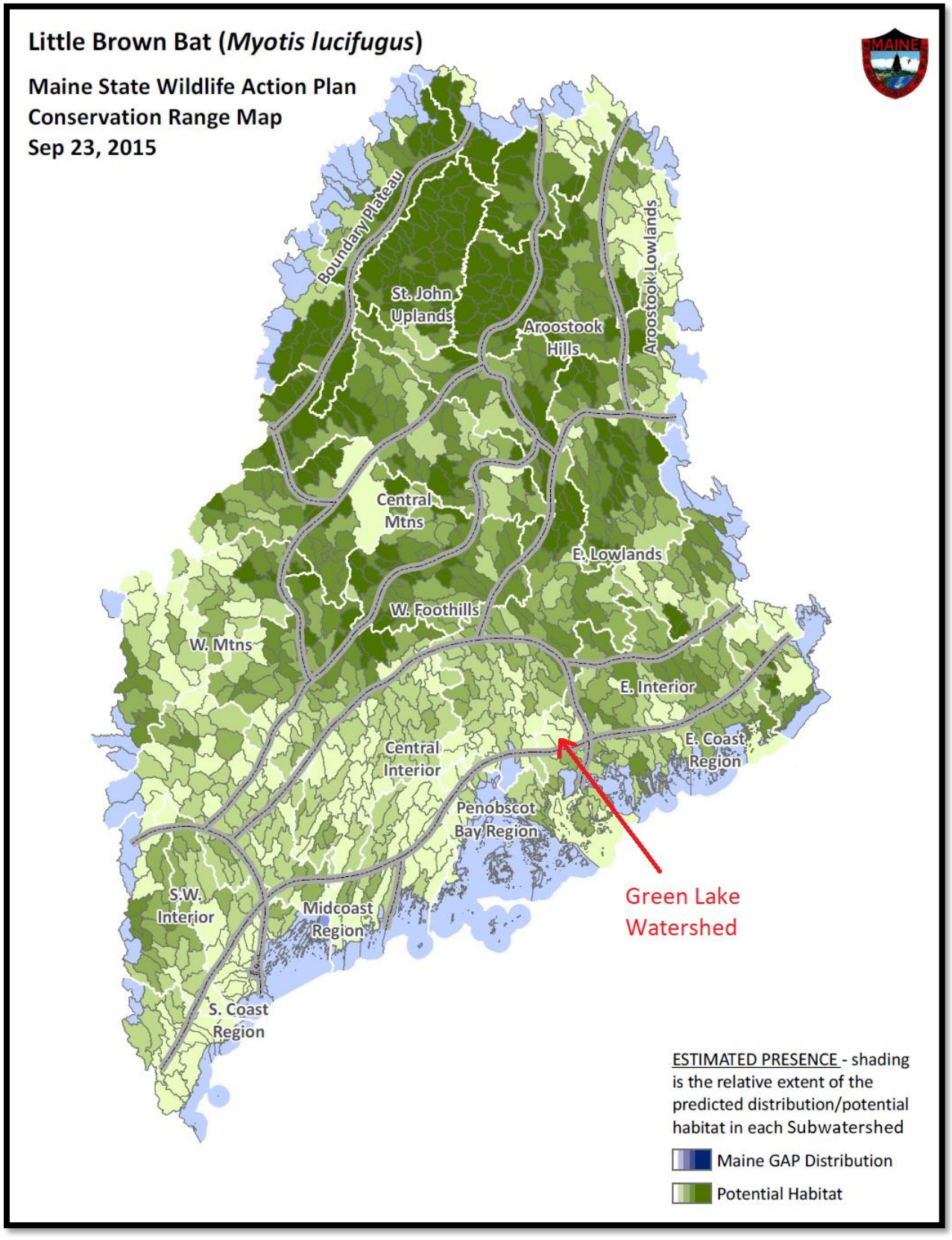
The northern long-eared bat is discussed in the Threatened and Endangered Species section 5.7 below.

5.6.5 Little Brown Bat

Little brown bats hibernate in large groups in caves and mines during the winter. During the summer they roost during the day in such places as tree hollows, wood piles, rocky outcrops, buildings, etc. They prefer to roost in places that are warm and dark. Since little brown bats eat insects, they often forage along the edges of lakes and streams. (MDIFW 2015), (Fenton 1980)

Wind turbines are listed as a high severity stressor for little brown bats. Dams/water level fluctuation are not listed as a stressor. (MDIFW 2015)

The Green Lake watershed has a relative estimated little brown bat habitat potential of 2 on a 1-7 scale:



(MDIFW 2015), GLWP modified: legend "Town" to "Subwatershed", labeled Green Lake

By supporting clean water in the Green Lake watershed and Reeds Brook and maintaining stable water levels during the summer the Project is unlikely to adversely affect little brown bats.

5.6.6 Brook Floater Mussel

In Maine, the brook floater mussel's distribution is largely concentrated in the Penobscot River drainage and several Downeast river systems, with a few scattered populations in the Kennebec, St. George and Sheepscot River watersheds. An isolated population in the Pleasant River (Cuberland Co.) is the only known occurrence in southern Maine. The Union River watershed is near the Penobscot watershed, and is commonly considered a "Downeast river system." (MDIFW 2012)

Brook floater mussels are documented as being present in the West Branch of the Union River above Graham Lake. (DACF UpperUnion)

Brook floater mussels inhabit flowing water, from small streams to large rivers. It does not live in high-gradient streams with very fast current, nor is it usually found in slow water. It seems to prefer stable substrates such as coarse sand and gravel, and is often found in association with rooted aquatic vegetation. During part of their life cycle they burrow into the bottom, anchoring themselves with a muscular foot. (MDIFW 2012)

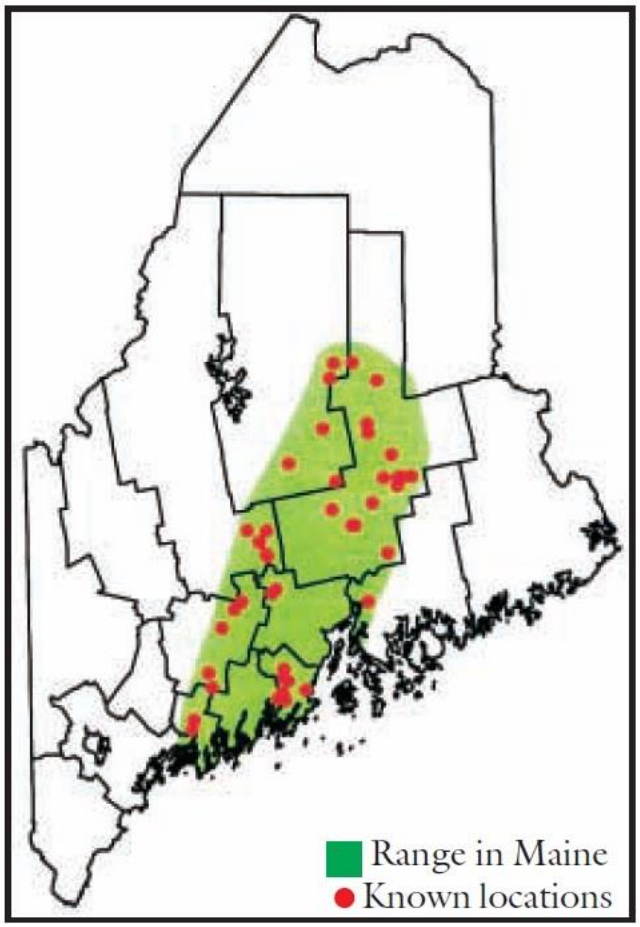
Green Lake, being essentially still water, would not be suitable habitat for brook floater mussels. Reeds Brook has sections that are medium or low gradient with moderate flows. The percentage of substrates that could be described as "course sand and gravel" is 11%, and this is in small pockets between cobble or boulders. The other 89% of the substrate is larger. Average flow velocities, even at higher CFS flow levels in Reeds Brook were not particularly high. Project operation has been shown to maintain good water quality in Reeds Brook. (See Study Results in section 7 below)

Reeds Brook offers some habitat for brook floater mussels, but it does not appear to be ideal, or (on average) very acceptable habitat. With moderate flow speeds and support for good water quality in Reeds Brook, GLWP believes project operations have not, and are not expected to, adversely affect brook floater mussels or their habitat.

5.6.7 Tidewater Mucket Mussel

In Maine, the tidewater mucket mussel is found in the Merrymeeting Bay and the Penobscot, St. George, lower Kennebec and lower Androscoggin River watersheds. Its distribution is very similar to that of the yellow lampmussel, and they are often found together. (MDIFW 2003a)

The range of the tidewater mucket mussel in Maine is shown in the following map:



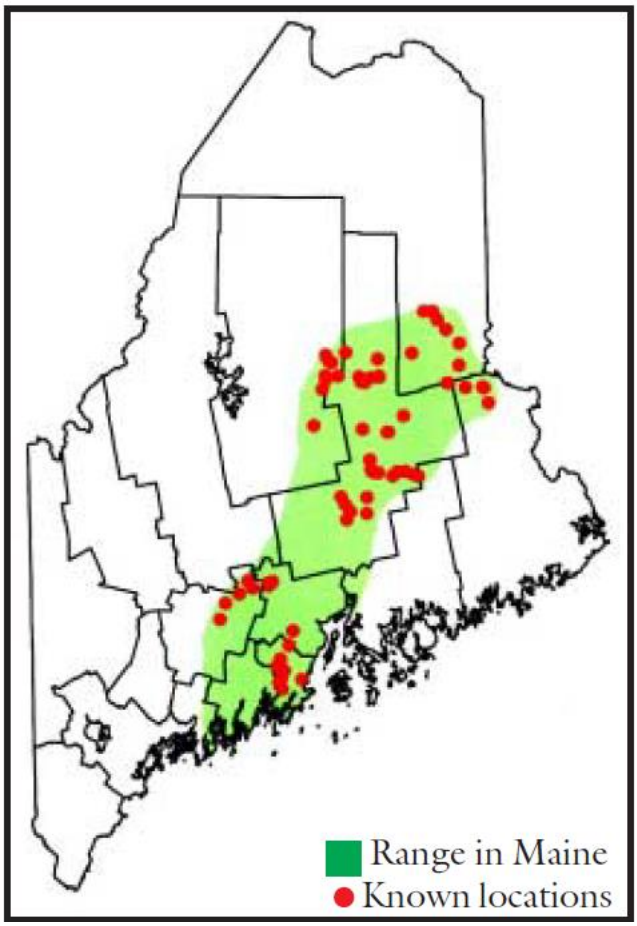
(MDIFW 2003b)

The tidewater mucket mussel range does not include any of the Green Lake watershed.

5.6.8 Yellow Lampmussel

In Maine, the yellow lampmussel is only known to exist in the Penobscot, St. Geore and lower Kennebec River watersheds. This species typically prefers medium to large rivers, but in Maine is often found in lakes and ponds, and will tolerate impounded sections of rivers. (MDIFW 2003b)

The range of the tidewater mucket mussel in Maine is shown in the following map:



(MDIFW 2003b)

The yellow lampmussel range does not include any of the Green Lake watershed.

5.6.9 Proposed environmental measures

No changes are proposed for Maine state listed species.

5.7 Threatened and Endangered Species

5.7.1 Threatened and Endangered Wildlife Resources and Habitats

The Endangered Species Act (ESA) was passed in 1973 to protect those animals and plants and associated habitats that are in danger of becoming extinct. The USFWS classifies animals and plants into two categories: "endangered species" are in danger of extinction throughout the area in which they are usually found and "threatened species" are those that could become endangered in the near future. The bald eagle was removed from the ESA list on June 28, 2007. However, bald eagles remain federally protected under the Bald and Golden Eagle Protection Act of 1940 and the Migratory Bird Treaty Act.

Wildlife species in Maine may also be protected under the Maine Endangered Species Act (MESA) like the ESA. Depending on their level of vulnerability to extinction, species may be listed as Endangered or Threatened. Under MESA, a species may also be identified as Special Concern if it does not meet the criteria of endangered or threatened but is particularly vulnerable and could easily become threatened, or is suspected to be endangered or threatened but for which insufficient data exists (MDIFW, 2009).

MESA includes the designation and protection of Essential Habitats, which are defined as “areas currently or historically providing physical or biological features essential to the conservation of endangered or threatened species in Maine and which may require species management considerations” (MDIFW, 2009). The Natural Resources Protection Act (NRPA) provides protection to certain natural resources including Significant Wildlife Habitats and is administered by the MDEP.

The USFWS has identified one fish and one bat as listed on the federal endangered species list (USDOI, 2018) within the Project Area: Atlantic salmon and northern long eared bat
(Table 5-10).

Table 5-10 – Federally Listed Endangered or Threatened Wildlife Species Documented as Occurring in The Project Area

COMMON NAME	SCIENTIFIC NAME	FEDERAL STATUS
Atlantic salmon	*Salmo salar*	Endangered
Northern long-eared bat	*Myotis septentrionalis*	Threatened
Rusty patched bumble bee	*Bombus affinis*	Endangered

Source: USDOI, 2018

A review of the Maine list of threatened and endangered species was completed. Based on the available habitat and ranges of the species listed, there are five Maine state listed species identified as potentially occurring within the Project. In addition, there are eighteen species listed as Species of Special Concern that may occur in the Project (Table 5-11) (MDIFW, 2019).

Table 5-11 – Endangered, Threatened, and Species of Special Concern that May Occur in the Project or in the Project Vicinity

Species Common Name	Endangered	Threatened	Special Concern
Amphibian			
Blue-spotted salamander			X
Northern leopard frog			X
Bird			
Great blue heron			X
Bald eagle			X
Northern Harrier			X
Barn owl			X
Whip-poor-will			X
Barn swallow			X
Northern rough-winged swallow			X
Veery			X
Rusty blackbird			X
Fish			
American eel			X
Mammal			
Little brown bat	X		
Northern long-eared bat	X		X
Red bat			X
Hoary bat			X
Silver-haired bat			X
Eastern pipistrelle			X
Reptile			
Northern ribbon snake			X

Species Common Name	Endangered	Threatened	Special Concern
Mussel			
Brook floater		X	
Tidewater mucket		X	
Yellow lampmussel		X	

Source: MDIFW, 2019

5.7.2 Threatened and Endangered Wildlife Species Distribution and Life History information

ATLANTIC SALMON

SPECIES DESCRIPTION AND LISTING

Atlantic salmon are an anadromous fish species with a complex life history. Individuals spend most of their adult life in marine environments but return to freshwater rivers and streams to spawn (Fay et al., 2006). Atlantic salmon are native to the North Atlantic Ocean and have been found worldwide as far south as Portugal in the eastern Atlantic and the Connecticut and Housatonic Rivers in the western Atlantic, and north to Ungava Bay in Quebec as well as the Nastapoka River in Hudson Bay (Morin, 1991). Atlantic salmon were initially listed as endangered on November 17, 2000, on eight coastal Maine watersheds by the NMFS and the USFWS (65 FR 69459). NMFS and the USFWS expanded the listing to include Atlantic salmon that inhabit large Maine rivers (Androscoggin, Kennebec, and Penobscot) that were partially or wholly excluded in the initial listing (74 FR 29344; June 19, 2009). NMFS determined that Atlantic salmon that inhabit the Gulf of Maine watersheds from the Androscoggin River eastward to the Dennys River are a distinct population segment (i.e., GOM DPS) and thus should be listed as a "species."

Currently, the GOM DPS includes Atlantic salmon that occupy freshwater from the Androscoggin River to the Dennys River, as well as anywhere Atlantic salmon occur in the estuarine and marine environments. The historical upstream limits of the species' freshwater range are primarily determined by impassable falls in the Penobscot River watershed, including Big Niagara Falls on Nesowadnehunk Stream in Township 3 Range 10 (91.2 miles north of the project), Grand Pitch Falls on Webster Brook in Trout Brook Township (100 miles northwest of the project), and Grand Falls on the Passadumkeag River (38 miles north of the project) (74 FR 29344; June 19, 2009). Additionally, conservation hatchery populations maintained by Green Lake National Fish Hatchery and Craig Brook National Fish Hatchery are included in the GOM DPS. Landlocked and commercially raised salmon are excluded from the listing (74 FR 29344; June 19, 2009).

LIFE HISTORY OF THE ATLANTIC SALMON

Anadromous Atlantic salmon go through several distinct phases which are accompanied by changes in behavior, physiology, morphology, and habitat requirements. While spawning by adult Atlantic salmon does not occur until fall, upstream migration begins in the spring. In Maine, most Atlantic salmon begin to ascend rivers from May to mid-July, but migration may continue until the fall (Meister, 1958). As soon as fish enter freshwater, they stop feeding and darken in coloration. Salmon that return in the early spring may spend up to 5 months in the river before spawning. These fish spend the summer months in cool water refuges such as deep pools, springs, and mouths of cold-water tributaries (Fay et al. 2006). In either the fall or the following spring, post-spawned adults (i.e., "kelts") migrate downstream after spawning and resume feeding once reaching the marine environment. A small percentage may return to spawn 1 to 2 years later.

Spawning typically takes place from late October through November when water temperatures are around 7°C to 10°C (45°F to 50°F). Preferred spawning sites consist of gravel substrate within flowing water (Peterson, 1978), with water depth ranging from 30 to 61 centimeters (11.8 to 24 inches) and water velocities averaging 60 centimeters a second (2.0 feet a second) (Beland, 1984). Eggs are deposited in a series of nests (i.e., redds) scoured from the gravel by the female. As they are deposited in the redd, one or more males will fertilize the eggs. A returning female can produce approximately 7,500 eggs (Fay et al., 2006).

In late March or April, salmon eggs hatch as alevin (or sac fry). Alevin remain in the redd for approximately 6 weeks nourished by their yolk sac. In mid-May, alevins emerge from the gravel and begin to actively feed, at which point they are called fry. Salmon fry enter the parr stage within days of emerging. This stage is indicated by vertical bars (i.e., "parr marks") which appear on their sides. Sites preferred by parr include areas with sufficient cover, water depths from roughly 10 to 60 centimeters (4.0 to 23.6 inches), water velocities between 30 and 92 centimeters a second (0.9 to 3.0 feet a second), and water temperatures around 16°C (60.8°F) (Fay et al. 2006). The diet of juvenile salmon includes aquatic invertebrates such as the larvae of mayflies, stoneflies, chironomids, caddisflies, aquatic annelids, and mollusks, as well as a variety of terrestrial invertebrates that fall into the river (Fay et al. 2006). In the fall, parr will seek shelter in the substrate as water flows increase and temperature and day length decrease (Fay et al., 2006).

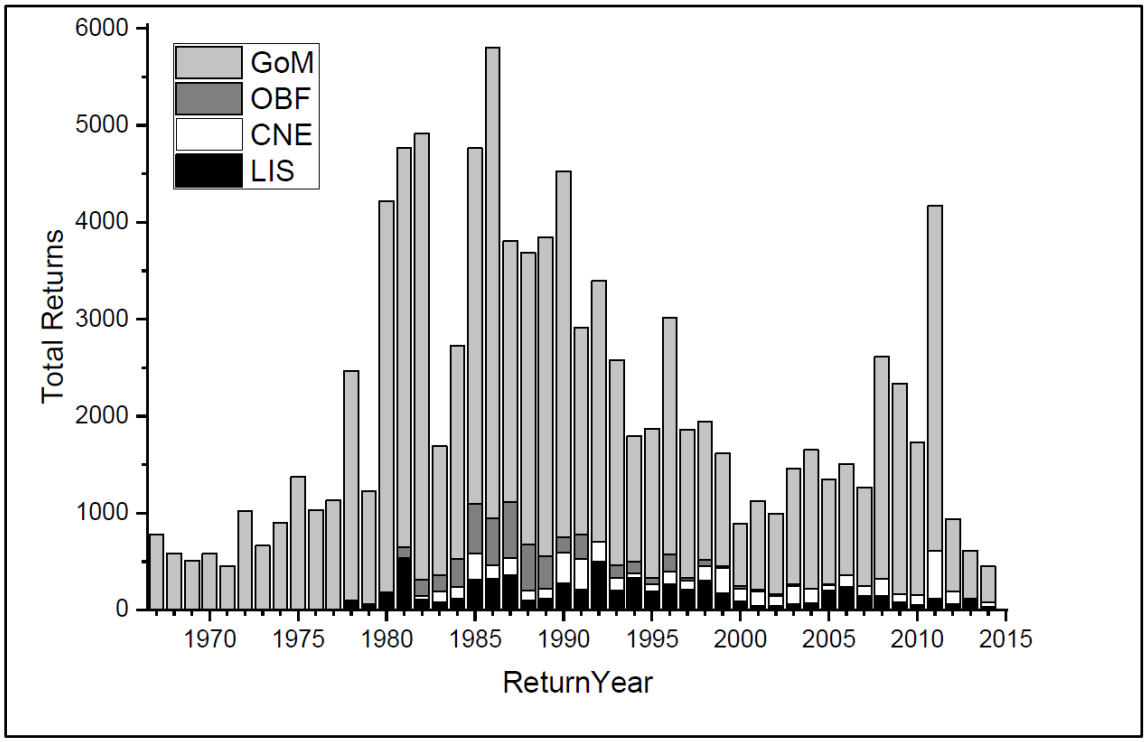
Parr will remain in freshwater for 1 to 3 years before undergoing smoltification, which is a series of physiological, morphological, and behavioral changes that prepare the salmon to move from freshwater to marine environments. In the Penobscot River watershed, smolts migrate back to the marine environment between late April and early June with a peak movement in early May (Fay et al., 2006). After returning to sea,

Atlantic salmon commence long migrations from their natal rivers. During this time, Atlantic salmon experience a period of rapid growth. Once they reach maturity, they return to their natal river (Fay et al., 2006). Atlantic salmon may spend up to 3 years in the marine environment before returning to their natal freshwater streams to spawn (Fay et al., 2006).

STATUS AND TRENDS OF ATLANTIC SALMON IN THE GULF OF MAINE DISTINCT POPULATION SEGMENT

The overall abundance of Atlantic salmon has been declining since the 1800s (Fay et al., 2006). Although comprehensive data on adult abundance are not available until after 1967, current abundance levels of Atlantic salmon are significantly lower than historical estimates Whereas Foster and Adkins (1869) estimated that approximately 100,000 adult Atlantic salmon returned to the Penobscot Rivers historically, since 1967 it has been uncommon for adult returns for the entire Gulf of Maine DPS to exceed 5,000 individuals (Fay et al., 2006, USASAC, 2014). Adult returns have remained low since 2011; only 376 individuals returned to the Gulf of Maine area in 2014, a 24 percent decrease from 2013 (USASAC, 2014). In 2016, 626 adult salmon returned to USA rivers; of these, 616 returned to the Gulf of Maine (USASAC, 2017).

Figure 5-8 – Estimated Total Returns to New England for Outer Bay of Fundy (OBF), GOM DPS, Central New England Complex (CNE), and Long Island Sound (LIS) Complex from 1967 to 2014



CRITICAL HABITAT FOR ATLANTIC SALMON IN THE GULF OF MAINE DISTINCT POPULATION SEGMENT

Section (5)(A) of the Endangered Species Act defines "critical habitat'' for a threatened or endangered species as:

> *(i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of this Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of this Act, upon a determination by the Secretary that such areas are essential for the conservation of the species.*

Coincident with the June 19, 2009, Atlantic salmon listing, NMFS designated critical (74 FR 29300; June 19, 2009). The final rule was revised on August 10, 2009, (74 FR 39003; August 10, 2009) in which designated critical habitat for the Atlantic salmon was revised to exclude trust and fee holdings of the Penobscot Indian Nation. Reeds Brook is not classified as critical habitat for species recovery (74 FR 29300; June 19, 2009).

In its stakeholder response, the National marine Fisheries Service said "Green Lake … occurs within the designated *critical* habitat for [Atlantic salmon]." (emphasis added) (Appendix B)

In its application for relicensing the Ellsworth Project, Black Bear discusses the Gulf of Maine Distinct Population Segment of Atlantic salmon, and notes the area included for all naturally reproducing Atlantic salmon populations includes the Union River, of which Graham Lake is a part. (Green Lake and Reeds Brook are upstream of Graham Lake.) That document notes: "[t]he Ellsworth Project falls within the designated *critical* habitat of the Downeast Coastal Salmon Habitat Recovery Unit for Atlantic salmon (NMFS 2009; Sean McDermott, NMFS, personal communication July 2, 2014)." (emphasis added) (Black Bear, 2015).

Based on these documents, GLWP believes Green Lake is classified as *critical* habitat rather than *essential* habitat for Atlantic salmon. An important part of this critical habitat is the Green Lake National Fish Hatchery and its water supply.

NORTHERN LONG-EARED BAT

The northern long-eared bat (NLEB) is listed as a federally threatened species and is listed as Endangered at the state level. The NLEB was listed as threatened on April 2, 2015, with a final rule published in the Federal Register on January 14, 2016. On April 27,

2016, the USFWS determined that the designation of critical habitat for the species was not prudent; therefore, no critical habitat is established for the NLEB (USFWS, 2018).

The northern long-eared bat feeds on invertebrates and is known to glean prey from vegetation and water surfaces. The NLEB winters in underground caves and cave like structures, but summers singly or in small colonies in cavities, under bark, or in hollows of live and dead trees typically, greater than 3 in. in diameter. Suitable roosting trees also include exfoliating bark, cavities, or cracks (USFWS, 2018).

Since the discovery of White-nose Syndrome (WNS) in 2006 in northeastern United States NLEB populations have experienced die-offs of greater than 90 percent. Specific population decline information for NLEB in Maine is lacking, however, WNS is present in neighboring states. It is predicted that WNS could extirpate cave and mine hibernating bats from the northeastern United States.

While the Project falls within the range of the NLEB it is unlikely that the overwintering or summer roosting occurs with the Project, although feeding may occur over the impoundment.

State Species

Little Brown Bat

The little brown bat (LBB) is listed as state endangered. The LBB was state listed in 2015 based on their decline in Maine and throughout their range in the United States. The LBB is part of Maine's Wildlife Action Plan, which looks at many rare or poorly known species and charts a path for their conservation.

The LBB feeds on feeds on invertebrates such as flying insects, especially mosquitoes, midges, caddisflies, and smaller beetles. This species a member of the cave bats and hibernates (winters) in underground caves or cave like structures, which include tunnels, abandoned mines, and building with a steady temperature of about 2-12 C. Maternity colonies commonly are in warm sites in buildings (e.g., attics) and other structures; also, infrequently in hollow trees (NatureServe, 2017a).

Since the discovery of White-nose Syndrome (WNS) in 2006 in northeastern United States LBB populations have experienced die-offs of greater than 90 percent. Specific population decline information for LBB in Maine is lacking, however, WNS is present in neighboring states. It is predicted that WNS could extirpate cave and mine hibernating bats from the northeastern United States.

While the Project falls within the range of the LBB it is unlikely that the overwintering occurs within the Project, although feeding may occur over the impoundment.

Brook Floater

The Brook Floater is listed as threatened under Maine's Endangered Species Act. The brook floater is found in creeks and small rivers where it is found among rocks in gravel substrates and in sandy shoals, the brook floater inhabits flowing-water habitats only. It occurs in running water and although typically found in riffles and moderate rapids with sandy shoals or riffles with gravel bottoms, it can also be found in a range of flow conditions (NatureServe, 2017b).

Although little is known about the feeding habitats of the species, stomach content analysis indicates freshwater mussels generally feed on mud, desmids, diatoms, rotifers, flagellates, and other unicellular organisms (NatureServe, 2017b).

Glochidia (larval form) of freshwater mussels are typically parasitic on fish. Historically in Maine, the species may have used the Atlantic salmon as a host species to transport larva. The brook floater is a long-term brooder. Like most species of freshwater mussels, the brook floater is long-lived and can live between 30 to 70 years (NatureServe, 2017b).

Tidewater Mucket

The tidewater mucket (TWM) is listed as threatened under Maine's Endangered Species Act. The TWM inhabits ponds, canals, and slow-moving sections of rivers; including artificial impoundments, using substrates such as silt, sand, gravel, cobble, and occasionally clay (NatureServe, 2017c).

This species is a long-term brooder as eggs are fertilized in late summer and glochidia are released the following spring. The only confirmed fish host for this species is white perch (NatureServe, 2017c).

Yellow Lampmussel

The yellow lampmussel (YLM) is listed as threatened under Maine's Endangered Species Act. The YLM occurs in larger streams and rivers, typically found in sand and gravel where good current exists, but has also been seen to inhabit ponds in northern portions of range, but generally prefers flowing water (NatureServe, 2017d).

Dispersal of the species occurs with the glochidia attaching its self to the host fish. Adult mussels may have passive movement downstream (NatureServe, 2017d). Glochidia of the YLM are parasitic on fish while the adult mussels are filter filters.

This species is a long-term brooder where eggs are fertilized in late summer and glochidia are released the following spring (Nedeau et al., 2000).

5.7.3 Threatened and Endangered Botanical Resources and Habitats

On the USFWS list of threatened, endangered, candidate and proposed species in Maine, no plant species are documented as occurring within Hancock County. (USFWS, 2017)

We believe there are no known state-listed plant species within the Project Boundary. (MDIFW, 2003)

5.7.4 Threatened and Endangered Botanical Species Distribution and Life History information

There are no federally or state listed threatened or endangered botanical species anticipated to occur in proximity of the Project.

5.7.5 Affected environment

The Green Lake dam affects the lake level of Green Lake and the flow in Reeds Brook. The dam also has fish screens to avoid passage of most fish and to stop turbine entrainment of large fish.

Project operation also affects the Green Lake National Fish Hatchery.

5.7.6 Environmental analysis

5.7.6.1 Atlantic salmon

Atlantic salmon are native to Green Lake. Atlantic salmon potentially have fish passage into Graham Lake (if fish trapped at the Ellsworth dam are released in the southern end of Graham Lake and not kept as brood stock or released in the Union River above Graham Lake.)

With the current return rates for Atlantic salmon in the Union River, if returning salmon were released into southern Graham Lake and swam to the upper Union River and Reeds Brook proportionally to the drainage area, fewer than one Atlantic salmon in 20 years would swim up Reeds Brook.

Upstream fish passage at the Green Lake dam would risk allowing invasive species and warm water fish from Graham Lake into Green Lake, a cold water lake. Some species, such as largemouth bass, are likely to over-compete with existing fisheries in Green Lake. Green Lake has been a largely landlocked lake for many years. The existing fisheries have likely adapted to that environment.

Per US FWS, fish passage downstream requires at least 25 cfs and upstream fishway requires at least 40 cfs. The Green Lake National Fish Hatchery has priority use of up to

30 cfs from Green Lake. During the summer they typically use much less than this, but most summers with their actual use, the release of 1 cfs minimum flow in Reeds Brook, and no generation, the Project has a water deficit in the lake (the lake level drops). Details on this are in GLWP's *Comments and Information Regarding NMFS Study Dispute*. (GLWP 2020)

Any discussion of Atlantic salmon at the Green Lake project must consider cumulative effects with the Green Lake National Fish Hatchery (Hatchery). The Green Lake project is beneficial to the Hatchery. The Hatchery requires the Green Lake dam for a reliable supply of high quality water. Without the lake level rise caused by the dam, the Hatchery intake pipes would not be able to flow sufficient water to meet their needs. Also, a penstock tap provides the Hatchery with a reliable supply warm, oxygenated surface water during seasons when that is beneficial.

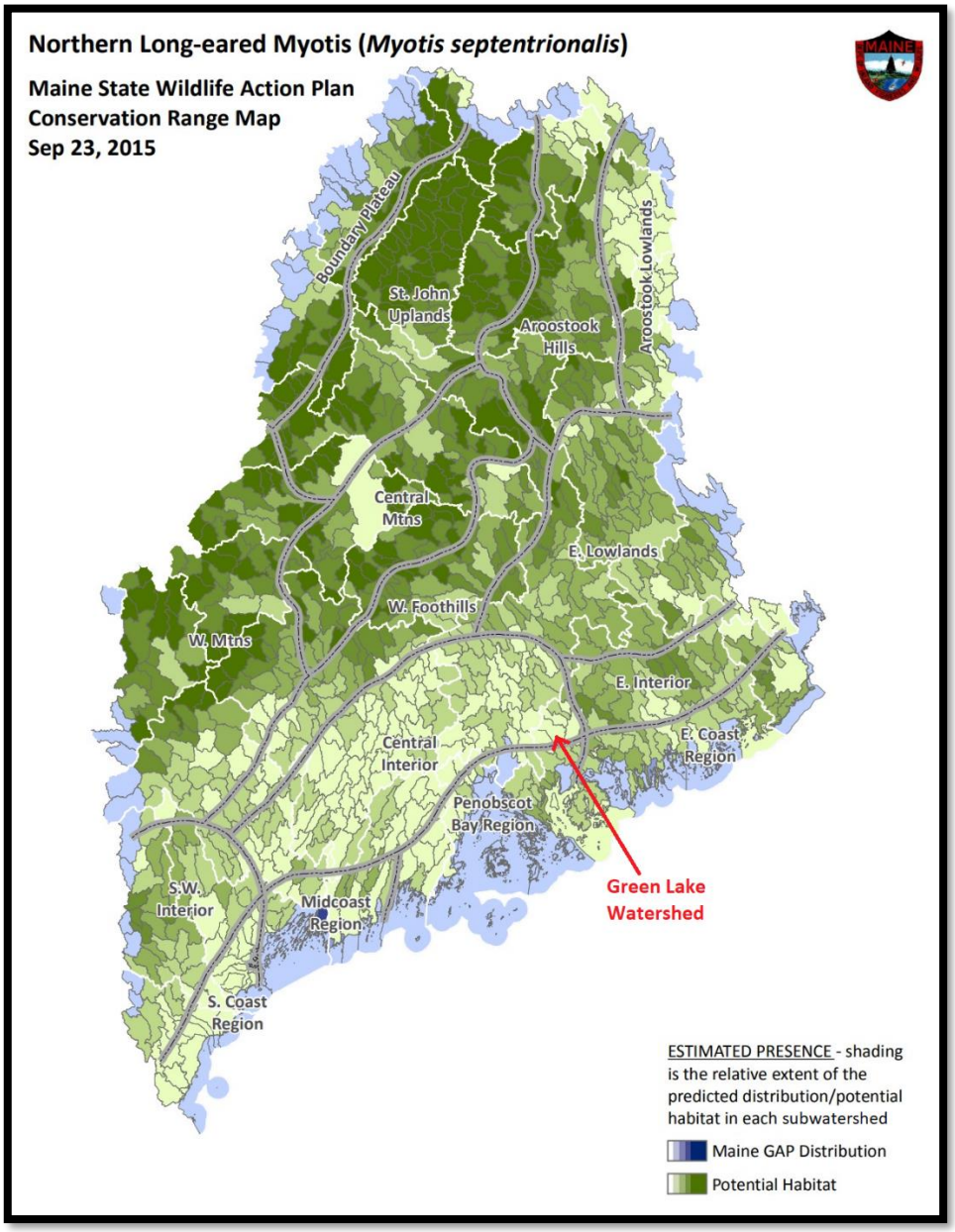
Because of pressure changes in the penstock when the turbine is running, turbine startups must be coordinated between GLWP and the Hatchery. Also, normal penstock patching cannot be performed in the summer and must be deferred until the fall. These Project activities involve expense and inconvenience for GLWP, but they are taken seriously as part of support of the Hatchery and its mission to protect and restore Atlantic salmon.

5.7.6.2 Northern long-eared bat

Northern long-eared bats hibernate in large groups in caves and mines during the winter. During the spring and summer they spend the day roosting in trees and artificial structures, switching roosts every other day on average. Roost trees tend to be close together and within 2000 ft of forage areas. They are well suited to foraging in the forest interior on a diet focused on moths, but they also eat beetles, flies and other insects. They forage under the forest canopy or at the edge of forests. (MDIFW 2015b), (Foster 1999)

Wind turbines are listed as a high severity stressor for little brown bats. Dams/water level fluctuation are not listed as a stressor. (MDIFW 2015)

The Green Lake watershed has a relative estimated northern long-eared bat habitat potential of 2 on a 1-7 scale: (MDIFW 2015b)



GLWP modified: legend "Town" to "Subwatershed", labeled Green Lake

By supporting clean water in the Green Lake watershed and Reeds Brook and maintaining stable water levels during the summer the Project is unlikely to adversely affect northern long-eared bats.

5.7.7 Proposed environmental measures

5.7.7.1 Atlantic salmon

No changes are proposed for Atlantic salmon.

5.7.7.2 Northern long-eared bat

No changes are proposed for northern long-eared bats.

5.7.8 Unavoidable adverse impacts

No unavoidable adverse impacts are expected for threatened and endangered species.

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5.8 Recreation, Land Use, and Aesthetic Resources

5.8.1 Existing Project Recreation Opportunities and Use

Green Lake provides a variety of recreational opportunities which include fishing, swimming, and boating during the warmer seasons and ice fishing in the winter. The lake's high quality water and proximity to the cities of Bangor and Ellsworth make it an attractive area for summer use. As of 2019 approximately 50% of the shoreline is estimated to be developed with private camps and recreational facilities which include a beach and boat launch site maintained by the City of Ellsworth, two private beaches at the north end of the lake, and a tenting area on the east side. A variety of secondary roads provide access to most of the lake shore. The boat ramp was extended and improved during the fall of 2018

There are no project-specific recreational facilities within or adjacent to the Project Boundary.

There are hiking trails at the Green Lake National Fish Hatchery.

> From the Green Lake National Fish Hatchery website:
>
> "These trails pass glacial erratics and old cellar holes and reward visitors with a bench overlooking Green Lake. A self-guided tour features information about the stocking program and a look at young salmon."
>
> https://www.mainetrailfinder.com/trails/trail/green-lake-national-fish-hatchery-trails

Also, the Green Lake Association contributes to the quality of the lake and recreation in the area. Their website states:

> "The Green Lake Association, serving the area surrounding Green Lake in Maine, was formed for charitable, educational and scientific purposes and was officially incorporated as a non-profit organization in 2007. Its objective is to advance and protect Green Lake as a valuable and natural resource. The Association undertakes educational and informational activities that promote the best practices for lake property owners and recreational users of the lake."
>
> https://greenlakeme.com

5.8.2 Regional Recreation Opportunities

Other recreation opportunities in the area include coastal sites, Mount Desert Island including Acadia National Park and Bar Harbor, numerous lakes, streams, and ponds, and so forth.

5.8.2.1 State Recreation Areas

There are no known state recreation areas in the project vicinity.

5.8.2.2 County/Municipal Recreation Areas

The City of Ellsworth maintains a beach and boat launch site. As of 2019, the boat launch site is being improved and extended to provide improved access to the lake by boaters during periods of low water.

5.8.3 Recreation Needs Identified in Management Plans

2014-2019 Maine State Comprehensive Outdoor Recreation Plan

The Maine State Comprehensive Outdoor Recreation Plan (MSCORP) provides information on the supply and demand for outdoor recreation opportunities in Maine, assesses recreation issues, provides an implementation plan, as well as serves to qualify Maine for funding from the federal Land and Water Conservation Fund (LWCF) to acquire or develop lands for public outdoor recreation. There are no recommendations

specific to the Green Lake Project. Recreation priorities outlined in the MSCORP that may bear relevance to the Project are (MDACF, 2015):

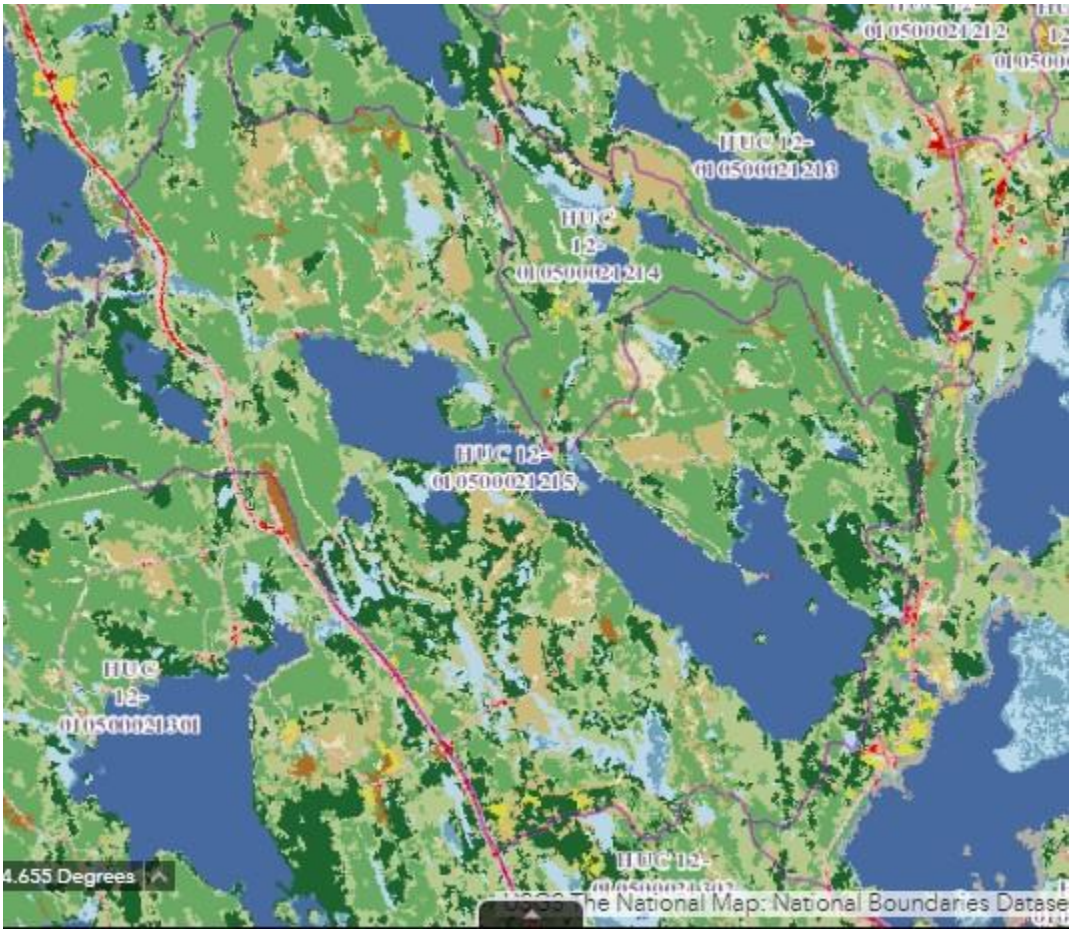
- To connect Mainers with the health and wellness benefits of outdoor recreation;
- To support regionally connected trail systems in less developed regions to increase access and enhance economic development;
- To connect to future tourism markets through recreation interests; and
- To increase access to and awareness of local and regional recreation opportunities through effective communication and collaboration between the public, municipal, and private landowners.

Green Lake and Reeds Brook do not appear to be part of any State Management Plan for public reserved land.

5.8.4 Land Uses and Management Within the Project Vicinity

See Table 5-12 in Section 5.10.1 below for land cover and land use data for the Maine Coastal Watershed, Hancock County, and the state. Based on that table, the watershed land cover is primarily forested (approximately 70%), woody wetland (approximately 12%), and scrub/shrub (approximately 7-8%).

Figure 5-9 – Green Lake Area Land Cover -- Map



Source: USGS, 2018

Figure 5-10 – Green Lake Area Land Cover – Image

Source: Google Maps, 2018

5.8.5 Land Use and Management of Project Lands

Project operations and maintenance are the primary activities that occur on project lands. There are no formal public recreation facilities at the Project and access to the dam is closed to unauthorized vehicles. There is a foot path that goes near the southwest end of the dam that is maintained by the GLNFH.

5.9 Aesthetic Resources

5.9.1 Visual Character of the Project Vicinity

The Green Lake Project is on Green Lake in Hancock County, Maine. Green Lake is located in a rural region which provides a variety of scenic and aesthetic resources. The lake's scenic shoreline, high quality water, and recreational opportunities attract both seasonal and year-round residents (GLWP, 1983)

Photo 5-1 – Green Lake

5.9.2 Visual Character of Project Lands and Waters

Project facilities include a 3-story powerhouse, of which only one story is visible from the access road. Green Lake is a glacially-formed lake lined with forest, woody wetland, and scrub/shrub areas. Much of the shoreline has private year-round and seasonal residences and camps.

Photo 5-2 – Green Lake

5.9.3 Nearby Scenic Attractions

See Sections 5.8.2 and 5.8.3 above for a description of recreational opportunities in the general area of the project.

5.9.4 Affected environment

The project affects the lake level in Green Lake. This affects docks, beaches and boat ramps on Green Lake.

5.9.5 Environmental analysis

Green Lake is a scenic, deep-water lake. It is desirable place to have a seasonal camp or year-round residence, and is popular for boating and fishing. It has a boat ramp and beach created and maintained by the City of Ellsworth on the southwest side near the middle of the lake. The boat ramp was recently extended so that it is usable at lower water levels in the fall. There is a commercial beach at the extreme northwest end of the lake and various private beaches around the lake. There are about 218 docks on the lake associated with camps and residences. Typically docks and floats are deployed in the spring and moved onto the shore, outside the reach of water and ice during the winter.

Much of the shore of Green Lake is rocky, with boulders or large cobble of varying sizes. During the 2020 study period an erosion survey was done, and no serious major or progressing erosion was found. Study results are in section 7 below.

Traditionally, other than ice fishing and other on-ice activities, recreational use of the lake has been during the summer period. The construction of year-round residences around the lake has started to change that somewhat. Depending on the weather conditions of any particular fall, residents may want to use the lake into September, and some years into October. A warming climate would further this shift.

Current project operations give priority to recreational uses of the lake during the summer. During the summer the water level is maintained within six inches of 160.2 feet NGVD29 datum. This stable water level facilitates the use of simple dock structures and increases predictability when navigating boats around rocks.

Outside the summer months, other factors are foremost in the management objectives. With concerns about dewatering fish eggs laid in the fall, the fall water level sets the minimum allowed water level until the following summer. This means that having room in Green Lake to absorb heavy spring runoff requires the lake be drawn down in the fall, and that the drawdown is completed before the fish in question spawn.

Another issue affecting lake residents as more permanent dock structures are built around the lake is ice. The maximum drawdown allowed by the Project is 2.2 feet below the summer range. During a heavy ice year with ice motion this is not enough of a height buffer to guarantee that structures that are near or under water in the summer will be protected from ice. It is not uncommon to have 2.5 feet of ice on some parts of the lake. When this ice is floating it rises about 3 inches above the water level, but pushed against the shore by wind it will rise 30 inches above the bottom.

The weather in the Ellsworth area is affected by the ocean more than non-coastal areas of central Maine. Some winters have thaws throughout the winter that keep an appreciable snowpack from forming. These winters may have cold dry spells that build significant ice on the lake as well. Without a snowpack to refill the lake in the spring, the lake must be kept reasonably full during the winter to avoid the lake level being too low during the following summer. These winters have the combined problem of higher than is considered "normal" water levels plus reasonably thick ice.

5.9.6 Proposed environmental measures

No changes are proposed at this time.

5.9.7 Unavoidable adverse impacts

Water level fluctuations, waves and ice conditions are inherent in the lake, whether the lake level is managed or not.

5.10 Cultural resources

5.10.1 History of the Project Vicinity

The State of Maine's cultural history began during the Paleo-Indian Period around 11,500 years before present. Before contact, about 20,000 Indians lived in Maine. As the "People of the Dawn," they shared language, culture, and ancestry with the larger Wabanaki confederation across New England and eastern Canada. The Ellsworth area was originally inhabited by members of the Passamaquoddy and Penobscot tribes. (MHO 2010a, Wikipedia 2019).

The first documented European visitor to Maine was Florentine seafarer Giovanni da Verrazano (~1485-1528), who came from France in search of gold. In the 1600's Pierre Du Gua, Sieur de Monts, and French Royal Geographer Samuel de Champlain established a colony on a small island at the mouth of a river they named St. Croix, at Passamaquoddy Bay (MHO 2010a).

The Penobscot River was used to explore the Maine lands during which time the explorers created a friendship with the Abenaki sagamore Bessabez (or Bashaba). (MHO 2010a).

In the 1700s inland towns became anchored to water sources. As millwrights gained economic footing, water power sites, attracted general stores, public houses, warehouses, distilleries, foundries, blacksmith shops, carding and fulling mills, spinning factories, or gristmills, and substantial towns formed. Around 1763 a party of English settled in the Union River area. They intended to build dams and sawmills to exploit the area's timber and water power. In the latter part of the 1700's ship building became a significant industry on the Union River. (MHO 2010b, Wikipedia 2019).

In the second half of the 1800s the lumber, leather, granite, ice, slate, fish, and lime industries still supported more than 40 percent of Maine's working population at the end of the century (MHO 2010c).

Between 1880 and 1900 some 40 mills were built in Maine to take advantage of the water resource, sustaining one of the most active periods of industrial expansion in Maine's history. This growth of mills moved the industries to the water, building new industrial centers in small towns and wilderness regions in the upper Androscoggin, Kennebec, and Penobscot River Basins (MHO 2010c).

Without access to cheap coal for steam power, hydroelectric power transmission promised to overcome these barriers. The hundreds of waterpower sites in upland Maine effectively placed a ceiling on development in the late 1800s monopolizing the energy by the rivers (MHO 2010c).

Before World War II, Maine hosted some 37 pulp and paper mills, 80 textile mills, and 11 large tanneries. The resulting pollution and related impacts to public health triggered the motion of river authorities, boards and other pollution control networks, and eventually contributed toward development of the federal Water Quality Act of 1965 (MHO 2010d).

The effort to restore migratory fish received a boost in 1997 when the Edwards Dam in Augusta became the first in history to have its license renewal refused by the Federal Energy Regulatory Commission, because its environmental costs outweighed its economic benefits. After the dam was removed, subsequent years saw dramatic increases in sea-run and resident fish and in osprey, bald eagles, heron, cormorants, and kingfishers (MHO 2010e).

A similar restoration project on the Penobscot River was undertaken with the Penobscot Indian Nation, American Rivers, Maine Audubon, Natural Resources Council of Maine, and Trout Unlimited to form the Penobscot River Restoration Trust in 2005. The migratory fish restoration project, like other aspects of Maine's environmental movement, reflected a strong commitment to forging ahead economically while preserving the best of Maine's past (MHO 2010e).

Hydropower continues to play an important role in electricity generation in the state. Maine produces more hydropower per capita than any other state east of the Mississippi (U.S. Energy Information Administration, 2013). Based on data derived from the U.S. Energy Information Administration, Form EIA-923, "Power Plant Operations Report" in 2012 hydroelectric generation was estimated at approximately 3,732 GWh, or 26% of the total energy generated in Maine. (Kleinschmidt, 2015)

5.10.2 Identification Of Historic And Archaeological Site In The Project Vicinity

No sites listed on the National Register of Historic Places are located within the Project boundary or within 2.5 miles of the project boundary (NPS, 2014).

5.10.3 Prior Cultural Resource Investigations

In 2011 a phase I survey was completed of the Nevells Shore Subdivision project by the Northeast Archaeology Research Center, Inc. No Native American or historic Euroamerican cultural material was recovered during this work. On the basis of the negative results of the survey, it is unlikely that significant Native American sites are present in the project and no further archaeological work is recommended for the Nevells Shore Subdivision Project. The archaeological report is included in the MHPC-Files attachment with this submission.

GLWP is not aware of any other prior cultural resource investigation in the project boundary.

In its application for the original license, GLWP noted: "The Maine Historic Preservation Commission has identified several prehistoric Indian archaeological sites along the western shore of Graham Lake near Reeds Brook. The sites contain scattered prehistoric stone tools deposited in mud beneath the water surface" (GLWP, 1983). It should be noted these areas are outside the project boundary.

Continued project operation will have little or no change to the condition of these sites.

5.10.4 Tribal Resources

GLWP is not aware that the Project affects any Native American tribe. There are no Native American lands, known Native American traditional cultural properties or religious properties, or National Register-eligible or -listed sites associated with Native American Nations within the Project boundary to GLWP's knowledge.

The representatives of tribes in Maine have been included in the licensing process.

TRIBES OF MAINE	ADDRESS
Aroostook Band of Micmacs	7 Northern Road Presque Isle, ME 04769
Houlton Band of Maliseet Indians	88 Bell Road #1 Littleton, ME 04730
Passamaquoddy Tribe – Indian Township	PO Box 301 Princeton, ME 04668
Passamaquoddy Tribe – Pleasant Point	PO Box 343 Perry, ME 04667
Penobscot Nation	12 Wabanaki Way Indian Island, ME 04468

Source: USDOI (no date)

The only tribe to communicate with GLWP regarding the relicensing is the Houlton Band of Maliseet Indians. They have not participated in the relicensing process but have provided these comments:

"We do not have an immediate concern with your project or project site and we do not currently have the resources to fully investigate same. Should any human remains, archaeological properties or other items of historical importance be unearthed while working on the project, we recommend you stop your project and report your findings to the appropriate authorities including the Houlton Band of Maliseet Indians."

5.10.5 Architectural

An architectural survey was done for the project in 2020. No architectural properties associated with the Project were found eligible for listing in the National Register of Historic places. The Maine State Historic Preservation Commission concurred. See study results in section 7.0 below.

5.10.6 Archeological

The Maine State Historic Preservation Commission determined, during the original licensing of the Green Lake project that it would not affect archeological resources:

MAINE HISTORIC PRESERVATION COMMISSION
55 Capitol Street
Augusta, Maine 04333

Earle G. Shettleworth, Jr.
Director

Telephone:
207-289-2133

September 14, 1981

Mr. Frank H. Dunlap
Kleinschmidt and Dutting
75 Main Street
P. O. Box 76
Pittsfield, Maine 04967

re: Green Lake Hydroeclectric Project, FERC #4894

Dear Mr. Dunlap:

My staff archaeologist, Dr. Arthur Spiess, has carefully field checked the project area for the proposed Green Lake Hydroelectric Project. There are archaeological sites nearby, but they are outside the project impact area.

I find that this project will have no effect upon any structure or site of historic, architectural, or archaeological significance as defined by the National Historic Preservation Act of 1966.

If I can be of further assistance concerning this matter, please do not hesitate to let me know.

Sincerely,

Earle G. Shettleworth, Jr.
State Historic Preservation Officer

EGS/slm

No changes to the basic project boundary are being requested during relicensing, and no erosion was found that would extend the area of potential affect beyond that of the original project. See study results in 7.0 below.

5.11 Socioeconomic Conditions

The following section provides a summary of selected socioeconomic variables for the project vicinity, Hancock County, as well as the City of Ellsworth and the state of Maine.

5.11.1 GENERAL LAND USE PATTERNS

Table 5-12 Land Use patterns for the Maine Coastal Watershed, Hancock County and Maine -- 2010

	Maine Coastal Watershed		Hancock County		Maine	
	(sq. mi.)	(% non-water area)	(sq. mi.)	(% non-water area)	(sq. mi.)	(% non-water area)
Land Cover by Type						
Developed, High Intensity	19.17	0.65%	10.55	0.66 %	157.25	0.51 %
Developed, Low Intensity	47.60	1.62 %	26.30	1.65 %	364.11	1.18 %
Developed, Open Space	12.86	0.44 %	5.59	0.35 %	135.46	0.44 %
Grassland	77.57	2.65 %	37.21	2.33 %	439.23	1.42 %
Agriculture	94.95	3.24 %	28.95	1.81 %	1,345.91	4.35 %
Forested	1,915.74	65.36 %	1,137.90	71.29 %	21,729.09	70.16 %
Scrub/Shrub	240.15	8.19 %	111.12	6.96 %	2,543.41	8.21 %
Woody Wetland	393.56	13.43 %	185.38	11.61 %	3,536.11	11.42 %
Emergent Wetland	80.15	2.73 %	35.74	2.24 %	458.13	1.48 %
Barren Land	49.24	1.68 %	17.32	1.09 %	261.45	0.84 %
Open Water	1,853.32	----	754.95	----	4,346.80	----

Source: NOAA, 2010

5.11.2 POPULATION PATTERNS

Table 5-13 Population Statistics for the City of Ellsworth, Hancock County and Maine, 2020

	City of Ellsworth	Hancock County	Maine
Population			
Population (2021 estimate)	8,531	56,192	1,372,247

	City of Ellsworth	Hancock County	Maine
Population (2020)	8,399	55,478	1,362,359
Population Growth (2020 to 2021)	1.9%	1.3%	0.7%
Geography (2020)			
Land area in square miles	79.29	1,587.13	30,845.10
Population Density	105.9/sq. mi.	35.0/sq.mi.	44.2/sq.mi.
Gender (2020)			
Male	46.1%	48.6%	49.3%
Female	53.9%	51.4%	50.7%
Age (2020)			
Persons under 5 years old	2.7%	3.9%	4.5%
Persons under 18 years old	17.5%	16.6%	18.4%
Persons 18 to 64 years old	59.9%	53.4%	55.4%
Persons 65 years old and over	19.9%	26.1%	21.7%
Race (2020)			
Caucasian	95.5%	95.5%	94.2%
Black	0.3%	1.1%	1.8%
American Indian and Alaska Native	1.6%	0.5%	0.7%
Asian	1.3%	1.3%	1.4%
Native Hawaiian and Other Pacific Islander	0.0%	Z	Z
Hispanic or Latino	1.4%	1.7%	2.0%
Two or more races	1.1%	1.5%	1.9%

Z -- Value greater than zero but less than half unit of measure shown
Source: United States Census Bureau – Population Statistics

5.11.3 PROJECT VICINITY EMPLOYMENT SOURCES

Table 5-14 Employment Statistics for the City of Ellsworth, Hancock County, and Maine, 2020

	City of Ellsworth	Hancock County	Maine
Civilian Labor Force Employment Status – 16 Years and Over - 2020			
Percentage Employed	68.4%	60.1%	60.3%
Total Employed Civilian Population:	4,697	28,029	675,784
Industry for the Civilian Employed Population 16 Years and Over – 2020	1.4%	6.8%	2.4%

Agriculture, forestry, fishing, and hunting, and mining			
Construction	7.0%	7.6%	7.3%
Manufacturing	6.2%	5.6%	8.7%
Wholesale Trade	0.9%	1.9%	2.0%
Retail Trade	11.3%	11.5%	12.9%
Transportation & Warehousing, and utilities	6.6%	3.9%	4.1%
Information	1.5%	1.2%	1.6%
Finance and insurance, and real estate and rental and leasing	4.5%	4.4%	6.3%
Professional, scientific, and management, and administrative and waste management services	11.8%	13.3%	9.2%
Educational services, and health care and social assistance	32.6%	26.2%	28.0%
Arts, entertainment and recreation, and accommodation and food services	11.0%	9.0%	8.4%
Other services, except public administration	3.4%	5.5%	4.6%
Public administration	1.7%	3.1%	4.4%

Source: United States Census Bureau – Employment

5.12 References

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6.0 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2) of the FPA, 16 U.S.C. § 803(a)(2)(A), requires FERC to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project. On April 27, 1988, FERC issued Order No. 481-A, revising Order No. 481, issued October 26, 1987, establishing that FERC will accord FPA Section 10(a)(2)(A) comprehensive plan status to any federal or stat plan that: (1) is a comprehensive study of one or more of the beneficial uses of a waterway or waterways; (2) specifies the standards, the data, and the methodology used; and (3) is filed with the Secretary of FERC.

FERC currently lists 40 comprehensive plans for the state of Maine (FERC 2021). Of the listed plans, FERC named the following 20 plans, that may be relevant to the project, in the Green Lake Scoping Document 2.

6.1 FERC-Approved State of Maine Comprehensive Plans

State of Maine Comprehensive Rivers Management Plan, May 1987 – Volume 1

Volume 1 contains the Comprehensive Hydropower Plan issued by the Maine Office of Energy Resources (MOER) in October 1982. The Comprehensive Hydropower Plan consists of three parts: Maine Rivers Policy, The Projected Contribution of Hydroelectric Generation to Meeting Maine's Electricity Needs in 1990 and 2000, and the Statewide Fisheries Plan, Summary.

"Maine Rivers Policy," Executive Order No. 1, FY 82/83

On July 6, 1982, Governor Joseph E. Brennan issued the above-captioned Executive Order designating certain river stretches as meriting special protection. The Governor ordered that no new dams shall be constructed on these stretches and that additional development or redevelopment of existing dams on these stretches be designed and executed in a manner that either enhances significant resources values or does not diminish them. This policy was adopted legislatively as part of the Maine Rivers Act.

The Project is not located on one of the listed river segments meriting special protection. Therefore, the order is not applicable to the Project.

The Projected Contribution of Hydroelectric Generation to Meeting Maine's Electricity Needs in 1990 and 2000 (Maine Office of Energy Resources, October 1982)

Executive Order No. 1, FY82/83 directed MOER to prepare an estimate of the contribution that hydropower could make to meet the State's electricity needs in the years 1990 and 2000. The report was prepared in 1982; therefore, much of the information in the MOER report is outdated. However, the report does stress that Maine's energy policy "call for increased reliance on indigenous and renewable resources, such as hydro, in preference to imported and nonrenewable resources, such as oil."

The Project currently conforms with this portion of the Plan in that it contributes hydroelectric generation (an indigenous and renewable resource) in meeting Maine's electricity needs. The new license for the Project is projected to be issued in 2024 and the Project will continue to conform with this portion of the Plan.

Statewide Fisheries Plan, Summary (Maine Department of Inland Fisheries and Wildlife, June 1982)

The Statewide Fisheries Plan evaluates, by river basin, whether new or improved fish passage facilities may be needed at hydro development sites. It also specifies the fishery agencies' management goals, as they existed in 1982. This Plan represents the policies of the three author agencies (Maine Department of Inland Fisheries and Wildlife [MDIFW], Department of Marine Resources [DMR], and Atlantic Sea-Run Salmon Commission – now under the auspices of the Division of Sea-run Fisheries and Habitat within the Maine DMR) regarding conservation, management, and enhancement of river fishery resources in Maine. The Plan also identifies and evaluates significant river fisheries based upon several criteria. The Plan was written before the Green Lake Project existed but it states that at the Ellsworth Project, "No fish passage is required at this time".

State of Maine Comprehensive Rivers Management Plan, May 1987 – Volume 2

Volume 2 of the State of Maine Comprehensive Rivers Management Plan consists of the 1982 Maine Rivers Study. The Maine Rivers Study, generated by the Maine Department of Conservation (MDOC) and the National Park Service (NPS), defines a list of unique and natural recreation rivers and classifies the rivers as A, B, C, or D. This study, prepared by the Maine Department of Conservation and National Park Service, identifies the main stem of the Union River from its outlet in Union Bay to Graham Lake, as Class C waters. The project is not directly on the main stem of the Union River.

Details regarding resources related to the project are in Section 5 of this document.

State of Maine Comprehensive Rivers Management Plan, May 1987 – Volume 3

Volume 3 of the State of Maine Comprehensive Rivers Management Plan contains two parts. Part I is a compilation of laws which affect the construction, operation, maintenance, and licensing of hydro projects in Maine. Part II is a compilation of Executive Department Orders and other plans. (Note: A discussion of revised laws and Executive Department Orders implemented after the submittal of Volume 3 to the FERC in 1987 is contained in Volume 4 of the State of Maine Comprehensive Rivers Management Plan submitted to FERC in 1992, see discussion below.)

Volume 3, Part I – Core Laws

The applicability of these Core Laws to the Green Lake Project are discussed below.

Maine Rivers Act

> In the Maine Rivers Act 12 M.R.S.A.§401 et. seq., the Legislature expressly found: …..the state's rivers comprise one of its most important natural resources, historically vital to the state's commerce and industry; that the value of the state's rivers and streams has increased

due to the growth in demand for hydropower; that the rivers and streams afford Maine people with major opportunities for economic expansion through the development of hydropower; and that "the best interests of the state's people are served by a policy which recognizes the importance that their rivers and streams have for meeting portions of several public needs, provides guidance for striking a balance among the various uses which affords the public the maximum benefit and seeks harmony rather than conflict among these uses." 38 M.R.S.A.§402(6).

Green Lake has consulted with and actively worked to resolve issues as they were raised by appropriate federal and state agencies, tribes, local governments, and non-governmental organizations (NGOs) during the relicensing process. This process has identified the importance of continued operation of the Project while identifying the relative importance of the lake and brook and their resources for various uses in providing public benefits. The Project conforms with these Core Laws.

Maine Waterway Development and Conservation Act (MWDCA) 38 M.R.S.A.§630 et. seq.

The MWDCA replaced several earlier laws and requires the developer to obtain one permit from the Maine Department of Environmental Protection (MDEP) or the Land Use Planning Commission (LUPC). The legislature emphasized the importance of hydropower to the State of Maine when it enacted the MWDCA.

> The legislature finds and declares that the surface waters of the State constitute a valuable indigenous and renewable energy resource; and that hydropower development utilizing these waters is unique in its benefits and impacts to the natural environment, and makes a significant contribution to the general welfare of the citizens of the State for the following reasons:
>
> - Hydropower is the State's only economically feasible, large-scale energy resource which does not rely on combustion of a fuel, thereby avoiding air pollution, solid waste disposal problems and hazards to human health from emissions, wastes and byproducts. Hydropower can be developed at many sites with minimal environmental impacts, especially at sites with existing dams or where current type turbines can be used.
> - Like all energy generating facilities, hydropower projects can have adverse effects; in contrast with other energy sources, they may also have positive environmental effects. For example, hydropower dams can control floods and augment downstream flow to improve fish and wildlife habitats, water quality and recreation opportunities.
> - Hydropower is presently the State's most significant indigenous resource that can be used to free our citizens from their extreme dependence on foreign oil for peaking power.

GLWP is proposing to continue to operate the Project to provide a source of renewable energy available to the people of Maine. Therefore, the continued operation of the Project is consistent

with the policies expressed by the Maine legislature. By continuing to operate the Project as proposed, the energy-related benefits noted above will continue, as will the benefits to fish and wildlife habitat, water quality and recreation opportunities.

An Act Concerning Fishways in Dams and Other Artificial Obstructions in Inland Waterways – 12 M.R.S.A.§7701-A

This act was enacted with the intent of conserving, developing, or restoring anadromous or migratory fish resources by requiring the construction or repair of fishways. The decision to require a fishway at a dam must, under the Act, be based on the restoration of one or more fish species of anadromous or migratory fish to the area upstream of the obstruction. In addition, the decision to require a fishway may be justified by the protection or enhancement of any rare, threatened, or endangered fish species.

See discussion of fishway facilities in Section 5 above.

An Act Concerning Fishways in Dams and Other Artificial Obstructions in Coastal Waters – 12 M.R.S.A.§6121

This act states that the Commissioner of Inland Fisheries and Wildlife shall annually examine all dams and other artificial obstructions to fish passage within the coastal waters in order to determine whether fishways are necessary, sufficient or suitable for the passage of anadromous fish.

See discussion of fishway facilities in Section 5 above.

The Maine Dam Inspection, Registration, and Abandonment Act – 38 M.R.S.A.§815 et. seq.2

This law allows MDEP to establish water level regimes and minimum flow requirements for impoundments not within the jurisdiction of FERC.

This statute is not applicable to the Project since it is a FERC-licensed Project and is not subject to Maine DEP jurisdiction regarding establishment of water levels.

An Act to Amend the Classification System for Maine Waters and Change the Classification of Certain Waters – 38 M.R.S.A.§464 et. seq.

This Act was enacted to restore and maintain the chemical, physical, and biological integrity of the State's waters and to preserve certain pristine state waters. Water quality standards for fresh surface waters established by the Act that are pertinent to the Green Lake Project consist of Class B, and Class GPA waters. The Project conforms with these standards.

Alteration of Rivers, Streams and Brooks – 38 M.R.S.A.§425 et. seq.

This article prohibited the alteration of a river, stream, or brook or areas adjacent to rivers, streams, or brooks due to dredging, filling, or construction such that any dredged spoil, fill or structure may fall or be washed into these waters without first obtaining a permit from the Commissioner. This act was replaced with the Natural Resources Protection Act (NRPA), 38 M.R.S.A.§480-A et. seq.

which regulates similar activities along the State's waters. However, projects that are reviewed under the MWDCA are not subject to review under the Natural Resources Protection Act (NRPA).

The Licensee is not proposing any construction or redevelopment of the Project that would require an NRPA permit. If any construction is proposed in the future, the appropriate permits will be obtained.

Mandatory Shoreland Zoning and Subdivision Control – 38 M.R.S.A.§435 et. seq.

This article requires that lands within 250 feet of the normal high water mark of certain waters or wetlands be subjected to municipal zoning and subdivision control.

The City of Ellsworth and the Town of Dedham currently have zoning requirements for those lands located within 250 feet of the normal high water mark of the Project impoundments.

Land Subdivision – 30-A M.R.S.A.§4401-4407

This article grants special protection from land subdivisions to particular river reaches identified in the article. This article does not include any Project area lands. GLWP is not proposing any construction that would be considered a subdivision. The Project conforms with this article.

Land Use Regulations – 12 M.R.S.A. §681 et. seq

This article requires the sound planning, zoning, and subdivision control of the unorganized and organized townships of the State.

The City of Ellsworth and Town of Dedham are located in an organized portion of the state that is subject to the jurisdiction of the Maine Department of Environmental Protection and local municipalities. The Project conforms to this article.

Special River Protection Zoning Map. Legend List (Maine Land Use Regulation Commission, 1987)

This map identifies river segments that have been designated by the Land Use Regulatory Commission3 for "Special River Protection Zoning." The Project is located in an organized portion of the state that is subject to the jurisdiction of the Maine Department of Environmental Protection and local municipalities. The project is not located in the Special River Protection Zoning area.

Maine Rivers Access and Easement Plan (Joseph Handy, 1985)

GLWP does not manage any recreational facilities. However, we support recreational use of the lake as covered in Section 5.8 above.

Designating the State Agencies Responsible for Water Quality Certification, Executive Order No. 5, FY85/86 Note: Updated Order No. 3, 96/97

This executive order identifies the state agencies responsible for reviewing and authorizing water quality certifications for hydropower projects. Maine DEP has jurisdiction for water quality certification for the licensing of the GLWP Project.

GLWP will apply for water quality certification from Maine DEP in accordance with FERC's regulations.

State of Maine Comprehensive River Management Plan – December 1992 – Volume 4

Volume 4 of the State of Maine Comprehensive River Management Plan consists of three sections. Part I is a summary of the revised Core Hydro Laws subsequent to those contained in Volume 3 which were approved in 1987. Part II is a compilation of Executive Orders and other plans including Maine resource agency policy regarding hydropower. Part III contains reports and studies regarding hydropower and relicensing.

Volume 4, Part I – Revised Core Hydro Laws

The revisions to the Core Hydro Laws contained in Volume 4 of the Plan are not all pertinent to the GLWP Project. The revised Core Hydro Laws that are pertinent to the Project are discussed below.

Hydropower Relicensing Standards

These standards require that existing hydropower impoundments be managed to protect habitat and aquatic life criteria commensurate with the appropriate water quality classifications. The operation of the Project and its consistency with these standards is discussed in Section 3

Volume 4, Part II – Compilation of Executive Orders and Other Plans

Part II of Volume 4, Implementing Plans and Orders, contains State resource agency plans and policies regarding hydropower. The following plans and orders are discussed:

State of Maine Statewide River Fisheries Management Plan, June 1982

This plan is discussed previously under State of Maine Comprehensive Rivers Management Plan, May 1987 – Volume 1.

Addendum to the State of Maine Statewide Fisheries Management Plan, June 1982

The addendum includes the Union River, which it lists as having the potential for two million alewives.

Maine Comprehensive Hydropower Plan, July 1992

This plan assessed the then current and future demand for hydropower in the State of Maine. Hydropower is recognized as a significant resource available for use in meeting current and future energy needs. Operation of the Green Lake Project is consistent with this plan as it will continue to produce reliable, efficient indigenous energy from hydropower to meet the State of Maine energy needs.

Maine State Agency Hydropower Policy Statements

These policy statements provide the basis for agency comments on hydro-project license applications. These statements are not directly applicable to the Green Lake Project as they set out the policy for State agencies to follow in commenting on hydro projects in general. Agency comments on the Project are addressed in full in Exhibit E Appendix A.

Executive Order Designating the State Agencies Responsible for Water Quality Certification

This order identifies Maine DEP as the agency responsible for reviewing and providing water quality certification. GLWP will apply for water quality certification from Maine DEP in accordance with FERC regulations. Project water quality and its consistency with these standards is discussed in Section 5

Feasibility Study of Maine's Small Hydropower Potential

This study was performed for the Maine Office of Energy Resources and examined the potential for development/expansion of hydropower development of Maine's low head dams.

This plan is not applicable to the Green Lake Project.

Maine Hydropower Licensing and Relicensing Status Report 1989-91

These reports update hydropower licensing and relicensing activities in the State of Maine for 1989 through 1991.

Volume 4, Part III – Hydropower and Relicensing Reports and Studies

This section of Volume 4 of the State of Maine Comprehensive River Management Plan describes the current regulations for hydropower relicensing and reports the status of Maine projects with regard to the federal relicensing process.

The studies and reports contained in Part III of the State of Maine Comprehensive River Management Plan are not pertinent to the Green Lake Project.

Department of Inland Fisheries and Wildlife, Maine Department of Marine Resources, and Atlantic Sea-Run Salmon Commission

This plan is discussed previously under State of Maine Comprehensive Rivers Management Plan, May 1987 – Volume 1.

Management of Atlantic Salmon in the State of Maine: A Strategic Plan – July 1984, Maine Atlantic Sea-Run Salmon Commission

This plan lists as its objectives the maintenance of Atlantic salmon populations in rivers where they currently exist, and the restoration of Atlantic salmon populations in historical salmon rivers. The plan also identifies specific strategies to achieve the stated objectives, including fishway installation or improvement, increased hatchery capacity, and diversion of hatchery stocks once natural reproduction increases in stocked rivers. This plan was written in 1984 so the Green Lake Project was not yet built. The Ellsworth Project was not targeted by these restoration plans.

Maine State Comprehensive Outdoor Recreation Plan (SCORP) 2003-2008, Maine Department of Conservation, Bureau of Parks and Lands

This plan serves as the State's official policy document for statewide outdoor recreation planning and for acquisition and development of public outdoor recreation areas and facilities. The plan identifies outdoor recreation issues of Statewide importance based upon, but not limited to, input

from the public participation program and also provides information about the demand for and supply of outdoor recreation resources and facilities in the state. The SCORP satisfies the requirements of the Land and Water Conservation Fund (LWCF) Act (P.I. 88-578) which dictates that each state have an approved SCORP available on file with the National Park Service in order to participate in the LWCF program. The SCORP contains an implementation program that identifies the State's strategies, priorities, and actions for the obligation of its LWCF apportionment. The SCORP also includes a wetlands priority component with Section 303 of the Emergency Wetlands Resources Act of 1986. This wetland component provides information on state wetland conservation planning efforts as reflected in the Maine State Wetlands Conservation Plan published in 2001.

The SCORP does not contain any recommendations or assessments that are specific to the Green Lake Project area. GLWP is in compliance with the strategies outlined in this plan.

6.2 FERC-Approved Federal Comprehensive Plans

Atlantic Salmon Restoration in New England, Final Environmental Impact Statement 1989-2021. U.S. Fish and Wildlife Service, 1989; Recovery Plan for the Gulf of Maine DPS of Atlantic Salmon – NMFS 2018

After originally listing the Gulf of Maine (GOM) distinct population segment (DPS) of Atlantic salmon as endangered in December 2000 and publishing a recovery plan in November 2005, the USFWS and NMFS conducted a second status review and listed an expanded GOM DPS on June 19, 2009. The expanded DPS encompasses all anadromous Atlantic salmon in a freshwater range covering the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River and includes all associated conservation hatchery populations used to supplement these natural populations. Concurrent with the new listing, NMFS identified and designated critical habitat within the range of the expanded GOM DPS.

This recovery plan is based on two premises: first, that recovery actions must focus on rivers and estuaries located in the GOM DPS until we better understand threats in the marine environment, and second, that survival of Atlantic salmon in the DPS will be dependent on conservation hatcheries through much of the recovery process.

Please see Section 5 for more information.

Fisheries USA: The Recreational Fisheries Policy of the U.S. Fish and Wildlife Service

This policy, under the auspices of the 1988 National Recreational Fisheries Policy (National Policy), encompasses the guiding principles, goals, and objectives set forth by the National Policy. The Policy, in short, defines the USFWS's stewardship role in management of the Nation's recreational fishery resources, which include not only angling, but fish watching and photographing. With the Fisheries USA, USFWS committed to accomplish three goals:

- Usability – to optimize the opportunities for people to enjoy the Nation's recreational fisheries.

- Sustainability – to ensure the future of quality and quantity of the Nation's recreational fisheries; and
- Action – to work in partnership with other Federal governmental agencies, states, tribes, conservation organizations, and the public to effectively manage the Nation's recreational fisheries.

GLWP does not manage any recreational facilities. However, we support recreational use of the lake as covered in Section 5.8 above.

Nationwide Rivers Inventory. National Park Service, January 1982, updated 1995

The Nationwide Rivers Inventory (NRI), completed in 1981 for the New England Region, is a survey of the nation's rivers conducted to identify segments meeting the minimum criteria for further study and/or potential inclusion into the National Wild and Scenic Rivers System (NWSRS). Once included on the NRI, a river is protected to the extent that pursuant to Section f(d) of the Wild and Scenic Rivers Act, and in accordance with a Presidential Directive and guidance in the form of "Procedures for Interagency Consultation to Avoid or Mitigate Adverse Effects on Rivers in the Nationwide Inventory," issued by the Council on Environmental Quality:

> "Each federal agency shall, as part of its normal planning and environmental review process, take care to avoid or mitigate adverse effects on Rivers identified in the Nationwide Inventory." [Presidential Directive, August 2, 1979.]

This directive gives guidance to federal agencies on protecting the resources that cause the river to qualify for listing on the NRI.

This directive is not applicable to the Green Lake Project.

North American Waterfowl Management Plan – 1986 U.S. Fish and Wildlife Service and Canadian Wildlife Service

This plan identifies waterfowl population goals and outlines the requirements of a waterfowl management and conservation program that would attain these goals. The plan addresses 37 species of the family *Anatidae*, (i.e., ducks, geese and swans) which occur in both the United States and Canada. The plan also discusses groups of similar species in terms of their ecological niche, distribution, abundance, breeding, population status and outlook, and causes of population declines or increases. The plan outlines a variety of initiatives and recommendations which will protect and enhance waterfowl resources, including: financial incentives for landowners for habitat maintenance; outright purchase of significant habitat; protective zoning; private land conservation promotion; financial participation of private conservation organizations; prioritization of public land management to enhance waterfowl resources; public works planning which considers and mitigates waterfowl resource impacts; and encouragement of joint ventures between private and public groups to enhance and preserve waterfowl habitat. Specific recommendations identify areas to be preserved, bag limits, and other hunting limitations for certain species and survey activities.

The majority of initiatives and recommendations contained in this plan are beyond the scope of GLWPs operation of the Green Lake Project. Continued operation of the Green Lake Project, as proposed, will have no new effects to Project wildlife or their habitats. The Project is in conformance with the plan.

Final Amendment #11 to the Northeast Multi-species Fishery Management Plan; Amendment #1 to the Atlantic Salmon FMP; and Components of the Proposed Atlantic Herring FMP for Essential Fish Habitat. Volume 1. (USFWS, 1998)

In 1996 the U.S. Congress recognized the increasing pressure on marine resources in the country and addressed these problems in its reauthorization of the Magnuson Fishery Conservation and Management Act, now known as the Magnuson-Stevens Act. This Act required the eight Regional Fishery Management Councils, in collaboration with National Oceanic and Atmospheric Administration (NOAA) Fisheries, to give heightened consideration to Essential Fish Habitat (EFH) in resource management decisions. Congress defined EFH as "those waters and substrates necessary to fish for spawning, breeding, feeding or growth to maturity." The designation and conservation of EFH seeks to minimize adverse effects on habitat caused by fishing and non-fishing activities.

The EFH designation for Atlantic salmon represents all waters currently or historically accessible to Atlantic salmon within the streams, rivers, lakes, ponds, wetlands, and other water bodies in Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut. Other species of fish incorporated under the NMFS amendments are not applicable to the Project.

Before a Federal agency proceeds with an activity that may adversely affect a designated EFH (e.g., relicensing of a hydro project), the agency must: 1) consult with NOAA Fisheries and, if requested, the appropriate Council for the recommended measures to conserve EFH and 2) reply within thirty days of receiving EFH recommendations. The agency response must include proposed measures to avoid or minimize adverse impacts on the habitat, or alternatively an explanation if the agency cannot adhere to the recommendation from NOAA Fisheries.

FERC will initiate consultation with NMFS regarding EFH for Atlantic salmon in the Project area following receipt of this application.

As mentioned previously, the CFMP addresses the need for fish passage facilities at the Project in a comprehensive fashion. The state and federal natural resource agencies are signatories to the CFMP, which is consistent with the objectives described in this document.

Fishery Management Report No. 35 of the Atlantic States Marine Fisheries Commission: Shad and River Herring – Technical Addendum 1 to Amendment 1 of the Interstate Fisheries Management Plan for Shad and River Herring

The Atlantic States Marine Fisheries Commission prepared a Fishery Management Plan for the shad and river herring fishery in order to protect and restore the species. The goal of this amendment is to: protect, enhance, and restore East Coast migratory spawning stocks of American shad, hickory shad, and river herrings in order to achieve stock restoration and maintain sustainable levels of spawning stock biomass.

These documents describe the goals and objectives for the species, its current status, the ecological challenges affecting the species, and management options and actions needed to reach and maintain management goals.

Shad and River Herring are discussed in Section 5.4

Interstate Fishery Management Plan for Shad and River Herring Amendment 2 - 2009. Atlantic States Marine Fisheries Commission.

Amendment 2 was developed based on the concern that river herring are in decline coast-wide. Amendment 2 prohibits interstate commercial and recreational fisheries beginning January 1, 2012, unless a sustainable management plan was submitted for approval by a state or jurisdiction by January 1, 2010. Amendment 2 also required fishery independent and dependent monitoring from member states to conserve, restore, and protect critical river herring habitat

Interstate Fishery Management Plan for Shad and River Herring Amendment 3 - 2010. Atlantic States Marine Fisheries Commission.

Amendment 3 establishes a coast wide commercial and recreational moratorium, with exceptions for sustainable systems, for shad and river herring. To improve data collection of shad and herring, Amendment 3 implemented additional fisheries independent and dependent monitoring for some states or jurisdictions, such as, monitoring stocks, hatchery production, and commercial, recreational, and bycatch fisheries. Finally, Amendment 3 requires states and jurisdictions to submit a habitat plan regardless of whether their commercial fishery would remain open.

Fishery Management Report No. 36 of the Atlantic States Marine Fisheries Commission: Interstate Fisheries Management for American Eel (*Anguilla rostrata*) – 2000;

Amendment 2 to the Interstate Fishery Management Plan for American eel – 2008; Addendum III to the Interstate Fishery Management Plan for American eel – 2013; Addendum IV to the Interstate Fishery Management Plan for American eel – 2014.

The Atlantic States Marine Fisheries Commission prepared a Fisheries Management Plan for the American eel fishery in order to protect and restore the species. The Atlantic States Marine Fisheries Commission American Eel Fisheries Management Plan is a working document that describes the goals and objectives for the species, its current status, the ecological challenges affecting the species, and management options and actions needed to reach and maintain management goals. The stated goals of the Fisheries Management Plan are to: (1) protect and enhance the abundance of American eel in inland and territorial waters of the Atlantic States and jurisdictions and contribute to the viability of the American eel spawning population, and (2) provide for sustainable commercial and recreational fisheries preventing the over harvest of any eel life stage.

Amendment 2 recommends stronger regulatory language to improve upstream and downstream passage of American eel. Addendums III and IV establish new management measures for both the

commercial (glass, yellow, and silver) and recreational eel fisheries, as well as implements fishery independent and fishery dependent monitoring requirements.

The American Eel is discussed in Section 5.4

6.3 References:

Federal Energy Regulatory Commission (FERC). 2021. List of Comprehensive Plans. *April 06, 2021* - Available online: https://cms.ferc.gov/media/list-comprehensive-plans Accessed October 25, 2021

7.0 STUDY RESULTS

7.1 Overview

GLWP proposed several studies to be done during the 2020 and 2021 field seasons. Significant progress was made despite the summer of 2020 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 7-1 – Turbine Operation During Study Period

7.1.1.1 Summary List of Studies

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

7.2 Study Results

7.2.1 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 7-1 – 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.

7.2.1.1 Impoundment Trophic State Study 1-1:

Full results for this study are in Appendix C

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).

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 7-2 – 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 and were kept at 4°C +/- 2°C in the interim

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 7-3 – Station #2 – Base Water Samples and Secchi Disk data

In late August the extended samples were collected from both Station #1 and Station #2

	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 7-4 – Late August extended water sample results

7.2.1.1.1 Weekly DO & Temp graphs

The graphs are not included here but can be found in the ISR that was submitted on 11th February 2021 – the ISR is in Appendix C

7.2.1.1.2 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.

7.2.1.1.3 References

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

7.2.1.2 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 aquatic life' will be determined as follows. Using 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%

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 7–1 – Littoral Drawdown Area

7.2.1.2.1 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.
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 7–2 – Littoral Drawdown Volume

7.2.1.2.2 Variances from FERC-approved Study Plan and Proposed Modifications

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

7.2.1.3 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

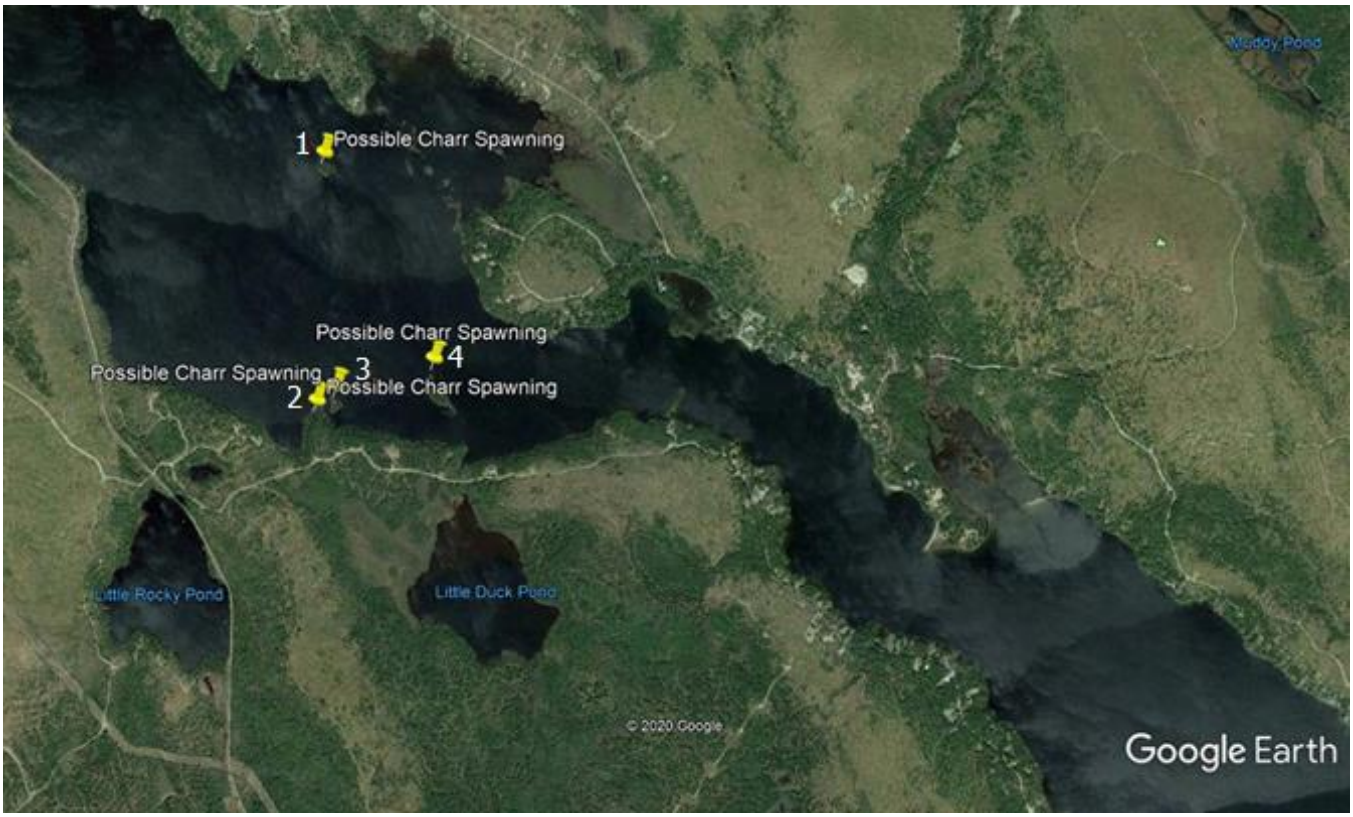


Figure 7–3 – Possible Arctic Char Spawning Sites – Map provided by MDIFW

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.

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

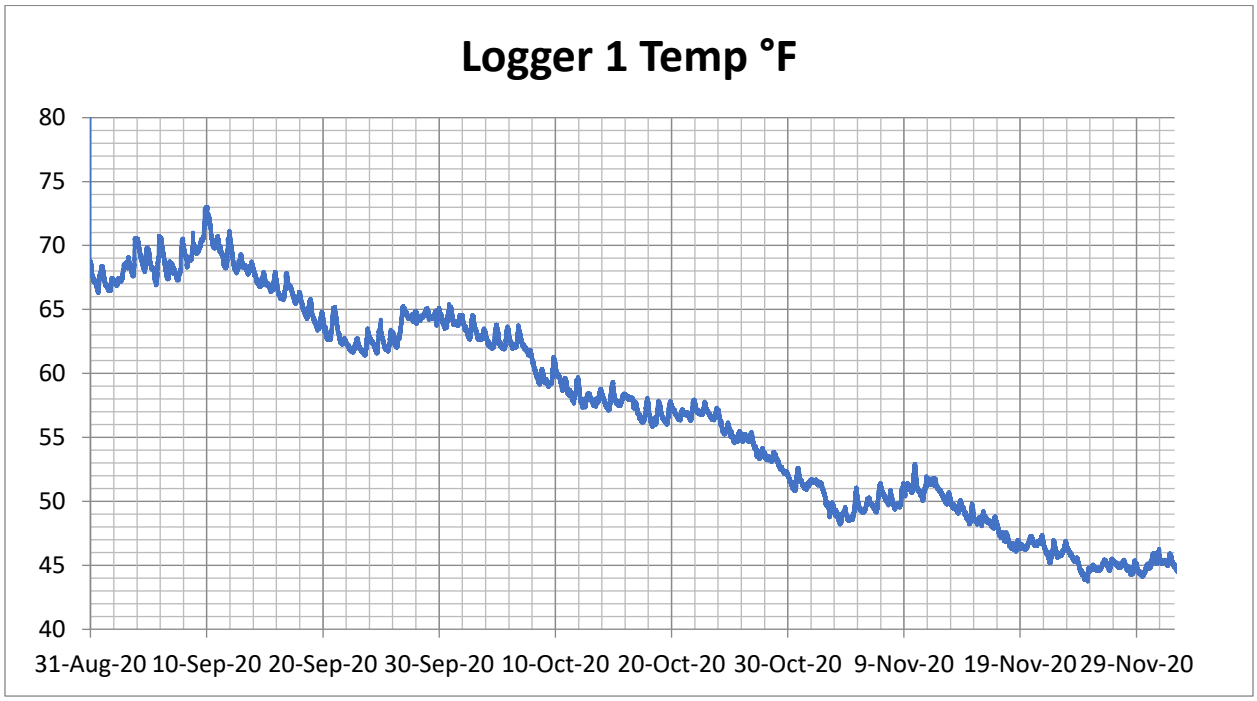


Figure 7–4 – Logger 1 Temp °F Graph – at potential spawning location 4

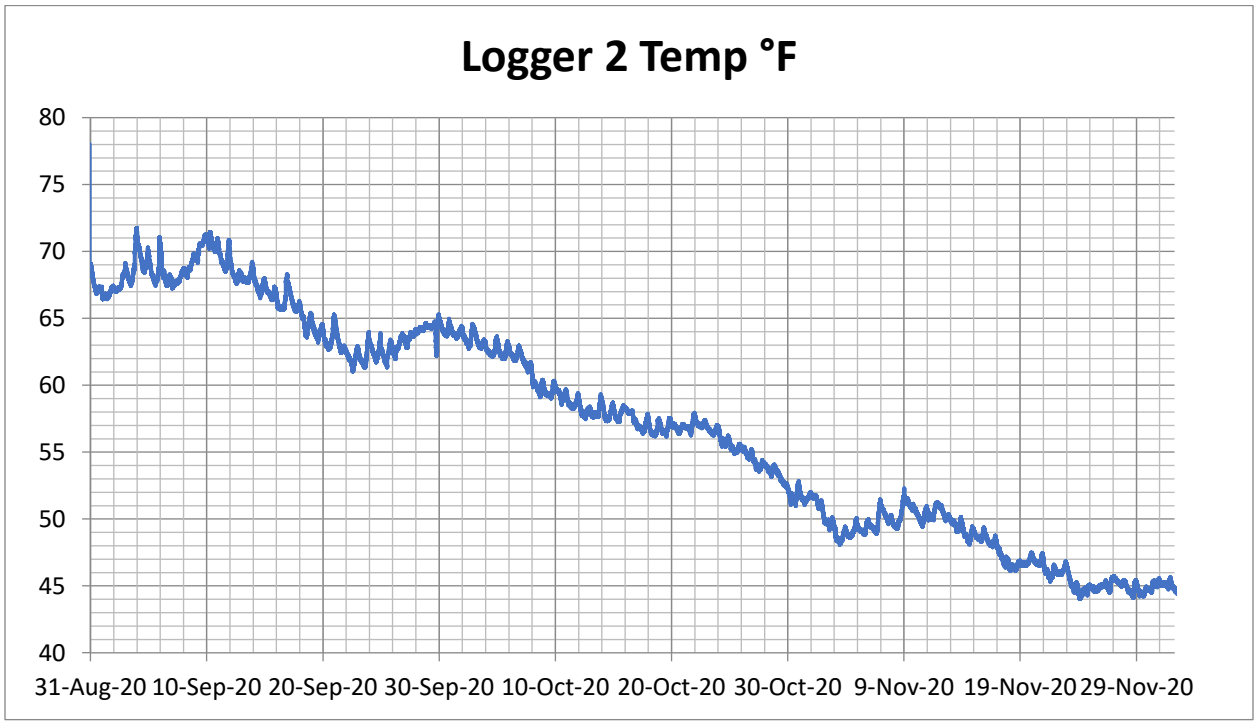


Figure 7–5 – Logger 2 Temp °F Graph – at potential spawning location 2

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

1.1.1.1 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.

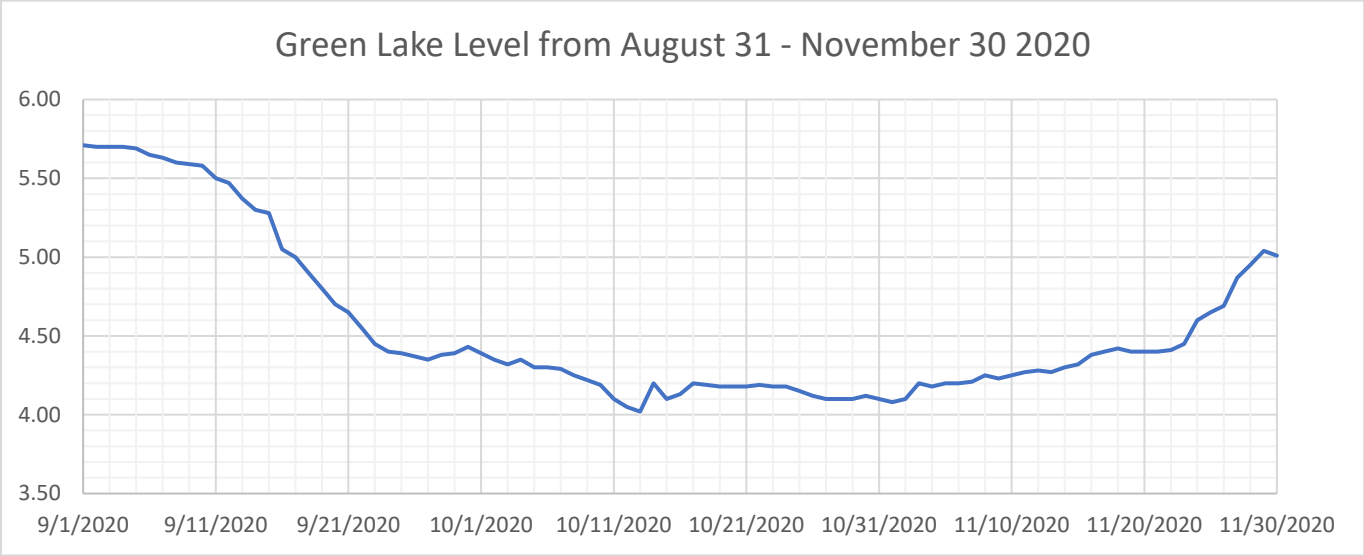


Figure 7–6 – Green Lake Level from August 31 - November 30 2020

7.2.1.3.1 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.

7.2.1.3.2 Variances from FERC-approved Study Plan and Proposed Modifications

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

7.2.1.3.3 References

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

7.2.1.4 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 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.

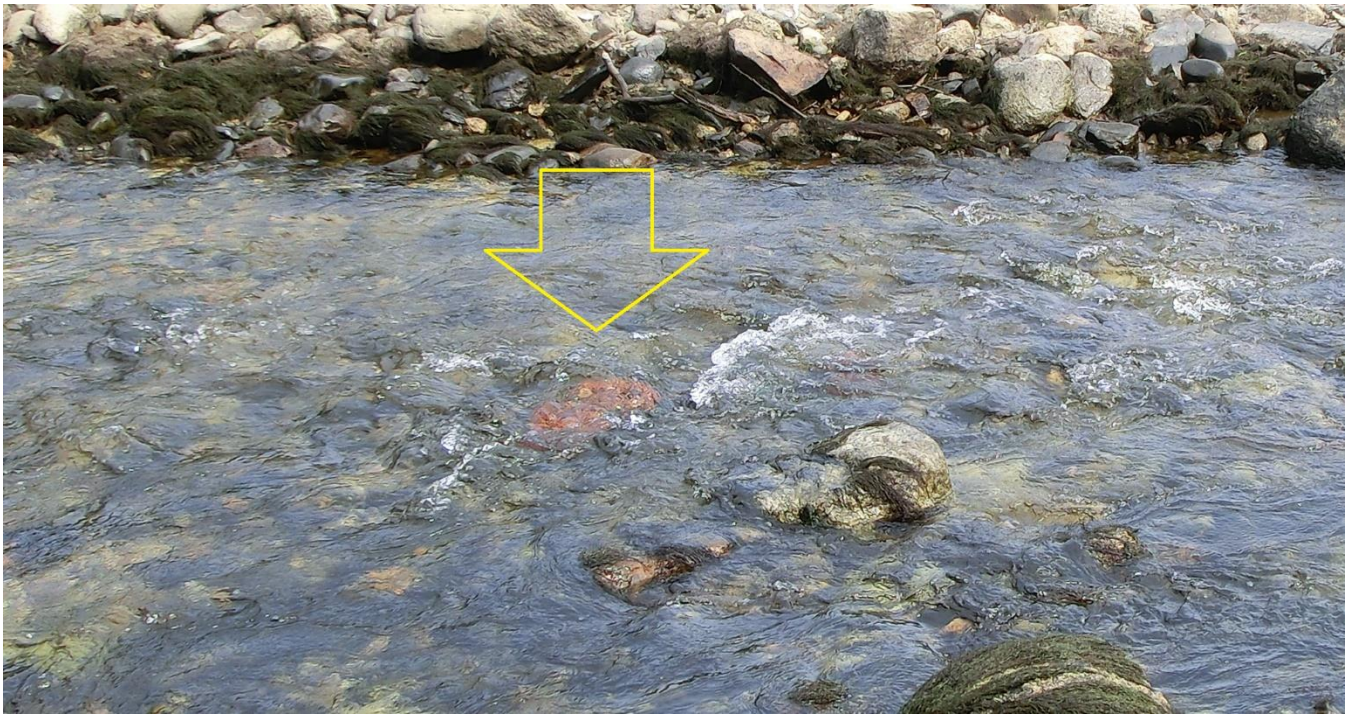


Photo 7-2 – A Rock Filled Basket in Reeds Brook

On September 24, 2020 Paul retrieved the baskets. He then collected the baskets and reviewed the contents. The data for each of the Sites was sent to MDEP for analysis using the Linear Discriminant Model (LDM).

The detailed results for all three sites are included in Appendix C.

MDEPs comments on the DLA include:

Benthic Macroinvertebrate Study - Based on the information included in the DLA, the Department concludes that Class B aquatic life and criteria are met in the bypass reach of Reeds Brook. Department analysis of samples collected in the Project tailrace indicate that Class B aquatic life and habitat criteria are not met, and that the structure and function of the macroinvertebrate community is influenced by the discharge from the fish hatchery outfall and from backwater effects of impounded water levels in Graham Lake. The Department finds that the condition of the macroinvertebrate community is influenced by periodic inundation of the sample location and by

the fish hatchery discharge and is, therefore, not caused by the presence and operation of the Green Lake Hydroelectric Project dam.

Aquatic Habitat Cross-Section Flow Study - Review of the information provided by the Applicant in its DLA including the results of the Aquatic Habitat Cross-Section Flow Study and the Benthic Macroinvertebrate Study, the Department concludes that Project operations are not expected to negatively affect the quality of aquatic habitat downstream of the Project dam. Pending review of the remaining BMI data, the Department tentatively concludes that Green Lake Water Power Company has provided sufficient information to demonstrate that the Project meets Class B aquatic life and habitat criteria.

7.2.1.4.1 Variances from FERC-approved Study Plan and Proposed Modifications

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

7.2.1.5 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).

Figure 7–7 – 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.

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

7.2.1.5.1 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.

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 7-5 – Calculation for Water Temperature and Flow Duration exceeding 1500

The following table provides the DO and temperature for the four locations for the full 10 weeks. The table included in the Initial Study Report was missing the DO Saturation percentage. That has been added to the table below.

					DO 1			DO 2			DO 3			DO 4		
Date	Time	Flow Duration	Average Water Temp	1500.00	Water Temp (°C)	DO (mg/L)	DO (% Sat)	Water Temp (°C)	DO (mg/L)	DO (% Sat)	Water Temp (°C)	DO (mg/L)	DO (% Sat)	Water Temp (°C)	DO (mg/L)	ODO (% Sat)
25-Jul	6:30 AM	94.00	22.98	2159.65	25.0	8.05	97.5	22.0	8.21	94.3	22.9	8.42	98.1	22.0	8.55	98.0
25-Jul	2:17 PM	94.00	25.70	2415.80	27.0	7.62	95.7	25.0	8.72	105.3	26.1	9.14	112.7	24.7	8.45	101.8
31-Jul	6:06 AM	92.00	23.65	2175.80	26.2	7.64	94.6	22.6	8.03	92.8	22.7	8.08	93.7	23.1	8.30	96.9
31-Jul	2:17 PM	92.00	25.93	2385.10	28.0	7.50	95.7	25.3	8.61	104.7	25.3	8.68	105.7	25.1	8.45	102.5
7-Aug	6:09 AM	72.00	21.25	1530.00	24.6	7.94	95.3	19.9	8.83	93.1	19.2	8.60	93.1	21.3	8.72	98.4
7-Aug	2:14 PM	72.00	23.30	1677.60	25.6	7.92	96.8	23.6	8.72	102.8	20.5	8.99	99.9	23.5	8.64	101.7
14-Aug	6:04 AM	81.21	22.03	1788.65	26.1	7.65	94.5	19.1	7.89	85.1	19.5	8.55	93.2	23.4	8.33	97.8
14-Aug	2:26 PM	81.21	25.15	2042.43	26.9	7.73	96.9	25.0	8.73	105.7	23.2	8.76	102.6	25.5	8.43	103.0
21-Aug	6:17 AM	84.00	20.98	1761.90	23.8	7.78	92.0	20.6	8.71	97.0	19.0	8.60	92.7	20.5	8.75	97.2
21-Aug	2:34 PM	84.00	22.33	1875.30	24.5	7.81	93.6	22.7	8.65	99.9	19.6	9.08	98.7	22.5	8.71	100.6
29-Aug	6:07 AM	86.80	18.83	1634.01	21.0	7.59	85.2	18.7	9.00	96.4	16.9	9.07	93.6	18.7	9.07	97.2
29-Aug	4:04 PM	86.80	19.10	1657.88	21.1	7.71	86.5	19.0	8.87	95.6	17.4	8.99	93.7	18.9	8.96	96.5
4-Sep	6:13 AM	38.00	18.63	707.75	20.1	7.94	96.1	18.6	8.83	96.8	17.2	8.60	93.0	18.6	8.72	97.3
4-Sep	3:06 PM	38.00	21.25	807.50	22.5	7.92	98.2	21.5	8.72	99.3	19.2	8.99	97.3	21.8	8.64	99.8
11-Sep	6:09 AM	48.00	18.55	890.40	20.8	7.65	96.2	18.2	7.89	98.3	16.9	8.55	96.6	18.3	8.33	98.1
11-Sep	2:40 PM	48.00	20.53	985.20	21.2	7.73	97.8	21.1	8.73	102.1	20.5	8.76	101.0	19.3	8.43	101.5
18-Sep	6:12 AM	76.00	17.98	1366.10	18.7	7.78	94.8	18.6	8.71	97.5	18.3	8.60	97.3	16.3	8.75	97.5
18-Sep	2:38 PM	76.00	18.00	1368.00	17.8	7.81	96.4	18.8	8.65	99.0	18.4	9.08	98.7	17.0	8.71	101.8
24-Sep	6:19 AM	92.00	16.30	1499.60	16.6	7.59	92.6	16.6	9.00	97.4	16.5	9.07	97.2	15.5	9.07	97.4
24-Sep	2:36 PM	92.00	17.45	1605.40	17.9	7.71	95.6	17.4	8.87	100.8	17.1	8.99	97.2	17.4	8.96	101.4
				Average		7.75	94.6		8.62	98.2		8.78	97.8		8.65	99.3
				Median		7.73	95.7		8.72	97.9		8.76	97.3		8.68	98.3
				Minimum		7.50	85.2		7.89	85.1		8.08	92.7		8.30	96.5
				Maximum		8.05	98.2		9.00	105.7		9.14	112.7		9.07	103.0

Table 7-6 – Dissolved Oxygen and Temperature Readings at DO 1, DO 2, DO3, and DO 4

7.2.1.5.2 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.

7.2.2 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 – NOTE: See Section 4 of this document for additional data on this study!

Reeds Brook (the Brook) flows from the Green Lake Dam to Graham Lake, a straight line distance of 1800 feet . (Whole quantity numbers in this section are approximate) 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 NGVD29 datum elevation of the water surface of the Brook.

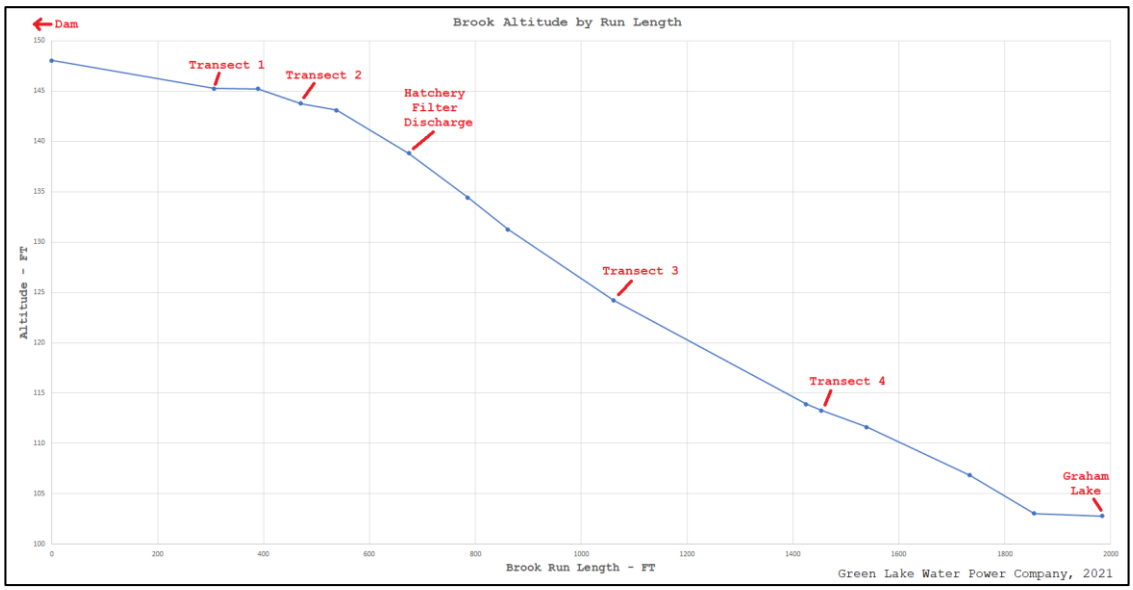


Figure 7–8 – Brook Run Elevation, Source GLWP

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.

7.2.2.1 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.

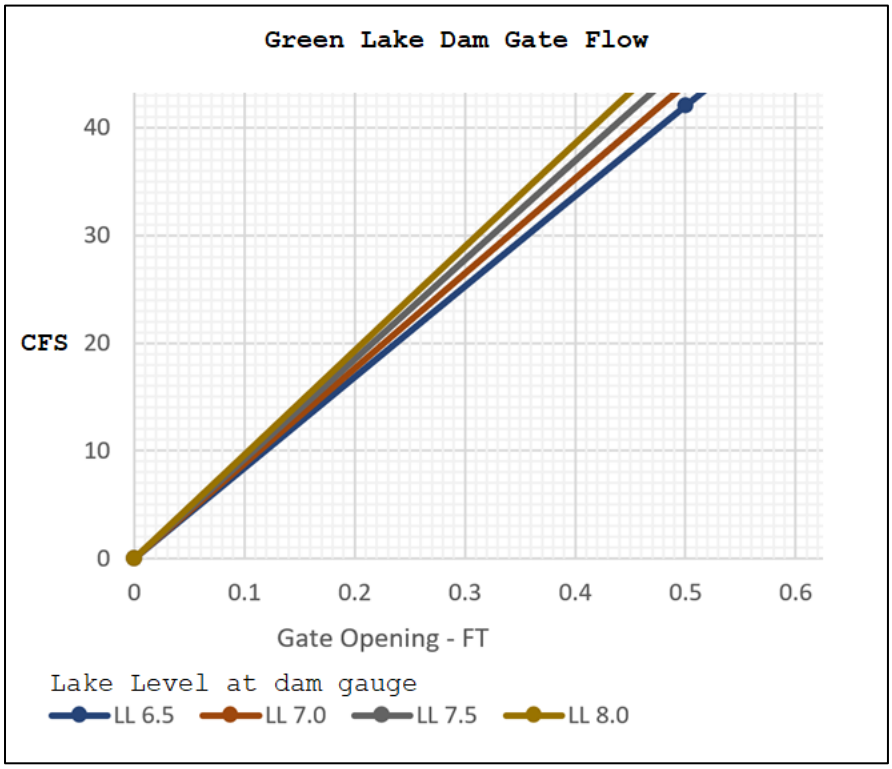


Figure 7–9 – Flow through Waste Gate 2

Source: GLWP and Bangor Hydroelectric

7.2.2.2 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.

7.2.2.2.1 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.

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

	Elev - ft NGVD29 datum	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 7-7 – 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."

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

Photo 7-3 – Bank full at Transect 1

7.2.2.2.2 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.

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

	Elev - ft NGVD29 datum	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 7-8 – Transect 2 Flow Quantities

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

Photo 7-4 – Bank full for Transect 2

The following picture shows Flow 3 overtopping the bank:

Photo 7-5 – Transect 2

7.2.2.2.3 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.

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

	Elev - ft NGVD29 datum	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 7-9 – Transect 3 Flow Quantities

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 7-6 – Transect 3 Bank Full

7.2.2.2.4 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.

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

	Elev - ft NGVD29 datum	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 7-10 – Transect 4 Flow Quantities

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

Photo 7-7 – Transect 4 Bank Full

7.2.2.3 Methodology:

The methodology is described in detail in the Initial Study Report.

This additional data was provided in the ISR Meeting Summary:

Study 2: <u>Bypass Reach Aquatic Habitat and In Stream Flow Study</u>

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%
Flow 4	16.28	33.02	1.78	3.3	1.14	98.43%

7.2.2.4 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.

7.2.3 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.

7.2.3.1 Eel Passage Survey Event

Photo 7-8 – Looking for eels at night – spillway

Photo 7-9 – 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 7-11 – Night time Eel Surveys

7.2.3.2 Variances from FERC-approved Study Plan and Proposed Modifications

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

7.2.4.1 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 7-10 – Approval Letter from MHPC

7.2.4.1.1 Variances from FERC-approved Study Plan and Proposed Modifications

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

7.2.4.2 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.

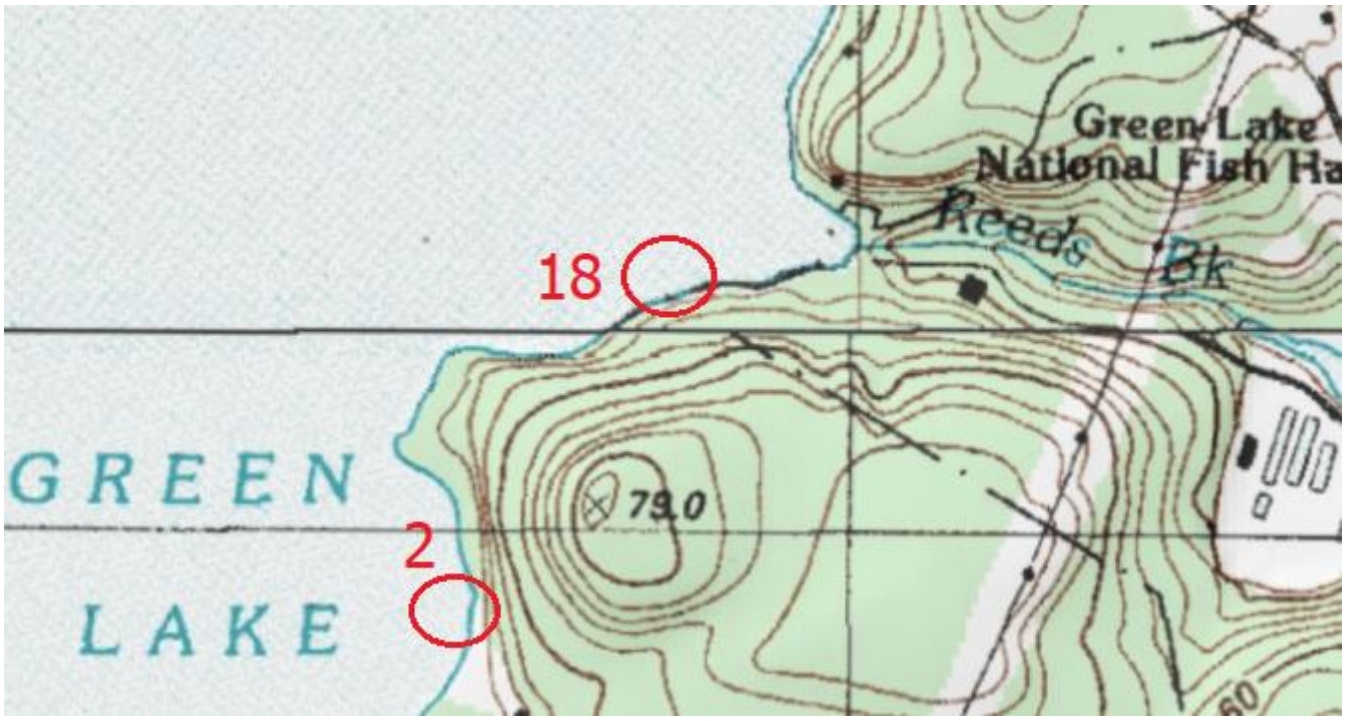


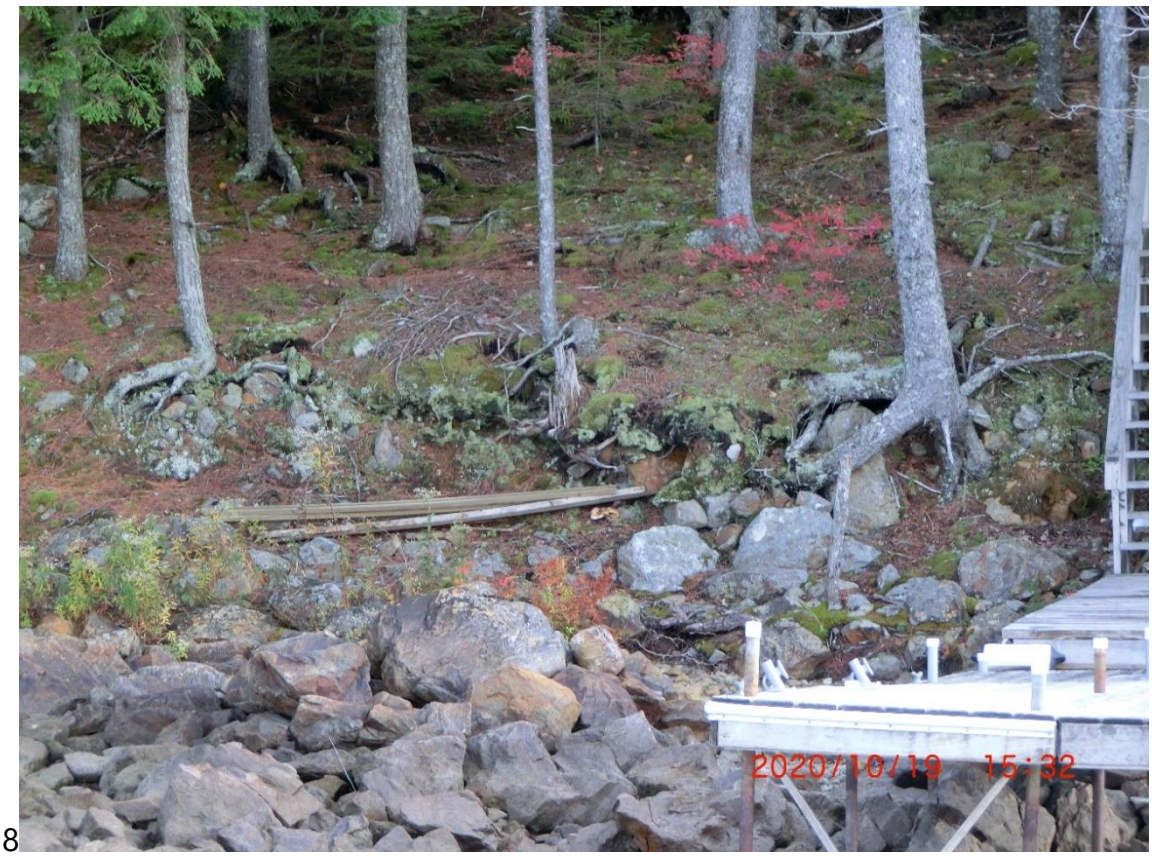
Figure 7-11 – Map of possible Erosion Sites

Site 2:

Site 2:

Site 18

Site 18



Site 18

7.2.4.2.1 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 – the pictures can be found in the Initial Study Report.

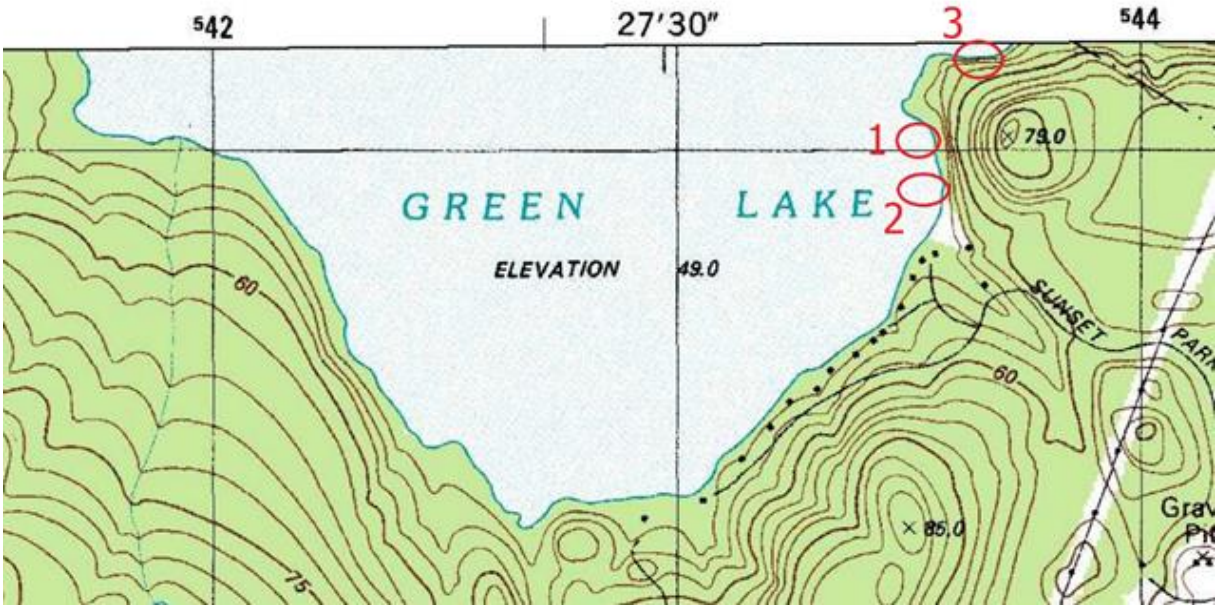


Figure 7-12 – Erosion Survey South End

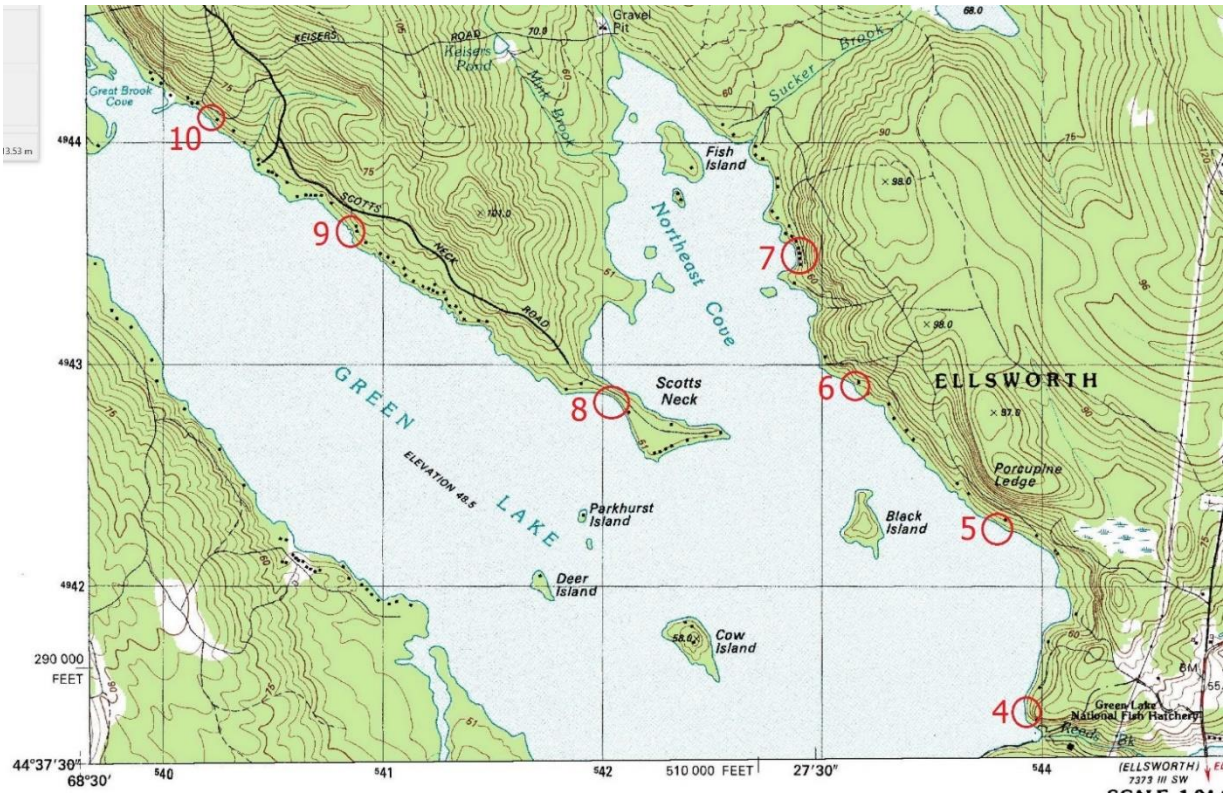


Figure 7-13 – Erosion Survey South East End

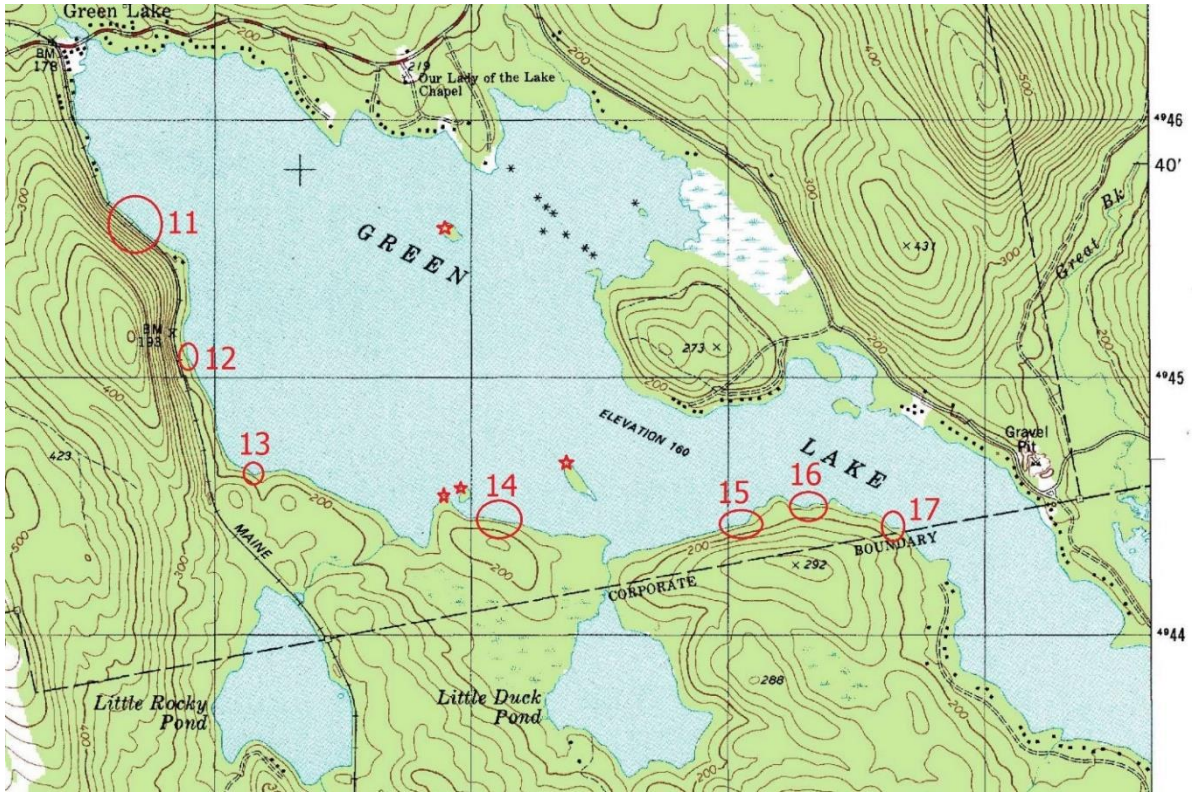


Figure 7-14 – Erosion Survey North End

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

Photo 7-10 – Loons on the lake

7.2.4.2.2 Variances from FERC-approved Study Plan and Proposed Modifications

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

7.2.5 ADDITIONAL INFORMATION REQUESTED

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

7.2.5.1 Terrestrial Resources

7.2.5.1.1 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 Audubon 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 Audubon 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: https://www.maineaudubon.org/wp-content/uploads/2018/06/Loon-Guide.pdf

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
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 7-12 – Loon and Nest Count

7.2.5.2 Recreation and Land Management

7.2.5.2.1 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.

7.2.5.2.1.1 IMPOUNDMENT LEVELS FROM 2015-2019 – SEPTEMBER – NOVEMBER

	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							

7.2.5.2.1.2 Docks and Beaches

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.

7.2.5.2.1.2.1 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 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.

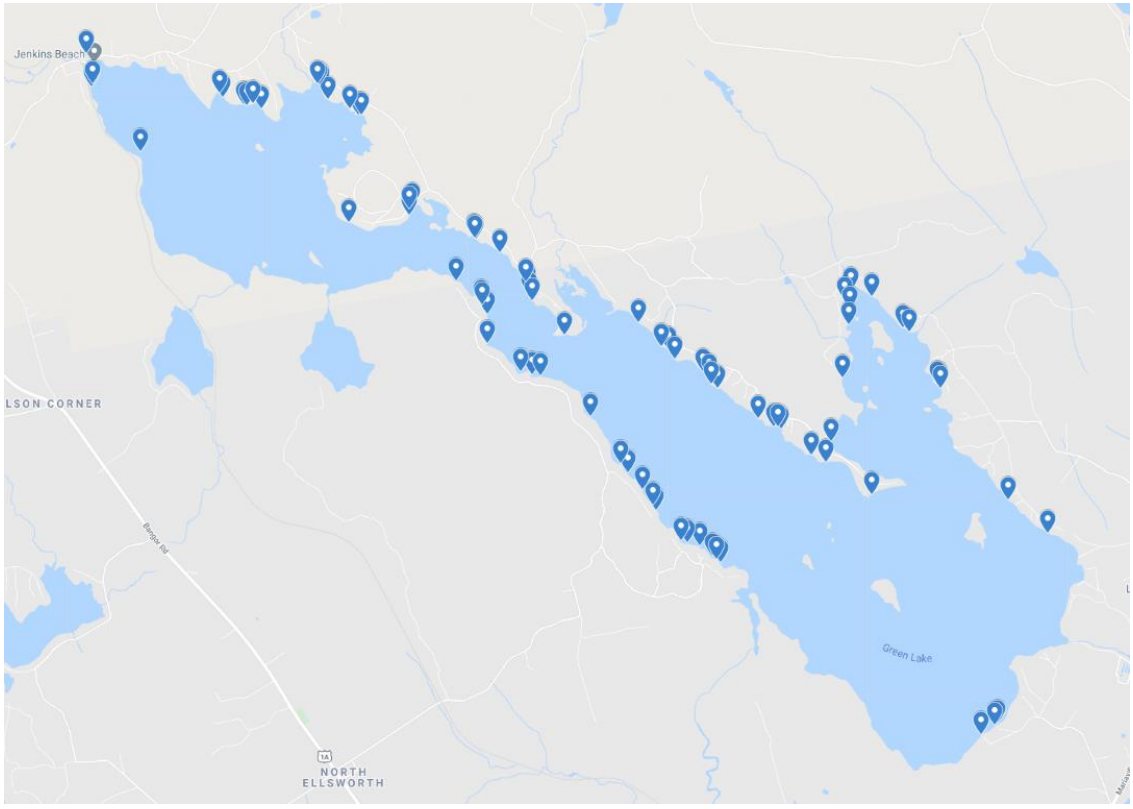


Figure 7-15 – Location of Docks included in the GLA Survey data

Figure 7-16 – Location of Docks included in the Google Maps survey

7.2.5.2.1.2.2 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**

7.2.5.2.1.2.3 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

7.2.5.2.1.2.4 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 in the Initial Study Report

7.2.5.2.1.3 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."

7.2.6 References

Appendix C includes the complete ISR Study Reports and USR Study Reports filed for the Project.