MATTACEUNK HYDROELECTRIC PROJECT
(FERC NO. 2520)

FINAL LICENSE APPLICATION
VOLUME I OF VI

GREAT LAKES HYDRO AMERICA, LLC
Millinocket, Maine

AUGUST 2016
FINAL LICENSE APPLICATION
MATTACEUNK PROJECT
VOLUME I OF VI

CONTENTS

Table of Contents
Executive Summary
Initial Statement
Exhibit A – Project Description
Exhibit B – Project Operation and Resource Utilization
Exhibit C – Construction History
Exhibit D – Statement of Cost and Financing
Exhibit F – General Design Drawings (public portion)
Exhibit G – Project Maps
Exhibit H – Description of Project Management and Need for Project Power
EXECUTIVE SUMMARY
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>INTRODUCTION</td>
<td>ES-1</td>
</tr>
<tr>
<td>2.0</td>
<td>SUMMARY OF THE MATTACEUNK PROJECT</td>
<td>ES-1</td>
</tr>
<tr>
<td>3.0</td>
<td>AGENCY CONSULTATION AND RELICENSING PROCESS</td>
<td>ES-2</td>
</tr>
<tr>
<td>4.0</td>
<td>SUMMARY OF PROPOSED ACTION AND ENHANCEMENT MEASURES</td>
<td>ES-3</td>
</tr>
<tr>
<td>5.0</td>
<td>APPLICATION ROAD MAP</td>
<td>ES-6</td>
</tr>
</tbody>
</table>
Executive Summary

1.0 INTRODUCTION

The Federal Energy Regulatory Commission (FERC or Commission), under the authority of the Federal Power Act, 16 United States Code (USC) §791(a), et seq., may issue licenses for up to 50 years for the construction, operation, and maintenance of non-federal hydroelectric developments. Great Lakes Hydro America, LLC (GLHA), a wholly owned subsidiary of Brookfield Renewable Partners, L.P. (Brookfield Renewable), is applying for a new 40-year license for the Mattaceunk Hydroelectric Project (FERC Project No. 2520) (Project). The current operating license for the Project was issued on September 30, 1988 and expires on August 31, 2018. In accordance with applicable regulations, 18 Code of Federal Regulations (CFR) §16.9(b), GLHA must file its application with FERC for a new license no later than August 31, 2016.

2.0 SUMMARY OF THE MATTACEUNK PROJECT

The Project has an authorized capacity of 19.2 megawatts and is located in Maine on the Penobscot River in the towns of Medway, Woodville, Mattawamkeag, and the unorganized township of Molunkus in Aroostook and Penobscot Counties. The Project impounds a reach of the Penobscot River that includes a section of the West Branch of the Penobscot River (West Branch) downstream of the Medway Dam, as well as a portion of the East Branch of the Penobscot River (East Branch). A portion of Salmon Stream is also impounded at the confluence with the main stem of the Penobscot River.

The Mattaceunk Project is operated in a run-of-river with pondage mode. GLHA maintains the reservoir surface elevation no lower than 1.0 foot below the dam crest elevation of 236.0 feet when the 4-foot-high flashboards are not in use, and no lower than 2.0 feet below the top of flashboards elevation of 240.0 feet when the 4-foot-high flashboards are in use. GLHA is also required to release a year-round continuous minimum flow of 1,674 cubic feet per second (cfs) or inflow, whichever is less, and a daily average minimum flow of 2,392 cfs from July 1 through September 30 and 2,000 cfs from October 1 through June 30, unless inflow is less than the stated
daily average minimum flows (in which case outflow from the Project must equal the inflow to the Project).

As described further in this Final License Application (FLA), the Project has established upstream and downstream fish passage and protection structures that were developed in consultation with applicable agencies and interested parties. These structures have been the subject of routine evaluation prior to and over the term of the Project’s existing license.

3.0 AGENCY CONSULTATION AND RELICENSING PROCESS

The Mattaceunk Project is being relicensed (and §401 Water Quality Certification sought) through the Commission’s Integrated Licensing Process (ILP). This process consisted of a series of consultation activities that began with early stakeholder outreach and the distribution of the Pre-Application Document (PAD). Following the distribution of the PAD and the Commission’s Scoping Meetings, GLHA met routinely with resource agencies and stakeholder representatives to complete the collaborative development of the proposed studies and their scopes. Based on the approved study plans and FERC’s subsequent determination letter, studies were performed to obtain additional information related to the following resource areas and areas of interest.

- Water Quality
- Minimum Downstream Flows
- Upstream Salmon Passage
- Downstream Salmon Passage
- Eel Passage
- Fish Entrainment and Impingement
- Smallmouth Bass
- Common Loons
- Marsh-Nesting Birds
- Recreation
- Historical and Cultural Resources
- Alosine Fishway Alternatives
Subsequent to the completion of the approved studies and the associated stakeholder consultation, GLHA consulted with the applicable agencies and interested parties regarding the proposed action and enhancement measures presented in this FLA.

**4.0 SUMMARY OF PROPOSED ACTION AND ENHANCEMENT MEASURES**

GLHA’s proposed operations and protection, mitigation, and enhancement (PM&E) measures in this application are intended to meet the diverse objectives for maintaining a balance of non-power and power values associated with the Penobscot River. As such, GLHA believes that these proposed PM&E measures represent the preferred alternative for this relicensing. A summary of these PM&E measures, which GLHA proposes for inclusion in a new 40-year license for the Project, is provided below.

GLHA proposes to continue to implement the following measures that contribute to the protection and enhancement of environmental resources associated with the Penobscot River and the Project area:

- Maintain year-round continuous minimum base flow of 1,674 cfs or inflow, whichever is less.
- Maintain a daily average minimum flow of 2,392 cfs from July 1 through September 30 and 2,000 cfs from October 1 through June 30, or average inflow, whichever is less.
- Operate within the existing impoundment fluctuation limitations that consist of the following:
  - Year-round use of 4-foot-high flashboards.
  - Maintain impoundment no lower than 2.0 feet below the flashboard crest elevation of 240.0 feet when the flashboards are in use.
  - Maintain impoundment no lower than 1.0 feet below the dam crest elevation of 236.0 feet when the flashboards are not in use.
- Maintain and operate upstream and downstream fish passage facilities for Atlantic salmon; the downstream fishway is operated from April 1 to June 15 for smolts.
(downstream migrating juvenile Atlantic salmon) and kelts (post-spawning adult Atlantic salmon) and in the fall from October 17 to December 1 for kelts.

- Continued operation and monitoring of the upstream fishway annually from May 1 to November 10 for upstream Atlantic salmon passage and to provide resource managers with spawning escapement tallies of Atlantic salmon into the upper reaches of the Penobscot River.

- Maintain existing Project recreation facilities including (1) a canoe portage trail, and (2) a downstream angler access area with a parking area, stairs leading to the tailrace area, and a covered picnic area.

In addition to continuing the existing environmental measures, GLHA is proposing the following PM&E measures at this time:

- Implement recreation facility improvements at the existing downstream angler access area within three years of license issuance, including (1) re-installing a pulley system to assist boaters with moving car top boats and other small watercraft up and down the stairs, (2) installation of a ramp adjacent to the existing recreation pavilion to provide wheel chair access to the pavilion and associated picnic table, and (3) additional signage associated with the angler access area.

- Seasonal installation and maintenance of an upstream eel ramp within two years of the effective date of the new license, including one year of monitoring.

- Implementation of a Species Protection Plan for the federally endangered Gulf of Maine Distinct Population Segment of Atlantic salmon to include the following measures:
  - In addition to annual operation of the upstream fishway, coordinate with resource agencies to stock uniquely marked Atlantic salmon smolts (originating from the Green Lake National Fish Hatchery) upstream of Weldon Dam in the first three years after license issuance; these fish would then serve as a source of imprinted adult fish (i.e., fish homing to areas upstream of Weldon Dam) for studying upstream passage of adults and downstream passage of kelts.
  - Conduct up to three years of upstream fishway effectiveness testing and up to three years of downstream kelt studies using the returning imprinted adult fish.
Installation of trashracks having 1-inch clear spacing to the full depth of the turbine intakes within two years of license issuance; the trashracks would be deployed during the fish passage season.

In addition to annual operation of the downstream fishway, open the Project’s log sluice (between 3% and 9% of station capacity, or between approximately 225 cfs and 690 cfs) in support of downstream Atlantic salmon smolt outmigration for three weeks (schedule to be determined in consultation with agencies and based on environmental factors including river temperatures and flows) beginning in the first passage season following license issuance.

Conduct up to three years of Atlantic salmon smolt downstream passage monitoring for existing fish passage operations, coupled with operation of the log sluice and implementation of the 1-inch clear spacing full-depth trashracks, including an assessment of sources of impoundment mortality.

Implement an adaptive management plan to address performance criteria for downstream passage, should the proposed measures be inadequate.

Additional operational and structural modifications and/or habitat enhancement measures, if necessary, to address outmigrating Atlantic salmon smolts and kelts and upstream migrating Atlantic salmon adults.

- Installation of an upstream passage structure for alosines in year 15 of the new license, including two years of monitoring.

- Annual nighttime turbine shutdowns (8 pm to 4 am) in combination with opening the Project’s roller gate\(^1\) implemented concurrent with installation of the 1-inch clear spacing full-depth trashracks in support of downstream outmigrations of silver American eels (schedule to be determined in consultation with agencies and based on a predictive model for eel movement through the Project; targeted events are expected to occur in September and October) beginning in the first passage season following license issuance, including two years of monitoring.

- Annual extended seasonal operation of the downstream fishway and log sluice operation (≈225 cfs and 690 cfs) from June 1 to November 30, as necessary based on smolt and alosine study results, once upstream passage for alosines (American shad and river

---

\(^1\) The cfs release will depend on river flows and the need to maintain stable impoundment elevation.
herring) is operational (expected year 16 of a new license term), including two years of downstream fish passage monitoring.

- Additional operational and structural modifications and/or habitat enhancement measures, if necessary, to provide eel and alosine passage (passage criteria for eels and alosines shall be based on a review of the performance of comparable fish passage measures in New England).
- Development of a Historic Properties Management Plan following completion of the 2017 Phase II archeological field studies.

5.0 APPLICATION ROAD MAP

This FLA consists of six volumes. The following provides a summary of the exhibits and documents associated with each volume.

VOLUME I OF VI (PUBLIC)

Volume I contains public information and the following exhibits:

- Table of Contents
- Executive Summary
- Initial Statement
- Exhibit A – Project Description
- Exhibit B – Project Operation and Resource Utilization
- Exhibit C – Construction History
- Exhibit D – Statement of Cost and Financing
- Exhibit F – General Design Drawings (public portion)
- Exhibit G – Project Maps
- Exhibit H – Description of Project Management and Need for Project Power
VOLUME II OF VI (PUBLIC)
Volume II contains public information and includes Exhibit E – Environmental Report

VOLUME III OF VI (PUBLIC)
Volume III contains public information and includes:

- Exhibit E Appendices, including Consultation Summary
- Response to Comments on the Draft License Application

VOLUME IV OF VI (PUBLIC)

- Volume IV contains the final study reports (Public)\(^2\)

VOLUME V OF VI (PUBLIC)
Volume V contains public information and includes:

- Draft Biological Assessment – including the Species Protection Plan and Fish Passage Operations & Maintenance Plan
- Fishway Design Drawings

VOLUME VI OF VI (CEII)
Volume VI contains critical energy and infrastructure information (CEII) materials not intended for public disclosure, including:

- Exhibit F – General Design Drawings
- Exhibits A and H – Single-Line Diagram of the Transmission System

\(^2\) The Cultural Resources Study reports were filed with the Commission on March 18, 2016. Because the reports contain information regarding the specific location and nature of historic and archaeological resources which is not to be disclosed to the public, GLHA requests that the Commission afford the Cultural Resources Study reports privileged treatment pursuant to 18 CFR §388.112(b).
INITIAL STATEMENT
BEFORE THE
UNITED STATES OF AMERICA FEDERAL ENERGY REGULATORY COMMISSION

Great Lakes Hydro America, LLC ) Project No. 2520 )
) Mattaceunk Hydroelectric Project

APPLICATION FOR NEW LICENSE
FOR A MAJOR WATER POWER PROJECT – EXISTING DAM

INITIAL STATEMENT

1. Great Lakes Hydro America, LLC (GLHA) applies to the Federal Energy Regulatory Commission for a new 40-year license for the Mattaceunk Hydroelectric Project (FERC No. 2520), as described in the attached exhibits.

2. The location of the Project is:

State or territory: Maine
Counties: Aroostook and Penobscot
Township or nearby Towns: Medway, Woodville, Mattawamkeag, and the Unorganized Township of Molunkus
Stream or other body of water: Penobscot River

3. The exact name and business address of the applicant are:

Great Lakes Hydro America, LLC
1024 Central Street
Millinocket, ME 04462

The exact name and business address of each person authorized to act as agent for the applicant in this application are:

Mr. Kevin Bernier
Senior Compliance Specialist
Brookfield Renewable Partners, L.P.
1024 Central Street
Millinocket, ME 04462

Ms. Kelly Maloney
Manager, Licensing and Compliance
Brookfield Renewable Partners, L.P.
150 Main Street
Lewiston, Maine, 04240

4. The applicant is a domestic corporation and is not claiming preference under section 7(a) of the Federal Power Act, 16 U.S.C. §796.
5. (i) The statutory or regulatory requirements of the State of Maine, in which the project is located, which would, assuming jurisdiction and applicability, affect the project as proposed with respect to bed and banks and the appropriation, diversion, and use of water for power purposes, and with respect to the right to engage in the business of developing, transmitting, and distributing power and in any other business necessary to accomplish the purposes of the license under the Federal Power Act are:

(2) Mill and Dam Act, M.R.S.A. Title 38, §651 et. seq.

(ii) The steps which the applicant has taken, or plans to take, to comply with each of the laws cited above are:

(1) The Maine Waterway Development and Conservation Act (MWDCA), enacted in 1983, regulates certain construction or reconstruction of hydropower projects which change water levels or flows above or below a dam. The applicant is not proposing any construction or changes in water levels as part of the relicensing that would require approval under the MWDCA.

(2) The Mill Act, essentially enacted in 1821, allows riparian owners to maintain dams and raise water. The statute does not require any permits and has been interpreted by the Maine Supreme Judicial Court to apply to hydroelectric generating plants. See Veazie v. Dwinel, 50 Me. 479 (1862). Maine case law has also held that owners of the riverbed have the right to the natural flow of a stream as it passes through their land, Wilson & Son v. Harrisburg, 107 Me. 207 (1910). The Licensee either owns or has easement or flowage rights to all Project lands and waters.

6. The Mattaceunk Hydroelectric Project consists of the following existing facilities: (1) the 1,060-foot-long, 45-foot-high Weldon Dam with a dam crest elevation of 236.0 feet\(^1\), consisting of (i) a 110-foot-long earthen embankment extending to the left abutment; (ii) a combined intake and powerhouse structure; (iii) an upstream fish ladder; (iv) a 10-foot-wide log sluice structure, controlled by an 8-foot-high vertical slide gate; (v) a 90-foot-long, 19-foot-high gated spillway with a single roller gate; (vi) a 657.5-foot-long, 70-foot high concrete gravity overflow spillway with 4-foot-high flashboards to a maximum flashboard crest elevation of 240.0 feet; and (vii) a retaining wall at the right abutment; (2) a reservoir having a surface area of 1,664 acres at normal pool elevation of 240.0 feet and a total storage capacity of 20,981 acre-feet; (3) a 142-foot-long, 99-foot-wide powerhouse (Weldon Station) integral to the dam containing two Kaplan turbines rated at 5,479 kilowatt (kW) and two fixed-blade propeller turbines rated at 5,489 kW each.

---

\(^1\) All elevations are referenced to U.S. Geological Survey datum.
driving a 6,000 kilovolt-ampere (kVA), 4,800 kW vertical synchronous generator for an authorized installed capacity of 19.2 megawatts (MW); (4) a downstream fishway; (5) an outdoor substation adjacent to the powerhouse; (6) a 9-mile-long, 34.5-kilovolt (kV) transmission line within a 120-foot-wide right of way; and (7) appurtenant facilities.

7. The Mattaceunk Project does not occupy any lands of the United States.

8. The Mattaceunk Project is an existing constructed project.

9. GLHA owns and will maintain all proprietary rights necessary to continue to operate and maintain the project.

10. GLHA is not currently seeking rights under Section 210 of the Public Utility Regulatory Policies Act of 1978 (PURPA) for the Mattaceunk Project; therefore, no additional information is required. GLHA reserves the right to exercise any rights available to it under PURPA in the future.

11. The names and mailing addresses of:

   (i) Every county in which any part of the project, and in which any Federal facility that is used or to be used by the project, is located:

       The Project is located within Aroostook and Penobscot counties.

       Aroostook County
       County Administrator
       144 Sweden Street
       Caribou, ME 04736

       Penobscot County
       County Administrator
       97 Hammond Street
       Bangor, ME 04401

   (ii) Every city, town, or similar local political subdivision in which the project is located and in which any Federal facility that is used by the project is located, or that is within 15 miles of the project dam and has a population of 5,000 or more people is:

       The Project is located in the towns of Medway, Woodville, Mattawameag, and the unorganized township of Molunkus:
There are no federal lands or facilities associated with the Project.

(iii) Every irrigation district, drainage district or similar special purpose political subdivision in which any part of the project is located and in which any Federal facility that is used by the project is located or that owns, operates, maintains or uses any project facility:

There are no irrigation, drainage, or special purpose political subdivisions associated with the Project.

(iv) Every other political subdivision in the general area of the project that there is some reason to believe would be likely to be interested in, or affected by, the application:

There are no other political districts or subdivisions that are likely to be interested in or affected by the application.

(v) All Indian tribes that may be affected by the project:

There are no Indian reservation lands with the Project Boundary. The following Indian tribes may have a level of interest in the issuance of a new license for the Project and, thus, have been included in the distribution list for the Project:

Penobscot Indian Nation
Kirk Francis
Tribal Chief
12 Wabanaki Way
Indian Island, ME 04468
Penobscot Indian Nation
John Banks
12 Wabanaki Way
Indian Island, ME 04468

Aroostook Band of Micmac
Indians of Maine
Victoria Higgins
7 Northern Road
Presque Isle, ME 04769

Aroostook Band of Micmac
Indians of Maine
Donna Augustine
P.O. Box 1132
Rexton, New Brunswick,
Canada E4W1V9

Houlton Band of Maliseet Indians
Brenda Commander
88 Bell Road
Littleton, ME 04730

Houlton Band of Maliseet Indians
Sharri Venno
88 Bell Road
Littleton, ME 04730

Passamaquoddy Tribe
Dale Covey
9 Grand Lake Stream Road
Princeton, ME 04668

Passamaquoddy Tribe
Martin Dana
P.O. Box 301
Princeton, ME 04668

Passamaquoddy Tribe
Don Soctomah
P.O. Box 301
Princeton, ME 04668
12. The applicant has in accordance with 18 CFR Section 5.18 (a)(3)(i) made a good faith effort to notify, by certified mail, the following entities of the filing of this application:

(i) Every property owner of record of any interest in the property within the bounds of the project; and

(ii) The entities identified in paragraph (11) above, as well as other Federal, state, municipal or other local government agencies that would likely be interested in or affected by the application.

13. In accordance with Sections 4.61 and 16.10 of the Commission’s regulations, the following Exhibits are attached to and made a part of this application:

   Exhibit A: Project Description
   Exhibit B: Project Operation and Resource Utilization
   Exhibit C: Construction History
   Exhibit D: Statement of Costs and Financing
   Exhibit E: Environmental Report
   Exhibit F: General Design Drawings
       (CEII filed under separate cover)
   Exhibit G: Project Maps
   Exhibit H: Description of Project Management and Need for Project Power
VERIFICATION

This application is executed in the

STATE OF: Maine
COUNTY OF: Penobscot

By: Mr. Kevin Bernier
Senior Compliance Specialist
Great Lakes Hydro America, LLC
1024 Central Street
Millinocket, ME 04462
Telephone: (207) 723-4341
Email: kevin.bernier@brookfieldrenewable.com

The undersigned being duly sworn, deposes and says that the contents of this application are true to the best of his knowledge or belief. The undersigned applicant has signed this application this 30th day of August, 2016.

Kevin Bernier

Subscribed and sworn to before me, a Notary Public of the State of Maine, this 30th day of August, 2016.

Notary Public

© Copyright 2016. Great Lakes Hydro America, LLC. All Rights Reserved
EXHIBIT A
PROJECT DESCRIPTION
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>INTRODUCTION</td>
<td>A-1</td>
</tr>
<tr>
<td>2.0</td>
<td>PROJECT STRUCTURES</td>
<td>A-1</td>
</tr>
<tr>
<td>2.1</td>
<td>Dam and Spillway</td>
<td>A-3</td>
</tr>
<tr>
<td>2.2</td>
<td>Intake</td>
<td>A-5</td>
</tr>
<tr>
<td>2.3</td>
<td>Powerhouse</td>
<td>A-5</td>
</tr>
<tr>
<td>2.4</td>
<td>Tailrace</td>
<td>A-5</td>
</tr>
<tr>
<td>2.5</td>
<td>Bypassed Reach</td>
<td>A-6</td>
</tr>
<tr>
<td>2.6</td>
<td>Fish Passage Facilities</td>
<td>A-6</td>
</tr>
<tr>
<td>2.7</td>
<td>Proposed Structures</td>
<td>A-7</td>
</tr>
<tr>
<td>3.0</td>
<td>IMPOUNDMENT DATA</td>
<td>A-8</td>
</tr>
<tr>
<td>4.0</td>
<td>TURBINES AND GENERATORS</td>
<td>A-9</td>
</tr>
<tr>
<td>4.1</td>
<td>Turbines</td>
<td>A-9</td>
</tr>
<tr>
<td>4.2</td>
<td>Generators</td>
<td>A-9</td>
</tr>
<tr>
<td>4.3</td>
<td>Proposed Turbines and Generators</td>
<td>A-10</td>
</tr>
<tr>
<td>5.0</td>
<td>SUBSTATION AND TRANSMISSION LINES</td>
<td>A-10</td>
</tr>
<tr>
<td>6.0</td>
<td>RECREATIONAL FACILITIES</td>
<td>A-11</td>
</tr>
<tr>
<td>7.0</td>
<td>LANDS OF THE UNITED STATES</td>
<td>A-11</td>
</tr>
</tbody>
</table>
### LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIGURE 2.0-1</td>
<td>MATTACEUNK PROJECT FACILITIES</td>
<td>A-2</td>
</tr>
</tbody>
</table>

### LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TABLE 2.0-1</td>
<td>MATTACEUNK SITE FEATURES</td>
<td>A-3</td>
</tr>
<tr>
<td>TABLE 3.0-1</td>
<td>CHARACTERISTICS OF THE MATTACEUNK PROJECT</td>
<td>A-8</td>
</tr>
<tr>
<td></td>
<td>IMPOUNDMENT</td>
<td></td>
</tr>
<tr>
<td>TABLE 4.1-1</td>
<td>TURBINE SPECIFICATIONS</td>
<td>A-9</td>
</tr>
<tr>
<td>TABLE 4.2-1</td>
<td>GENERATOR SPECIFICATIONS</td>
<td>A-10</td>
</tr>
</tbody>
</table>
Exhibit A
Project Description

1.0 INTRODUCTION

Great Lakes Hydro America, LLC (GLHA or Licensee), an affiliate of Brookfield Renewable Partners, L.P. (Brookfield Renewable), owns and operates the 19.2-megawatt (MW) Mattaceunk Hydroelectric Project (Mattaceunk Project or Project), located on the Penobscot River in Aroostook and Penobscot Counties, Maine. The Project is located within the towns of Medway, Woodville, Mattawamkeag, and the unorganized township of Molunkus. The Project’s impoundment, which is primarily located on the main stem of the Penobscot River, incorporates portions of Salmon Stream and the East and West Branches of the Penobscot River. The Project is located approximately seven miles downstream of the confluence of the East and West Branches of the Penobscot River and approximately seven miles southeast of the Town of Medway. The Medway Hydroelectric Project (Federal Energy Regulatory Commission [FERC or Commission] Project No. 2666) is located approximately seven miles upstream of the Mattaceunk Project on the West Branch of the Penobscot River. The West Enfield Project (FERC Project No. 2600) is located approximately 29 miles downstream of the Mattaceunk Project on the main stem of the Penobscot River.

2.0 PROJECT STRUCTURES

Figure 2.0-1 presents the Project’s primary structures, which include the Project’s spillway, gated spillway with roller drum gate, upstream and downstream fishways, powerhouse, and substation. These structures, along with the Project’s additional structures, including the Project’s recreational areas, are described below. In addition, Table 2.0-1 provides a summary of structural and operational features associated with the Project.
TABLE 2.0-1
MATTACEUNK SITE FEATURES

<table>
<thead>
<tr>
<th>Site Features</th>
<th>Mattaceunk Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approximate Powerhouse Location (River Miles to head of tide in Bangor, Maine)</td>
<td>67</td>
</tr>
<tr>
<td>Authorized Installed Capacity (MW)</td>
<td>19.2</td>
</tr>
<tr>
<td>Net Head (feet)</td>
<td>41</td>
</tr>
<tr>
<td>Dam Length (feet)</td>
<td>1,060¹</td>
</tr>
<tr>
<td>Spillway Length (feet)</td>
<td>657.5</td>
</tr>
<tr>
<td>Height of Flashboards (feet)</td>
<td>4.0</td>
</tr>
<tr>
<td>Normal Water Surface Elevation (feet U.S. Geological Survey [USGS])</td>
<td>240.0</td>
</tr>
<tr>
<td>Impoundment Area at Flashboard Crest (acres)</td>
<td>1,664</td>
</tr>
<tr>
<td>Impoundment Drawdown Limits (feet)</td>
<td>1.0 foot below the dam crest elevation of 236.0 feet (USGS) when no flashboards are installed, and no lower than 2.0 feet below the top of flashboard elevation of 240.0 feet when the 4-foot-high flashboards are in use</td>
</tr>
<tr>
<td>Normal Operating Mode</td>
<td>Run-of-river with pondage</td>
</tr>
<tr>
<td>Operating Control</td>
<td>Remote</td>
</tr>
<tr>
<td>Estimated Turbine Hydraulic Capacity (cubic feet per second [cfs])</td>
<td>7,438</td>
</tr>
</tbody>
</table>

¹ Length includes the combined length of the Project’s six contiguous water-retaining sections. See Section 2.1.

2.1 Dam and Spillway

The Project’s dam (Weldon Dam) contains six contiguous water-retaining sections: the left earthen embankment, the intake/powerhouse structure (described in greater detail in Section 2.2), the fish ladder and log sluice structure, the gated spillway, the ungated overflow spillway, and the right abutment. These structures have a combined length of approximately 1,060 feet and a maximum height above riverbed of approximately 45 feet.

The left embankment/abutment consists of a 110-foot-long earthen embankment containing a concrete core wall. The embankment extends from the powerhouse structure to the natural ground surface on the left bank. The upper 30 feet of the concrete core wall is 2 feet thick. The lower portion of the core wall, which is approximately 30 feet below the crest, widens to 6 feet thick. The earthen embankment has a crest at elevation of 248.0 feet. The upstream slope of the embankment is at a 3 horizontal to 1 vertical (3H:1V) slope and is covered with riprap. The grass-covered downstream slope is at 1.5H:1V.

¹ Throughout this application, all references to “left” and “right” are defined from the perspective of looking downstream.
A concrete buttress wall that is approximately 35 feet long and 10.5 feet high is located on the downstream side of the left embankment slope. The buttress wall extends about 35 feet from the powerhouse to a counterfort wall abutting the left abutment. The total base width of 12.5 feet wide is about 2 feet below the existing grade. The upstream side of the wall slopes into the embankment at 1.5H:1V slope.

The upstream fish ladder and log sluice structure are located between the Project’s powerhouse and roller gate and have a total length of 36.5 feet. Discharge to the 10-foot-wide log sluice is controlled by a 10-foot-wide by 8-foot-high vertical slide gate. The sluice gate is used for debris management and, in combination with the roller gate, for passing flows in excess of the Project’s turbine capacity. The sluice gate is also utilized as the first open and last closed gate for passing excess flows during the downstream migration seasons for Atlantic salmon.

The roller gate spillway is a reinforced-concrete structure measuring 114 feet long beginning at the northeast end of the log sluice structure and extending to the ungated spillway. The structure is approximately 75 feet high from its assumed base – elevation 175 feet to the top of the concrete piers at elevation 250 feet. The spillway contains a single steel roller (drum) gate measuring 90 feet long and 19 feet high, an ogee-shaped spillway section with a crest elevation of 221.0 feet, and a bridge at elevation 250.0 feet spanning 90 feet between the piers. The gate is operated by a motor-driven chain hoist located on the left side. The roller gate is used to release water during plant shutdowns or when flows are in excess of turbine capacity of approximately 7,438 cfs. The roller gate has a discharge capacity of 25,637 cfs at normal pond elevation of 240 feet when the gate is opened 13.3 feet.

The ungated overflow spillway is a concrete gravity structure measuring 657.5 feet long and has a maximum height of approximately 70 feet from the spillway’s foundation to the top of the flashboards. The ogee-shaped spillway has a permanent crest elevation of 236.0 feet (USGS2) and is equipped with 4-foot-high wooden flashboards that result in a normal pond elevation of 240.0 feet.

---

2 All elevations in this license application are USGS datum, unless otherwise noted.
The right abutment consists of an approximately 140-foot-long concrete retaining/training wall located at the right end of the overflow spillway.

### 2.2 Intake

The Project’s intake is a concrete structure integral with the powerhouse having a total length of 142 feet. Individual intake openings, which consist of two openings per generating unit for a total of eight openings, include steel trashracks and 12-foot-wide by 16-foot-high vertical slide headgates. The trashracks and headgates are located within an enclosed gatehouse. The gates are operated by two 12.5-ton electric hoists that travel on a roof-mounted trolley beam. Intakes 3 and 4 also include downstream fish passage inlets. The intake is equipped with trashracks with 1-inch clear spacing covering the top 16 feet (at normal pond) of the water column to discourage fish entrainment (at depths greater than 16 feet, the trashracks have 2-5/8-inch clear spacing). The trashracks and the downstream fish passage facility are discussed in additional detail in Section 2.6.

### 2.3 Powerhouse

The powerhouse (Weldon Station) is composed of an integral concrete gravity substructure with a brick masonry superstructure. The powerhouse is 142 feet long, 99 feet wide (upstream to downstream), and has a maximum height of approximately 75 feet from the foundation to the intake deck. The powerhouse contains four vertical-shaft turbines. Units 1 and 2 are Kaplan turbines, and Units 3 and 4 are fixed-blade propeller.

### 2.4 Tailrace

During original construction of the Project, an area immediately downstream of the powerhouse was excavated to improve flows out of the powerhouse. Water from the powerhouse discharges directly to the river.
2.5  **Bypassed Reach**

Given the direct discharge from the powerhouse to the Penobscot River, the Project does not have a bypassed reach.

2.6  **Fish Passage Facilities**

The upstream fishway consists of a pool, weir, and orifice design, consisting of 36 pools with a drop of approximately 14 inches between pools. Fish are able to ascend the fishway by way of either submerged orifices or weir notches. A gravity fed pipe provides auxiliary water (7 cfs) for additional attraction flow to the entrance pool. A fish trap is located at the upstream exit (top) of the fishway, so that fish enter the trap for monitoring purposes through a funnel-like opening.

The upstream fishway was constructed in the late 1930s at the time of Project construction. The fishway’s current general configuration has been utilized for fish passage since the mid 1980s after it was improved through agency consultation and then evaluated for several years for effectiveness in passing Atlantic salmon. The fishway (with the supplemental attraction water) is typically operated from May through mid-November, and it is voluntarily monitored (through use of the fish trap) on a daily basis for successful Atlantic salmon passage and to ensure that undesirable species (such as northern pike) are not passed upstream.

Permanent downstream fish passage facilities were installed at the Mattaceunk Project in 1992, after temporary downstream passage alternatives were evaluated beginning in 1987. The permanent facilities include single surface inlets integral with the trashracks in two of the four turbine forebays (intakes 3 and 4), trashracks with a 1-inch clear spacing covering the top 16 feet (at normal pond) of the water column to discourage fish entrainment (at depths greater than 16 feet, the trashracks have 2-5/8-inch clear spacing), and a buried 42-inch-diameter stainless steel pipe for passing of fish to the tailrace area.

In addition, for system performance and fish condition studies, a trapping and monitoring facility was installed at the outlet from the downstream passage facilities (Great Northern Paper [GNP] 1993). This monitoring facility is comprised of an entrance chamber, an inclined dewatering
system, and a holding chamber. Water flows passing through the downstream passage system empty into the monitoring facility’s entrance chamber from the underground passage pipe. During trapping operations, flows are filtered over the inclined screen to separate the majority of the water from fish and potential debris. All collected fish and debris then drop off the end of the screen into the monitoring facility’s holding chamber. A constant water flow is provided to the holding chamber through a six-inch pipe that originates in the entrance chamber (GNP 1993).

This temporary monitoring facility is used for system performance and fish condition studies, as well as for the collection of wild smolts (downstream migrating juvenile Atlantic salmon) when requested by agencies or researchers for studies, such as the University of Maine and USGS smolt tracking studies conducted in 2010 and 2011. In 2014, GLHA extended the 42-inch bypass fish pipe through the entrance chamber, so that the monitoring facility is currently bypassed and fish are discharged directly into the tailrace. This modification was done to address concerns that fish were being injured within the monitoring facility; however, the bypass pipe is removable, thus allowing the trapping of wild smolts if requested by agencies or researchers for studies, or if needed by GLHA for system performance and fish condition studies.

2.7 Proposed Structures

Based on consultation with the relicensing parties, GLHA is proposing the installation and maintenance of a seasonal upstream American eel ramp. The ramp would be located on the river right end of the Project’s ungated spillway and would be further designed in consultation with the applicable relicensing parties and based on the conceptual design developed to date. The ramp would be installed and operated on a seasonal basis.

Discussions are ongoing regarding the passage of Atlantic salmon (as part of Endangered Species Act consultations to develop a Species Protection Plan), downstream-migrating eels, and the potential passage of alosines (American shad and river herring).
3.0 IMPOUNDMENT DATA

The Project impounds a reach of the Penobscot River that includes a section of the West Branch of the Penobscot River downstream of Medway Dam, as well as a portion of the East Branch of the Penobscot River. A portion of Salmon Stream is also impounded at the confluence with the main stem of the Penobscot River. The Project impoundment has a surface area of 1,664 acres and a total storage capacity of approximately 20,891 acre-feet at the normal pond elevation of 240.0 feet. The drainage area at Weldon Dam is approximately 3,348 square miles.

In accordance with Article 401 of the Project’s existing license, as amended through the FERC order dated February 9, 1990, the Project is operated in a run-of-river with pondage mode. Article 401 allows GLHA to operate the impoundment down to 1.0 foot below the dam crest elevation of 236.0 feet when no flashboards are installed and no lower than 2.0 feet below the top of flashboard elevation of 240.0 feet when the 4-foot-high flashboards are in use.

Additional characteristics of the Project’s impoundment are provided in Table 3.0-1.

### TABLE 3.0-1
CHARACTERISTICS OF THE MATTACEUNK PROJECT IMPOUNDMENT

<table>
<thead>
<tr>
<th>Characteristics of the Mattaceunk Project Impoundment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Area (square miles)</td>
<td>3,348</td>
</tr>
<tr>
<td>Permanent Spillway Crest of Dam (feet USGS)</td>
<td>236.0 feet</td>
</tr>
<tr>
<td>Height of Flashboards (feet)</td>
<td>4.0</td>
</tr>
<tr>
<td>Normal Water Surface Elevation (feet USGS)</td>
<td>240.0</td>
</tr>
<tr>
<td>Surface Area at Normal Pond Elevation (acres)</td>
<td>1,664</td>
</tr>
<tr>
<td>Impoundment Shoreline Length, including islands (miles)</td>
<td>39</td>
</tr>
<tr>
<td>Impoundment Drawdown Limits</td>
<td>1.0 foot below the dam crest elevation of 236.0 feet (USGS) when no flashboards are installed, and no lower than 2.0 feet below the top of flashboard elevation of 240.0 feet when the 4-foot-high flashboards are in use</td>
</tr>
<tr>
<td>Storage Capacity (acre-feet)</td>
<td>20,891</td>
</tr>
<tr>
<td>Usable Storage (acre-feet)</td>
<td>2,900</td>
</tr>
</tbody>
</table>
4.0 TURBINES AND GENERATORS

4.1 Turbines

The Project has an authorized installed capacity of 19.2 MW and contains four turbine units. Units 1 and 2 consist of Kaplan turbines, and Units 3 and 4 are fixed-blade propeller turbines. Table 4.1-1 provides specification details for each of the Project’s four turbines.

<table>
<thead>
<tr>
<th>Type</th>
<th>Unit 1</th>
<th>Unit 2</th>
<th>Unit 3</th>
<th>Unit 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Vertical Kaplan</td>
<td>Vertical Kaplan</td>
<td>Vertical fixed-blade propeller</td>
<td>Vertical fixed-blade propeller</td>
</tr>
<tr>
<td>Manufacture</td>
<td>General Electric</td>
<td>General Electric</td>
<td>General Electric</td>
<td>General Electric</td>
</tr>
<tr>
<td>Year Installed</td>
<td>1939</td>
<td>1939</td>
<td>1940</td>
<td>1941</td>
</tr>
<tr>
<td>Rated Capacity (horsepower)</td>
<td>7,344.5</td>
<td>7,344.5</td>
<td>7,361</td>
<td>7,361</td>
</tr>
<tr>
<td>Rated Head (feet)</td>
<td>39</td>
<td>39</td>
<td>39</td>
<td>39</td>
</tr>
<tr>
<td>Minimum Hydraulic Capacity (cfs)</td>
<td>471</td>
<td>471</td>
<td>1,102</td>
<td>1,102</td>
</tr>
<tr>
<td>Maximum Hydraulic Capacity (cfs)</td>
<td>1,883</td>
<td>1,883</td>
<td>1,836</td>
<td>1,836</td>
</tr>
<tr>
<td>Speed (revolutions per minute [rpm])</td>
<td>189.5</td>
<td>189.5</td>
<td>189.5</td>
<td>189.5</td>
</tr>
<tr>
<td>Governor Type</td>
<td>Woodward Cabinet – oil pressure</td>
<td>Woodward Cabinet – oil pressure</td>
<td>Woodward Cabinet – oil pressure</td>
<td>Woodward Cabinet – oil pressure</td>
</tr>
</tbody>
</table>

4.2 Generators

During the 2004-2006 turbine-generator overhaul, the original four General Electric (GE) units were re-wound and converted from 40 Hertz (Hz) to 60 Hz generators. New rotors were installed in order to change the frequency/speed of the machines. The original 40 Hz rating was 6,000 kilovolt-ampere (kVA) at a 0.8 power factor (pf). Table 4.2-1 provides specification details for each of the Project’s four generators following the conversion.
TABLE 4.2-1
GENERATOR SPECIFICATIONS

<table>
<thead>
<tr>
<th></th>
<th>Unit 1</th>
<th>Unit 2</th>
<th>Unit 3</th>
<th>Unit 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td>Vertical</td>
<td>Vertical</td>
<td>Vertical</td>
<td>Vertical</td>
</tr>
<tr>
<td><strong>Manufacture</strong></td>
<td>General Electric</td>
<td>General Electric</td>
<td>General Electric</td>
<td>General Electric</td>
</tr>
<tr>
<td><strong>Rating (kVA)</strong></td>
<td>6,000</td>
<td>6,000</td>
<td>6,000</td>
<td>6,000</td>
</tr>
<tr>
<td><strong>Capacity (kW)</strong></td>
<td>4,800</td>
<td>4,800</td>
<td>4,800</td>
<td>4,800</td>
</tr>
<tr>
<td><strong>Power Factor</strong></td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td><strong>Stator Temperature Rise (°C)</strong></td>
<td>45</td>
<td>45</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td><strong>Frequency (Hz)</strong></td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td><strong>Speed (rpm)</strong></td>
<td>189.5</td>
<td>189.5</td>
<td>189.5</td>
<td>189.5</td>
</tr>
</tbody>
</table>

4.3 Proposed Turbines and Generators

The Licensee is not proposing to install additional turbines or generators at this time.

5.0 SUBSTATION AND TRANSMISSION LINES

Power from the Project is fed to an outdoor substation located adjacent to the Project’s powerhouse. The substation contains six single-phase, oil-filled transformers, each rated at 5,000 kVa, 34.5 kV/6.9 kV, 40 Hz, connected into two delta-delta banks (known as T155 and T156) via overhead copper tubular buswork supported on standoff insulators from a galvanized steel overhead structure. Although rated at 40 Hz, these transformers operate well at 60 Hz (due to the lower core flux densities at increased frequencies).

The high voltage side of each bank of main power transformers is connected through 1200 A vacuum power circuit breakers (known as K157 and K158) to the main 34.5 kV power bus of the substation. This power bus feeds to the Project’s transmission line.

The substation is supported on a concrete foundation. There is also a galvanized steel bus support structure and a full perimeter cyclone security fence.
The Project’s transmission line (Line #7) connects the station to the 60 Hz local transmission grid through the Powersville substation. Line #7 consists of a single circuit of 4/0 American wire gauge (AWG) hard-drawn copper, supported by suspension insulators supported by galvanized steel towers. The conductors are protected from lightning by two overhead ground wires. The Powersville substation is the point of interconnection to the local utility and is jointly owned by GLHA and Emera Maine. The transmission line is approximately nine miles in length and has a 120-foot right-of-way (60 feet on each side of the transmission line). This transmission line is part of the FERC-licensed facilities for the Project. GLHA maintains a single-line diagram for the Project that is considered Critical Energy Infrastructure Information (CEII) in accordance with the Commission’s regulations; thus, it is being filed as CEII within Volume VI of this Final License Application (FLA). GLHA will provide appropriate relicensing parties with a copy of the single-line diagram upon request.

6.0 RECREATIONAL FACILITIES

In support of downstream access to the river, GLHA owns and maintains a downstream angler access area on river left, which includes signage, a parking area, a covered picnic table, and stairs that lead to the river. This access area provides opportunities for fishing downstream of the Project and for the put in and take out of car-top boats and other small watercraft.

In addition, GLHA owns and maintains a canoe portage trail with associated put in and take out areas on the river right bank that allow canoeists to portage around Weldon Dam. GLHA has installed and maintains signage associated with the trail, as well as the put in and take out.

7.0 LANDS OF THE UNITED STATES

The Project does not occupy any lands of the United States.

Literature Cited

EXHIBIT B

PROJECT OPERATION AND RESOURCE UTILIZATION
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>PROJECT OPERATION</td>
<td>B-1</td>
</tr>
<tr>
<td>1.1</td>
<td>Operating Mode</td>
<td>B-1</td>
</tr>
<tr>
<td>1.2</td>
<td>Annual Plant Factor</td>
<td>B-1</td>
</tr>
<tr>
<td>1.3</td>
<td>Project Operation During Adverse, Mean, and High Water Years</td>
<td>B-3</td>
</tr>
<tr>
<td>1.3.1</td>
<td>Normal Project Operations</td>
<td>B-3</td>
</tr>
<tr>
<td>1.3.2</td>
<td>Operation During High Water and Adverse Conditions</td>
<td>B-4</td>
</tr>
<tr>
<td>1.3.3</td>
<td>Operation During Low Water and Adverse Conditions</td>
<td>B-5</td>
</tr>
<tr>
<td>1.3.4</td>
<td>Fishway Operations</td>
<td>B-6</td>
</tr>
<tr>
<td>2.0</td>
<td>DEPENDABLE CAPACITY AND AVERAGE ANNUAL ENERGY PRODUCTION</td>
<td>B-7</td>
</tr>
<tr>
<td>2.1</td>
<td>Project Hydrology</td>
<td>B-7</td>
</tr>
<tr>
<td>2.2</td>
<td>Dependable Capacity</td>
<td>B-9</td>
</tr>
<tr>
<td>2.3</td>
<td>Area-Capacity and Rule Curve</td>
<td>B-9</td>
</tr>
<tr>
<td>2.4</td>
<td>Estimated Hydraulic Capacity</td>
<td>B-10</td>
</tr>
<tr>
<td>2.5</td>
<td>Tailwater Rating Curve</td>
<td>B-10</td>
</tr>
<tr>
<td>2.6</td>
<td>Powerplant Capability vs. Head</td>
<td>B-10</td>
</tr>
<tr>
<td>3.0</td>
<td>UTILIZATION OF PROJECT POWER</td>
<td>B-14</td>
</tr>
<tr>
<td>4.0</td>
<td>PLANS FOR Operational changes or FUTURE DEVELOPMENT</td>
<td>B-14</td>
</tr>
</tbody>
</table>

**APPENDICES**

APPENDIX B-1  FLOW DURATION CURVES
LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIGURE 2.3-1</td>
<td>AREA AND CAPACITY CURVES</td>
<td>B-11</td>
</tr>
<tr>
<td>FIGURE 2.5-1</td>
<td>TAILWATER RATING CURVE</td>
<td>B-12</td>
</tr>
<tr>
<td>FIGURE 2.6-1</td>
<td>PLANT CAPABILITY CURVE</td>
<td>B-13</td>
</tr>
</tbody>
</table>

LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TABLE 1.2-1</td>
<td>MATTACEUNK PROJECT MONTHLY AND ANNUAL GENERATION – 2007 TO 2015</td>
<td>B-2</td>
</tr>
<tr>
<td>TABLE 1.3-1</td>
<td>MONTHLY AND ANNUAL AVERAGE, MINIMUM, AND MAXIMUM FLOWS (1996-2015)</td>
<td>B-4</td>
</tr>
</tbody>
</table>
Exhibit B
Project Operation and Resource Utilization

1.0 PROJECT OPERATION

1.1 Operating Mode

The Mattaceunk Project is operated in a run-of-river with pondage mode and is controlled remotely from Brookfield Renewable’s North America System Control Center located in Marlborough, Massachusetts. Through these operations, the Project is operated to maintain a normal impoundment elevation of 240.0 feet\(^1\) and to release a continuous minimum flow of 1,674 cubic feet per second (cfs) or inflow, whichever is less, throughout the year. The Project is also operated to maintain a daily average minimum flow of 2,392 cfs from July 1 through September 30 and 2,000 cfs from October 1 through June 30, unless inflow is less than the stated daily average minimum flows (in which case outflow from the Project must equal the inflow to the Project).

Dispatchers are on duty at the control center 24 hours a day, seven days a week. The Project is normally visited by maintenance personnel each workday, Monday through Friday. In addition, local personnel can be called out to the Project at any time on an as-needed basis.

1.2 Annual Plant Factor

Based on generation from 2007 through 2015, the Project has annual average generation of approximately 123,332 megawatt-hours (MWh), which in combination with the Project’s authorized capacity of 19.2 megawatts (MW), results in an annual plant factor of approximately 73.3 percent. Table 1.2-1 provides the Project’s monthly and annual generation for 2007 through 2015.

\(^1\) All elevations are in U.S. Geological Survey (USGS) datum.
<table>
<thead>
<tr>
<th>Year</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>11,466</td>
<td>8,968</td>
<td>11,336</td>
<td>11,758</td>
<td>13,890</td>
<td>9,981</td>
<td>7,361</td>
<td>6,814</td>
<td>7,411</td>
<td>7,435</td>
<td>10,878</td>
<td>11,021</td>
<td>118,318</td>
</tr>
<tr>
<td>2008</td>
<td>12,259</td>
<td>11,430</td>
<td>13,832</td>
<td>13,030</td>
<td>10,721</td>
<td>10,858</td>
<td>10,660</td>
<td>12,689</td>
<td>9,870</td>
<td>9,146</td>
<td>10,600</td>
<td>12,489</td>
<td>137,582</td>
</tr>
<tr>
<td>2009</td>
<td>11,483</td>
<td>10,074</td>
<td>11,987</td>
<td>12,843</td>
<td>11,446</td>
<td>9,820</td>
<td>12,706</td>
<td>11,844</td>
<td>9,288</td>
<td>8,490</td>
<td>7,318</td>
<td>11,501</td>
<td>128,800</td>
</tr>
<tr>
<td>2010</td>
<td>12,004</td>
<td>9,941</td>
<td>13,876</td>
<td>13,690</td>
<td>10,094</td>
<td>9,895</td>
<td>11,215</td>
<td>11,814</td>
<td>12,004</td>
<td>12,994</td>
<td>13,147</td>
<td>12,403</td>
<td>143,075</td>
</tr>
<tr>
<td>2011</td>
<td>10,670</td>
<td>9,290</td>
<td>13,609</td>
<td>13,442</td>
<td>13,054</td>
<td>9,218</td>
<td>7,501</td>
<td>9,774</td>
<td>12,679</td>
<td>12,275</td>
<td>7,272</td>
<td>10,537</td>
<td>129,321</td>
</tr>
<tr>
<td>2012</td>
<td>9,341</td>
<td>8,359</td>
<td>11,120</td>
<td>9,871</td>
<td>12,238</td>
<td>9,390</td>
<td>9,479</td>
<td>7,244</td>
<td>6,926</td>
<td>11,334</td>
<td>10,464</td>
<td>10,560</td>
<td>116,327</td>
</tr>
<tr>
<td>2013</td>
<td>9,836</td>
<td>9,874</td>
<td>10,055</td>
<td>13,317</td>
<td>11,612</td>
<td>13,397</td>
<td>7,553</td>
<td>1,883</td>
<td>3,420</td>
<td>8,152</td>
<td>7,613</td>
<td>9,521</td>
<td>106,233</td>
</tr>
<tr>
<td>2014</td>
<td>12,592</td>
<td>8,813</td>
<td>8,627</td>
<td>12,375</td>
<td>11,883</td>
<td>10,291</td>
<td>9,776</td>
<td>7,918</td>
<td>6,852</td>
<td>7,822</td>
<td>9,187</td>
<td>13,240</td>
<td>119,375</td>
</tr>
<tr>
<td>2015</td>
<td>8,993</td>
<td>7,123</td>
<td>8,746</td>
<td>11,239</td>
<td>11,069</td>
<td>10,140</td>
<td>7,812</td>
<td>8,594</td>
<td>8,066</td>
<td>9,218</td>
<td>7,953</td>
<td>12,002</td>
<td>110,953</td>
</tr>
<tr>
<td>Average</td>
<td>10,961</td>
<td>9,319</td>
<td>11,465</td>
<td>12,396</td>
<td>11,778</td>
<td>10,332</td>
<td>9,340</td>
<td>8,730</td>
<td>8,502</td>
<td>9,652</td>
<td>9,381</td>
<td>11,475</td>
<td>123,332</td>
</tr>
</tbody>
</table>
1.3 Project Operation During Adverse, Mean, and High Water Years

1.3.1 Normal Project Operations

The Mattaceunk Project is operated in a run-of-river mode with pondage. The Project is typically operated with minimal fluctuations of the reservoir surface elevation for public safety, consistent head for generation, and for the protection of aquatic resources in the Penobscot River. However, flexibility on reservoir elevations is needed to provide for safe replacement and repairs to the flashboards and to allow an adequate margin for wave action, debris and ice loads, or sharp inflow increases, such as from the unregulated East Branch of the Penobscot River upstream of the Project that might cause the flashboards to fail. As such, the license was amended in 1990 to stipulate that reservoir surface elevation be maintained no lower than 1.0 feet below the dam crest elevation of 236 feet when the 4-foot-high flashboards are not in use and maintained no lower than 2.0 feet below the flashboard crest elevation of 240 feet when the 4-foot-high flashboards are in use.

The Project has a maximum hydraulic capacity of 7,438 cfs through the facility’s four turbines. Due to the regulation of the upstream facilities on the West Branch of the Penobscot River, inflow to the Mattaceunk Project exceeds total station hydraulic capacity less than 20 percent of the time, as recorded over a 20-year period. In accordance with the “FERC Order Granting Appeal in Part and Amending License” issued on February 9, 1990 (50 ¶61,163) and the “Order on Rehearing” issued on June 21, 1991 (55 FERC ¶61,472), the Mattaceunk Project is required to release a continuous minimum flow of 1,674 cfs or inflow, whichever is less, throughout the year and maintain a daily average minimum flow of 2,392 cfs from July 1 through September 30 and 2,000 cfs from October 1 through June 30, unless inflow is less than the stated daily average minimum flows (in which case outflow from the Project must equal the inflow to the Project). In addition to flows associated with generation, flows associated with the Project are used to support the Project’s upstream and downstream fish passage structures.

The reservoir elevation limitations and minimum flows may be temporarily modified under emergency conditions or with agreement from the Maine Department of Environmental Protection (MDEP).
1.3.2 Operation During High Water and Adverse Conditions

The Project’s 10-foot-wide debris sluice and 90-foot-long by 19-foot-high roller (drum) gate are used to release surplus waters when flows are in excess of turbine capacity (7,438 cfs). As an enhancement measure for downstream Atlantic salmon passage, the debris sluice is also currently operated as the first open and last closed gate for releasing surplus flows during periods when the Project’s downstream fishway is in operation. It is estimated that the Project spills surplus flows up to 20 percent of the time, as recorded over a 20-year period. Higher flows in the Penobscot River Basin typically occur on an annual basis during the spring run-off period. The magnitude of the spring flows vary considerably depending on the water content of melting snow, the occurrence of coincidental heavy spring rainfall, and seasonal temperatures.

Table 1.3-1 presents the monthly and annual average, minimum, and maximum flows based on the calculated river flows, as described further in Section 2.1.

Flows at the Mattaceunk Project are typically the highest in the spring (April through June) due to annual spring runoff, with average flows ranging from 4,427 cfs to 9,715 cfs. Monthly flow duration curves have been developed for the Project and are located in Appendix B-1 of this license application.

<table>
<thead>
<tr>
<th>Month</th>
<th>Average Flow (cfs)</th>
<th>Minimum Flow (cfs)</th>
<th>90% Exceedance (cfs)</th>
<th>10% Exceedance (cfs)</th>
<th>Maximum Flow (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>5,437</td>
<td>1,163</td>
<td>2,821</td>
<td>8,338</td>
<td>24,645</td>
</tr>
<tr>
<td>February</td>
<td>5,216</td>
<td>1,287</td>
<td>3,003</td>
<td>8,002</td>
<td>22,111</td>
</tr>
<tr>
<td>March</td>
<td>5,800</td>
<td>1,231</td>
<td>2,908</td>
<td>9,148</td>
<td>25,699</td>
</tr>
<tr>
<td>April</td>
<td>9,715</td>
<td>1,740</td>
<td>3,687</td>
<td>17,911</td>
<td>59,738</td>
</tr>
<tr>
<td>May</td>
<td>9,280</td>
<td>1,673</td>
<td>3,428</td>
<td>17,964</td>
<td>69,936</td>
</tr>
<tr>
<td>June</td>
<td>6,269</td>
<td>2,189</td>
<td>3,204</td>
<td>10,243</td>
<td>27,541</td>
</tr>
<tr>
<td>July</td>
<td>5,071</td>
<td>1,899</td>
<td>2,851</td>
<td>8,760</td>
<td>41,321</td>
</tr>
<tr>
<td>August</td>
<td>4,427</td>
<td>1,891</td>
<td>2,873</td>
<td>6,636</td>
<td>27,796</td>
</tr>
<tr>
<td>September</td>
<td>5,106</td>
<td>2,232</td>
<td>3,431</td>
<td>6,890</td>
<td>31,691</td>
</tr>
<tr>
<td>October</td>
<td>6,152</td>
<td>1,726</td>
<td>2,987</td>
<td>9,808</td>
<td>45,108</td>
</tr>
<tr>
<td>Month</td>
<td>Average Flow (cfs)</td>
<td>Minimum Flow (cfs)</td>
<td>90% Exceedance (cfs)</td>
<td>10% Exceedance (cfs)</td>
<td>Maximum Flow (cfs)</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------</td>
<td>-------------------</td>
<td>----------------------</td>
<td>----------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>November</td>
<td>5,738</td>
<td>1,266</td>
<td>2,773</td>
<td>10,188</td>
<td>33,421</td>
</tr>
<tr>
<td>December</td>
<td>6,215</td>
<td>1,087</td>
<td>2,824</td>
<td>9,541</td>
<td>46,240</td>
</tr>
<tr>
<td>Annual</td>
<td><strong>6,204</strong></td>
<td><strong>1,087</strong></td>
<td><strong>2,999</strong></td>
<td><strong>10,529</strong></td>
<td><strong>69,936</strong></td>
</tr>
</tbody>
</table>

1. Water management modifications were instituted at upstream hydropower projects with the issuance of new licenses for the Ripogenus and Penobscot Mills projects in 1996; therefore, this Period of Record (POR) reflects current flow management on the Penobscot River and at the Mattaceunk Project, as compared to the pre-1996 POR. The 2015 data are provisional and subject to revision until the U.S. Geological Survey (USGS) provides final approval.

In 2014, historical river flow and Project operational data were reviewed and analyzed as part of the Minimum Flow Study conducted by GLHA, which is described in greater detail in Section 5.3.3 – “Fish and Aquatic Resources” in Exhibit E of this license application. Data were analyzed from 1996 to 2012 to evaluate the frequency, timing (seasonal occurrence), and duration of flows at or below a minimum flow of 1,674 cfs. During this period of record (POR), average minimum flows at or below 1,674 cfs only occurred on 48 days from 1996 to 2012, or less than 1 percent of the total days, and were often associated with low flow conditions within the river basin.

1.3.3 Operation During Low Water and Adverse Conditions

During low inflow conditions, GLHA operates the Project to maintain the impoundment level near 240.0 feet and to provide the required minimum downstream releases and flows necessary for operation of the fish passage structures in accordance with Article 401 of the Project’s current FERC license. The minimum downstream releases are provided through turbine operations and fish passages when in operation. During the rare occasions when inflows to the impoundment are less than the minimum hydraulic capacity of the Project’s turbines, the minimum downstream release is provided through the Project’s debris sluice, roller gate, fish passages, and/or over the spillway. In conjunction with providing the necessary flows for fish passage, GLHA is proposing to continue this operational strategy through the Project’s new FERC license.
1.3.4 Fishway Operations

The upstream fishway was constructed in the late 1930s at the time of Project construction. The fishway’s current general configuration has been utilized for fish passage since the mid 1980s; it consists of a pool and weir design, consisting of 36 pools with a drop of approximately 14 inches between pools. Fish are able to ascend the fishway by way of either submerged orifices or weir notches. Flows through the fishway consist of 6 to 8 cfs transport flow with an additional attraction water flow of 7 cfs for a total flow of 13 to 15 cfs. The headpond is maintained within a narrow band in elevation when the flashboards are in place, thereby maintaining relatively stable fishway inflows. Under the infrequent conditions of high flows causing flashboard failure and a need for replacement or repair, the pond is drawn down temporarily (typically no more than 1 to 3 days). Under these infrequent conditions, the upstream fishway is not operational. The tailrace elevation has little impact to the upstream fishway entrance due to the height of the lower entrance weirs. The use of the entrance weir may be impacted under flood flow conditions; however the fishway is not operated under those conditions. The fishway is typically operated from May through mid-November, and it is voluntarily monitored (through use of the fish trap) on a daily basis for successful Atlantic salmon passage and to ensure that undesirable species (such as northern pike) are not passed upstream.

The installation of downstream fish passage facilities at the Mattaceunk Project and subsequent monitoring for Atlantic salmon originated from Article 404 associated with the Project’s 1988 FERC license. The design of these facilities and monitoring plans were conducted in consultation with the U.S. Fish and Wildlife Service (USFWS), Atlantic Sea Run Salmon Commission (ASRSC), Maine Department of Marine Resources (MDMR), and National Marine Fisheries Service (NMFS), along with the final approval by FERC.

Permanent downstream fish passage facilities were installed at the Mattaceunk Project in 1992 and consist of single surface inlets integral with the trashracks in two of the four turbine forebays (intakes 3 and 4), together with 1-inch clear spacing trashracks covering the top 16 feet (at normal pond) of the water column. At depths greater than 16 feet, the trashracks have 2-5/8-inch clear spacing. The surface inlets are designed to pass two percent of the station flow (70 cfs each). The downstream passage facilities are currently operated from October 17 to December 1
for kelts (post-spawning adult Atlantic salmon) and from April 1 to June 15 for smolts (downstream-migrating juvenile salmon) and kelts.

2.0 DEPENDABLE CAPACITY AND AVERAGE ANNUAL ENERGY PRODUCTION

2.1 Project Hydrology

The Mattaceunk Project lies within the Penobscot River Basin. The Penobscot River rises in northwestern Maine and flows in a southeasterly direction over a distance of approximately 240 miles to the Atlantic Ocean at Penobscot Bay. It is formed by the joining of two major tributaries, the West Branch and the East Branch, in the Town of Medway, located at the upstream end of the Mattaceunk Project. The total drainage area of the Penobscot River is 8,525 square miles. The drainage area of the West Branch is 2,113 square miles, while that of the East Branch is 1,120 square miles. The drainage area of the main stem between the confluence of the East and West Branches and the Mattaceunk Project dam is 115 square miles. The total drainage at the Mattaceunk Project dam is 3,308 square miles.

With the issuance of new FERC licenses for the Ripogenus and Penobscot Mills projects in 1996, flows on the West Branch upstream of the Mattaceunk Project were modified. Therefore, based on consultation with the relicensing parties and in order to develop an accurate description of current river flows, the hydrologic POR utilized for analysis was limited from 1996 through 2015. This POR reflects current flow management on the Penobscot River and at the Mattaceunk Project, as compared to the pre-1996 POR.

Flows at the Project were calculated for the period January 1, 1996, through December 31, 2015, through the combination and proration of data from the following two U.S. Geological Survey (USGS) gages. The results of these calculations are presented in Table 1.3-1. In addition, the flow duration curves associated with this POR are presented in Appendix B-1.
- West Enfield gage 01034500 on the Penobscot River just downstream of the confluence with the Piscataquis River, with a drainage area of 6,671 square miles, for the period 1902-present; and
- Mattawamkeag gage 01030500 on the Mattawamkeag River, with a drainage area of 1,418 square miles, for the period 1934-present.

In addition to the data set specific to the 1996 through 2015 POR, in order to provide a historical understanding of the river flows, GLHA has developed a second set of flow duration curves that include the following additional gage data.

- Former Weldon gage 01030000 on the Penobscot River near Mattawamkeag (just downstream of the Project), with a drainage area of 3,356 square miles, for the period 1940-1991; and
- West Branch gage 01028000 on the Penobscot River near Medway for the period 1916-1939.

Although GLHA developed the additional flow duration curves based on stakeholder input to the consultation process, the 1996-2015 POR is the primary data set given the controlling influences associated with the West Branch.

For the POR of 1996 through 2015, the Mattawamkeag gage was representative of the drainage area between the Weldon and the West Enfield gages. The Mattawamkeag gage was prorated to a drainage area equivalent to the Project drainage area. The flows reported at the Mattawamkeag gage were multiplied by a proration factor of 2.338, which represents the drainage area of the West Enfield gage minus the drainage area of the Weldon gage, divided by the drainage area of the Mattawamkeag gage.

To calculate flows at the Project, the factored flow data were then subtracted from the reported flows at the West Enfield gage.

As common in calculated data sets, adjustments to the data were necessary to overcome negative flow calculations. Negative flow values are the result of the differences in hydrograph timing,
travel time, and the shape of the hydrographs between the West Enfield and Mattawamkeag gages, including the effects of storm size, types, and tracking. Within the data set, there were 205 negative or low flow days requiring further adjustment, amounting to 2.8 percent of the total data. Project flows for these days were calculated based on an alternative method. The alternative method calculated flows at the Project based on the flows reported at the West Enfield gage, prorated by a factor of 0.502, which represents the drainage area of the project site divided by the drainage area of the West Enfield gage.

2.1.1 Flow Duration Curves

Given the modification in flows from the West Branch following 1996, flow duration curves for the POR of both 1916 to 2015 and 1996 to 2015 were developed based on the calculated flows at the Project, as described in Section 2.1 (Appendix B-1). Flows at the Mattaceunk Project are typically the highest in the spring (April through June) due to annual spring runoff, with average flows ranging from 4,427 cfs to 9,715 cfs.

2.2 Dependable Capacity

The Project’s dependable capacity is estimated to be 4,900 kilowatts (kW) using the 7Q10 flow determined using calculated flows at the Project, as outlined in Section 2.1, for the period January 1, 1996, through December 31, 2015. The 7Q10 flow is the lowest 7-day flow occurring with a frequency of once in 10 years. The 7Q10 flow for this period was approximately 1,680 cfs. Dependable capacity was calculated at the generator terminals assuming a flow of 840 cfs through both Unit 1 and Unit 2.

2.3 Area-Capacity and Rule Curve

The Project’s impoundment at a normal pond elevation of 240.0 feet USGS has a surface area of approximately 1,664 acres, with a storage capacity of approximately 20,891 acre-feet. Figure 2.3-1 presents the Project’s area and capacity curves. Given the Project’s current and proposed run-of-river with pondage mode of operation, a rule curve has not been developed for
the Project. If a guide curve were to be developed, the curve would present a horizontal line at 240.0 feet throughout the year.

2.4 Estimated Hydraulic Capacity

The Project has a combined estimated maximum hydraulic capacity of 7,438 cfs. The Project’s minimum hydraulic capacity is 471 cfs, which represents the minimum hydraulic capacity of either Unit 1 or Unit 2.

2.5 Tailwater Rating Curve

The Project’s normal tailwater elevation is 199.0 feet. The tailwater rating curve for the Project is presented in Figure 2.5-1.

2.6 Powerplant Capability vs. Head

Figure 2.6-1 provides the plant capability curve for the Project. Given the Project’s run-of-river with pondage mode of operation, in combination with the Project’s year-round use of 4-foot-high flashboards, the Project impoundment’s normal elevation is 240.0 feet and the Project is operated to maintain this elevation. The Project’s maximum head is equal to the Project’s normal head of approximately 41 feet, which is achieved with the impoundment at normal elevation of 240.0 feet, the tailwater at normal elevation of 199.0 feet, and flows within the Project’s hydraulic capacity. The Project’s minimum impoundment drawdown limit is elevation 235.0 feet (1.0 foot below the dam crest elevation of 236.0 feet), which provides the Project’s minimum head of approximately 16.6 feet, achieved with the historical maximum flow from the Project, 69,936 cfs, and equivalent tailwater elevation of 218.4 feet.
FIGURE 2.3-1
AREA AND CAPACITY CURVES

Area In Hundred Acres

Full Pond El. 240

Crest Of Dam El. 236

Crest Gate Section El. 221

Elevation In Feet (U.S.G.S.)

Capacity In Acre Feet (x10^3)
FIGURE 2.5-1
TAILWATER RATING CURVE

TAILWATER RATING CURVE
WELDON DAM
SUPPLEMENT TO FIFTH PERIODIC
SAFETY INSPECTION REPORT
WELDON STATION
STONE & WEBSTER ENGINEERING CORPORATION
FIGURE 2.6-1
PLANT CAPABILITY CURVE

Headpond Elevation vs. Station Capacity
Mattaceunk Project
3.0 UTILIZATION OF PROJECT POWER

GLHA is an independent power producer and, as such, does not provide electric service to any particular group or class of customers, or prepare and submit load and capability forecasts or resource plans to any regulatory body.

The Project generates renewable and emission-free power for Maine and the regional power pool administered by Independent System Operator New England (ISO New England). Currently, generation from the Project is sold on the open market through bidding into the New England Power Pool (NEPOOL) market administered by ISO New England, the non-profit independent system operator for New England. ISO New England administers all significant aspects of the NEPOOL power market. GLHA estimates that between 1 and 2 percent of the Project’s total annual generation is used for station service power.

4.0 PLANS FOR OPERATIONAL CHANGES OR FUTURE DEVELOPMENT

GLHA proposes to continue to provide a year-round continuous minimum flow of 1,674 cfs or inflow, whichever is less, and a daily average minimum flow of 2,392 cfs from July 1 through September 30 and 2,000 cfs from October 1 through June 30, unless inflow is less than the stated daily average minimum flows, in which case outflow from the Project would equal the inflow to the Project. This proposal is based upon the studies performed in support of this relicensing, consultation with the relicensing parties, the FERC Order Granting Appeal in Part and Amending License on February 9, 1990 (50 ¶61,163), and the Order on Rehearing issued on June 21, 1991 (55 FERC ¶61,472).

GLHA also proposes to continue to operate within the existing impoundment fluctuation limits including maintaining the impoundment within 2.0 feet below the crest of the 4-foot-high flashboards (238.0 feet limit) when the flashboards are installed and 1.0 feet below the crest elevation of the dam (235.0 feet limit) when the flashboards are not installed.
GLHA proposes to continue to operate the upstream and downstream fishways as described elsewhere in this exhibit. In addition, GLHA is proposing the following operational changes and future development to enhance fish passage at the Project:

- Annually opening the Project’s log sluice (~690 cfs) for three weeks in support of downstream Atlantic salmon smolt outmigration (schedule to be determined in consultation with agencies and based on environmental factors including river temperature and flow);
- Annual nighttime turbine shutdowns (8 pm to 4 am) in combination with opening the Project’s roller gate\(^2\) in support of downstream outmigrations of silver American eels during expected peak outmigration events (schedule to be determined in consultation with agencies and based on a predictive model for eel movement through the Project);
- Annual extended seasonal log sluice operation (~690 cfs), June to November, once an upstream passage facility for alosines (American shad and river herring) is operational, expected year 16 of a new license term;
- Installation of trashracks having 1-inch clear spacing over the full depth of the turbine intakes; these trashracks will be installed within two years of license issuance and would be deployed during the downstream fish passage season;
- Seasonal installation and maintenance of an upstream eel ramp within two years of the effective date of the new license;
- Installation of an upstream passage facility to accommodate alosines by year 15 of the new license.

Operation of the Project’s log sluice (located adjacent to the powerhouse) during the Atlantic salmon smolt outmigration is an enhancement to operation of the existing downstream fish passage facility. The 10-foot-wide log sluice is estimated to release approximately 690 cfs of flow, or nine percent of maximum station flow, which would be in addition to the 140 cfs currently released through the Project’s existing downstream fishway. The log sluice would be opened for three weeks in support of downstream Atlantic salmon smolt outmigrations (likely in

\(^2\) The cfs release will depend on river flows and the need to maintain stable impoundment elevation.
May), with the schedule to be determined in consultation with agencies and based on environmental factors including river temperature and flow.

GLHA is also proposing nighttime turbine shutdowns to enhance downstream passage of silver stage American eels. The nighttime shutdowns would be accompanied with opening of the Project’s roller gate, which provides a deeper (mid-level) opening suitable for American eels. The schedule for these shutdowns would be determined in consultation with agencies and based on a predictive model for eel movement through the Project. Based on historical data, the peak outmigration of American eels in the upper Penobscot River occurs in September and October and is often accompanied by storm events, resulting in increased river flows. It is anticipated that the turbine shutdowns will target these conditions.

These two operational changes, seasonal operation of the log sluice and nighttime turbine shutdowns (concurrent with operation of the roll gate) will be initiated in year one of the new license.

Additional operational modifications are proposed once a new upstream passage facility designed to pass alosine species is constructed and operational, expected by year 16 of the new license. These operational modifications will consist of extended seasonal operation of the log sluice from June through November, and extended operation of the downstream fish passage facility to encompass the entire downstream fish passage season (i.e., April through November). The log sluice measure will provide 690 cfs, or approximately nine percent of maximum station flow, to support the safe passage of downstream migrating post-spawn and juvenile American shad and river herring. This 690 cfs of log sluice flow would be in addition to the 140 cfs of flow through the existing downstream fish passage facility.

In addition to these operational changes, GLHA will install a seasonal American eel upstream passage ramp within two years of the new license issuance and a new permanent upstream passage facility suitable for alosines (including American shad, alewife, and blueback herring), expected to be a fishlift, by year 15 of the new license. These newly proposed operational changes and facility construction will increase maintenance activities.
Finally, as economic conditions continue to change, GLHA routinely performs periodic evaluations of all generating facilities regarding potential upgrades; GLHA will continue these evaluations for the Mattaceunk Project after license issuance and into the future. GLHA anticipates that potential future development activities would be the subject of an amendment to the Project’s new license.
APPENDIX B-1
FLOW DURATION CURVES
Mattaceunk Project
Annual Flow Duration

Hydrology based on combined, prorated and adjusted data from the USGS gages:
- USGS 01028000 West Branch Penobscot River near Medway, ME,
- USGS 01030000 Penobscot River Nr Mattawamkeag, ME,
- USGS 01029500 East Branch Penobscot River @ Grindstone, ME, and
- USGS 01030500 Mattawamkeag River near Mattawamkeag, Maine
Mattaceunk Project
January Flow Duration

Hydrology based on combined, prorated and adjusted data from the USGS gages:
- USGS 01028000 West Branch Penobscot River near Medway, ME,
- USGS 01030000 Penobscot River Nr Mattawamkeag, ME,
- USGS 01029500 East Branch Penobscot River @ Grindstone, ME, and
- USGS 01030500 Mattawamkeag River near Mattawamkeag, Maine
Hydrology based on combined, prorated and adjusted data from the USGS gages:
- USGS 01028000 West Branch Penobscot River near Medway, ME,
- USGS 01030000 Penobscot River Nr Mattawamkeag, ME,
- USGS 01029500 East Branch Penobscot River @ Grindstone, ME, and
- USGS 01030500 Mattawamkeag River near Mattawamkeag, Maine
Mattaceunk Project
March Flow Duration

Hydrology based on combined, prorated and adjusted data from the USGS gages:
- USGS 01028000 West Branch Penobscot River near Medway, ME,
- USGS 01030000 Penobscot River Nr Mattawamkeag, ME,
- USGS 01029500 East Branch Penobscot River @ Grindstone, ME, and
- USGS 01030500 Mattawamkeag River near Mattawamkeag, Maine

Appendix B-1, Page 4
Hydrology based on combined, prorated and adjusted data from the USGS gages:
- USGS 01028000 West Branch Penobscot River near Medway, ME,
- USGS 01030000 Penobscot River Nr Mattawamkeag, ME,
- USGS 01029500 East Branch Penobscot River @ Grindstone, ME, and
- USGS 01030500 Mattawamkeag River near Mattawamkeag, Maine
Mattaceunk Project
May Flow Duration

Hydrology based on combined, prorated and adjusted data from the USGS gages:
- USGS 01028000 West Branch Penobscot River near Medway, ME,
- USGS 01030000 Penobscot River Nr Mattawamkeag, ME,
- USGS 01029500 East Branch Penobscot River @ Grindstone, ME, and
- USGS 01030500 Mattawamkeag River near Mattawamkeag, Maine

Appendix B-1, Page 6
Mattaceunk Project

June Flow Duration

Hydrology based on combined, prorated and adjusted data from the USGS gages:
- USGS 01028000 West Branch Penobscot River near Medway, ME,
- USGS 01030000 Penobscot River Nr Mattawamkeag, ME,
- USGS 01029500 East Branch Penobscot River @ Grindstone, ME, and
- USGS 01030500 Mattawamkeag River near Mattawamkeag, Maine

Appendix B-1, Page 7
Hydrology based on combined, prorated and adjusted data from the USGS gages:
- USGS 01028000 West Branch Penobscot River near Medway, ME,
- USGS 01030000 Penobscot River Nr Mattawamkeag, ME,
- USGS 01029500 East Branch Penobscot River @ Grindstone, ME, and
- USGS 01030500 Mattawamkeag River near Mattawamkeag, Maine
Mattaceunk Project
August Flow Duration

Hydrology based on combined, prorated and adjusted data from the USGS gages:
- USGS 01028000 West Branch Penobscot River near Medway, ME,
- USGS 01030000 Penobscot River Nr Mattawamkeag, ME,
- USGS 01029500 East Branch Penobscot River @ Grindstone, ME, and
- USGS 01030500 Mattawamkeag River near Mattawamkeag, Maine

Appendix B-1, Page 9
Mattaceunk Project

September Flow Duration

Flow in cfs

Percent Exceedence

Hydrology based on combined, prorated and adjusted data from the USGS gages:
- USGS 01028000 West Branch Penobscot River near Medway, ME,
- USGS 01030000 Penobscot River Nr Mattawamkeag, ME,
- USGS 01029500 East Branch Penobscot River @ Grindstone, ME, and
- USGS 01030500 Mattawamkeag River near Mattawamkeag, Maine

Appendix B-1, Page 10
Mattaceunk Project
October Flow Duration

Hydrology based on combined, prorated and adjusted data from the USGS gages:
- USGS 01028000 West Branch Penobscot River near Medway, ME,
- USGS 01030000 Penobscot River Nr Mattawamkeag, ME,
- USGS 01029500 East Branch Penobscot River @ Grindstone, ME, and
- USGS 01030500 Mattawamkeag River near Mattawamkeag, Maine
Mattaceunk Project

November Flow Duration

Hydrology based on combined, prorated and adjusted data from the USGS gages:
- USGS 01028000 West Branch Penobscot River near Medway, ME,
- USGS 01030000 Penobscot River Nr Mattawamkeag, ME,
- USGS 01029500 East Branch Penobscot River @ Grindstone, ME, and
- USGS 01030500 Mattawamkeag River near Mattawamkeag, Maine

Appendix B-1, Page 12
Mattaceunk Project
December Flow Duration

Hydrology based on combined, prorated and adjusted data from the USGS gages:
- USGS 01028000 West Branch Penobscot River near Medway, ME,
- USGS 01030000 Penobscot River Nr Mattawamkeag, ME,
- USGS 01029500 East Branch Penobscot River @ Grindstone, ME, and
- USGS 01030500 Mattawamkeag River near Mattawamkeag, Maine

Appendix B-1, Page 13
EXHIBIT C
CONSTRUCTION HISTORY
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>CONSTRUCTION HISTORY</td>
<td>C-1</td>
</tr>
<tr>
<td>1.1</td>
<td>Original Construction</td>
<td>C-1</td>
</tr>
<tr>
<td>1.2</td>
<td>Modification or Additions to the Existing Project</td>
<td>C-2</td>
</tr>
<tr>
<td>2.0</td>
<td>PROJECT SCHEDULE OF NEW DEVELOPMENT</td>
<td>C-3</td>
</tr>
</tbody>
</table>
Exhibit C
Construction History

1.0 CONSTRUCTION HISTORY

Given that 18 Code of Federal Regulations (CFR) §4.51(d)(1) requires a construction history only for applications for an initial (i.e., original) license, a construction history is not required for this relicensing application for a new license for the Mattaceunk Project. However, to provide general and background information regarding the Project, a brief summary of the construction history of the Project is provided below.

1.1 Original Construction

The Mattaceunk Project was originally developed between 1937 and 1940 by Great Northern Paper Company and originally consisted of Units 1 and 2 with Kaplan runners and Unit 3 with a fixed-blade wheel. An empty turbine bay was provided during the original construction, which was later filled in 1942 with Unit 4 (Kleinschmidt 2005). The following provides a summary of the primary activities associated with construction of the Project.

- 1937 – Soil investigation to support structural design.
- 1937 to 1940 – Construction of sub and superstructures for dam and powerhouse.
- 1938 and 1939 – Purchase and install water wheels, generators, motor exciters, and auxiliary equipment for Units 1 and 2.
- 1937 to 1939 – Purchase land and construct transmission line from Project to East Millinocket Mill.
- 1939 and 1940 – Purchase and install third generator unit (Unit 3).
- 1941 and 1942 – Purchase and install fourth generator unit (Unit 4).
1.2 Modification or Additions to the Existing Project

The following provides a summary of the primary modifications or additions to Project:

- **1962** – The power station was placed on remote control with operation being handled from the control board at the Millinocket boiler house.
- **1973** – Repairs of the roller gate and gated spillway concrete were performed.
- **1976** – The crest of the entire spillway was refaced, and new flashboard pin sockets were installed.
- **1977** – The downstream faces of 13 spillway monoliths (blocks 4, 5, 6, 8, 10, 12, and 14 through 20) were refaced with concrete, and repairs of the spillway piers, wingwalls, fish ladder, powerhouse walls, tailrace deck, and retaining walls were performed.
- **1983** – Modifications were made to the Project’s existing upstream fishway.
- **1984** – A new roller gate seal was installed.
- **1992** – The Project’s existing downstream fishway was installed.
- **1998** – A back-up propane generator for emergency operation of the roller gate was installed. Operator mechanism and limit switches were repaired, and additional security fencing was added after vandals gained entry to the plant and raised the roller gate, which was damaged when the drive chain bound up after the gate passed the normal full-up position.
- **1999** – Concrete repairs of the gated spillway deck were performed.
- **2004 to 2006** – The Project’s turbines were refurbished, and the Project’s generators were rewound and converted from 40 to 60 Hz.
- **2013** – Repairs of the roller gate and gated spillway concrete were completed. Refurbishments to the upstream and downstream fishways were performed.
2.0 PROJECT SCHEDULE OF NEW DEVELOPMENT

The Licensee does not propose any new development (e.g., additional generating units) at the Project. The schedule associated with the potential installation of additional fish passage and protection facilities is presented in Exhibit E of this application.

Literature Cited

EXHIBIT D

STATEMENT OF COSTS AND FINANCING
### TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>ORIGINAL COST OF EXISTING FACILITIES</td>
<td>D-1</td>
</tr>
<tr>
<td>2.0</td>
<td>ESTIMATED AMOUNT OF PAYABLE UPON TAKEOVER PURSUANT TO SECTION 14 OF THE FEDERAL POWER ACT</td>
<td>D-1</td>
</tr>
<tr>
<td>2.1</td>
<td>Fair Value</td>
<td>D-1</td>
</tr>
<tr>
<td>2.2</td>
<td>Net Investment</td>
<td>D-2</td>
</tr>
<tr>
<td>2.3</td>
<td>Severance Damages</td>
<td>D-2</td>
</tr>
<tr>
<td>3.0</td>
<td>ESTIMATED COST OF NEW FACILITIES AND MEASURES</td>
<td>D-2</td>
</tr>
<tr>
<td>3.1</td>
<td>Land and Water Rights</td>
<td>D-2</td>
</tr>
<tr>
<td>3.2</td>
<td>Cost of New Facilities</td>
<td>D-2</td>
</tr>
<tr>
<td>4.0</td>
<td>AVERAGE ANNUAL COST OF THE PROJECT</td>
<td>D-3</td>
</tr>
<tr>
<td>4.1</td>
<td>Current Annual Costs</td>
<td>D-3</td>
</tr>
<tr>
<td>4.2</td>
<td>Costs of Proposed Environmental Measures</td>
<td>D-3</td>
</tr>
<tr>
<td>5.0</td>
<td>VALUE OF PROJECT POWER</td>
<td>D-7</td>
</tr>
<tr>
<td>6.0</td>
<td>SOURCES AND EXTENT OF FINANCING AND ANNUAL REVENUES</td>
<td>D-7</td>
</tr>
<tr>
<td>7.0</td>
<td>COST TO DEVELOP LICENSE APPLICATION</td>
<td>D-8</td>
</tr>
<tr>
<td>8.0</td>
<td>ESTIMATED AVERAGE DECREASE IN GENERATION</td>
<td>D-8</td>
</tr>
<tr>
<td>Table</td>
<td>Title</td>
<td>Page No.</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>TABLE 4.1-1</td>
<td>OPERATING COSTS FOR 2015</td>
<td>D-3</td>
</tr>
<tr>
<td>TABLE 4.2-1</td>
<td>PRELIMINARY COST ESTIMATES OF PROPOSED ENVIRONMENTAL MEASURES</td>
<td>D-6</td>
</tr>
<tr>
<td>TABLE 8.0-1</td>
<td>PRELIMINARY ESTIMATES OF REDUCED GENERATION OF PROPOSED ENVIRONMENTAL MEASURES</td>
<td>D-8</td>
</tr>
</tbody>
</table>
Exhibit D
Statement of Costs and Financing

1.0 ORIGINAL COST OF EXISTING FACILITIES

Given that Great Lakes Hydro America, LLC (GLHA or Licensee) is applying for a new 40-year license for an existing project, as compared to an initial (i.e., original) license for an unconstructed project, the requirement to provide a tabulated statement providing the actual or approximate cost of Project construction is not applicable to this application.

2.0 ESTIMATED AMOUNT OF PAYABLE UPON TAKEOVER PURSUANT TO SECTION 14 OF THE FEDERAL POWER ACT

Under Section 14(a) of the Federal Power Act (FPA), the Federal government may take over a project licensed by the Federal Energy Regulatory Commission (FERC or Commission) upon the expiration of the current license. If such a takeover were to occur upon expiration of the current license, the Licensee would have to be reimbursed for the net investment, not to exceed fair value, of the property taken, plus severance damages. To date, no agency or interested party has recommended a federal takeover of the Project pursuant to Section 14 of the FPA.

2.1 Fair Value

The fair value of the Project is dependent on prevailing power values and license conditions, both of which are currently subject to change. The best approximation of fair value would likely be the cost to construct and operate a comparable power generating facility. Because of the high capital costs involved with constructing new facilities and the increase in fuel costs associated with operation of such new facilities (assuming a fossil-fueled replacement), the fair value would be considerably higher than the net investment amount. If a takeover were to be proposed, the Licensee would calculate fair value based on then-current conditions.

GLHA has estimated the fair market value of the Project through an evaluation of recent acquisition of hydroelectric facilities throughout the United States. These acquisitions have ranged from $2,500 to $5,000 per installed kilowatt (kW). Based on this evaluation, the
estimated fair market value of the 19.2-megawatt (MW) Mattaceunk Project could be considered in the range of $48,000,000 to $96,000,000. However, this estimate is subject to change given the dynamic energy markets and regulatory changes.

2.2 Net Investment

The current net investment in the Mattaceunk Project is $25,119,230. This should not be interpreted as the fair market value of the Project.

2.3 Severance Damages

Severance damages are not clearly defined in the FPA or its implementing regulations, and many principles applicable to determining this component of takeover compensation are uncertain and can only be estimated. However, GLHA believes that potential severances inflicted by a takeover of the Project would be significant. Therefore, given the challenges of estimating damages associated with severance, GLHA is reserving the right to provide the Commission with such an estimate should the Commission consider federal takeover of the Project.

3.0 ESTIMATED COST OF NEW FACILITIES AND MEASURES

3.1 Land and Water Rights

The Licensee is not proposing to expand land or water rights as a consequence of this license application.

3.2 Cost of New Facilities

The Licensee is not proposing any capacity-related developments at the Project. Regarding the cost of new fish passage measures, GLHA estimates the capital cost of the upstream seasonal eel ramp to be between $50,000 and $100,000 and the new upstream passage facility for alosines to be between $3,000,000 and $7,000,000. For downstream passage, GLHA estimates that
providing 1-inch clear spacing full-depth trashracks will require a capital investment of roughly $1,000,000.

4.0 AVERAGE ANNUAL COST OF THE PROJECT

There is no fixed cost for GLHA’s life extension program. Instead, the program is a sequence of activities designed to be implemented when required. Accordingly, there is not a fixed annual budget allocated for life-extension activities. These activities would be performed on an as-needed basis using existing planning procedures that provide short- and long-term windows to evaluate, schedule, and budget replacements and rehabilitation work in an orderly fashion.

4.1 Current Annual Costs

Based on operations and maintenance costs for 2015, the estimated annual costs for the Mattaceunk Project are presented in Table 4.1-1.

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual operation, maintenance, expenses, fees, insurance, overhead, and depreciation</td>
<td>$1,797,906</td>
</tr>
<tr>
<td>Local, State and Federal Taxes</td>
<td>$626,853</td>
</tr>
<tr>
<td>Total</td>
<td>$2,424,759</td>
</tr>
</tbody>
</table>

4.2 Costs of Proposed Environmental Measures

GLHA proposes to continue to implement the following measures that contribute to the protection and enhancement of environmental resources associated with the Penobscot River and the Project area:

- Maintain year-round continuous minimum base flow of 1,674 cfs or inflow, whichever is less.
- Maintain a daily average minimum flow of 2,392 cfs from July 1 through September 30 and 2,000 cfs from October 1 through June 30, or average inflow, whichever is less.
• Operate within the existing impoundment fluctuation limitations that consist of the following:
  o Year-round use of 4-foot-high flashboards.
  o Maintain impoundment no lower than 2.0 feet below the flashboard crest elevation of 240.0 feet when the flashboards are in use.
  o Maintain impoundment no lower than 1.0 feet below the dam crest elevation of 236.0 feet when the flashboards are not in use.
• Maintain and operate upstream and downstream fish passage facilities for Atlantic salmon; the downstream fishway is operated from April 1 to June 15 for smolts (downstream migrating juvenile Atlantic salmon) and kelts (post-spawning adult Atlantic salmon) and in the fall from October 17 to December 1 for kelts.
• Continued operation and monitoring of the upstream fishway annually from May 1 to November 10 for upstream Atlantic salmon passage and to provide resource managers with spawning escapement tallies of Atlantic salmon into the upper reaches of the Penobscot River.
• Maintain existing Project recreation facilities including (1) a canoe portage trail, and (2) a downstream angler access area with a parking area, stairs leading to the tailrace area, and a covered picnic area.

In addition to continuing the existing environmental measures, GLHA is proposing the following Protection, Mitigation, and Enhancement (PM&E) measures at this time:

• Implement recreation facility improvements at the existing downstream angler access area within three years of license issuance, including (1) re-installing a pulley system to assist boaters with moving car top boats and other small watercraft up and down the stairs, (2) installation of a ramp adjacent to the existing recreation pavilion to provide wheelchair access to the pavilion and associated picnic table, and (3) additional signage associated with the angler access area.
• Seasonal installation and maintenance of an upstream eel ramp within two years of the effective date of the new license, including one year of monitoring.
• Implementation of a Species Protection Plan for the federally endangered Gulf of Maine Distinct Population Segment of Atlantic salmon to include the following measures:
In addition to annual operation of the upstream fishway, coordinate with resource agencies to stock uniquely marked Atlantic salmon smolts (originating from the Green Lake National Fish Hatchery) upstream of Weldon Dam in the first three years after license issuance; these fish would then serve as a source of imprinted adult fish (i.e., fish homing to areas upstream of Weldon Dam) for studying upstream passage of adults and downstream passage of kelts.

- Conduct up to three years of upstream fishway effectiveness testing and up to three years of downstream kelt studies using the returning imprinted adult fish.

- Installation of trashracks having 1-inch clear spacing to the full depth of the turbine intakes within two years of license issuance; the trashracks would be deployed during the fish passage season.

- In addition to annual operation of the downstream fishway, open the Project’s log sluice (between 3% and 9% of station capacity, or between approximately 225 cfs and 690 cfs) in support of downstream Atlantic salmon smolt outmigration for three weeks (schedule to be determined in consultation with agencies and based on environmental factors including river temperatures and flows) beginning in the first passage season following license issuance.

- Conduct up to three years of Atlantic salmon smolt downstream passage monitoring for existing fish passage operations, coupled with operation of the log sluice and implementation of the 1-inch clear spacing full-depth trashracks, including an assessment of sources of impoundment mortality.

- Implement an adaptive management plan to address performance criteria for downstream passage, should the proposed measures be inadequate.

- Additional operational and structural modifications and/or habitat enhancement measures, if necessary, to address outmigrating Atlantic salmon smolts and kelts and upstream migrating Atlantic salmon adults.

- Installation of an upstream passage structure for alosines in year 15 of the new license, including two years of monitoring.

- Annual nighttime turbine shutdowns (8 pm to 4 am) in combination with opening the Project’s roller gate¹ implemented concurrent with installation of the 1-inch clear spacing full-depth trashracks in support of downstream outmigrations of silver American eels

¹The cfs release will depend on river flows and the need to maintain stable impoundment elevation.
(schedule to be determined in consultation with agencies and based on a predictive model for eel movement through the Project; targeted events are expected to occur in September and October) beginning in the first passage season following license issuance, including two years of monitoring.

- Annual extended seasonal operation of the downstream fishway and log sluice operation (~225 cfs and 690 cfs) from June 1 to November 30, as necessary based on smolt and alosine study results, once upstream passage for alosines (American shad and river herring) is operational (expected year 16 of a new license term), including two years of downstream fish passage monitoring.

- Additional operational and structural modifications and/or habitat enhancement measures, if necessary, to provide eel and alosine passage (passage criteria for eels and alosines shall be based on a review of the performance of comparable fish passage measures in New England).

- Development of a Historic Properties Management Plan following completion of the 2017 Phase II archeological field studies.

A cost estimate associated with implementation of these additional measures is provided in Table 4.2-1.

### TABLE 4.2-1
PRELIMINARY COST ESTIMATES OF PROPOSED ENVIRONMENTAL MEASURES

<table>
<thead>
<tr>
<th>Item</th>
<th>Capital Cost (2016 dollars)</th>
<th>Incremental O&amp;M or Annual Cost (2016 dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project recreation facility improvements (re-install a pulley system to assist boaters, install ramp to picnic table at the downstream angler access area, and install signage).</td>
<td>$2,000</td>
<td>$200</td>
</tr>
<tr>
<td>Installation of a ramp to provide additional access to the recreation pavilion and picnic table</td>
<td>$1,000</td>
<td>$100</td>
</tr>
<tr>
<td>1-inch clear spacing full-depth trashrack within two years of license issuance.</td>
<td>$1,000,000</td>
<td>$15,000</td>
</tr>
<tr>
<td>Seasonal installation and maintenance of an upstream eel ramp within two years of license issuance.</td>
<td>$50,000</td>
<td>$5,000</td>
</tr>
<tr>
<td>Annual nighttime turbine shutdowns (8 pm to 4 am) in combination with opening of the Project’s roller gate in support of downstream outmigration of silver eels</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Annual opening of the Project’s sluice gate (~690 cfs) for three weeks in support of the Atlantic salmon smolt outmigration</td>
<td>$0</td>
<td>$0</td>
</tr>
</tbody>
</table>
## Exhibit D

### Statement of Costs and Financing

<table>
<thead>
<tr>
<th>Item</th>
<th>Capital Cost (2016 dollars)</th>
<th>Incremental O&amp;M or Annual Cost (2016 dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual extended seasonal sluice gate operation (~690 cfs), April to November, once upstream passage for alosines is operational in year 16 of a new license.</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Install a new upstream passage facility, expected to be a fishlift, which will be suitable for alosines by year 15 of the new license.</td>
<td>$7,000,000</td>
<td>$100,000</td>
</tr>
<tr>
<td>Development and implement Historic Properties Management Plan</td>
<td>$10,000&lt;sup&gt;2&lt;/sup&gt;</td>
<td>$2,000&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Fishway monitoring activities</td>
<td>$500,000</td>
<td>$0</td>
</tr>
</tbody>
</table>

<sup>1</sup> Incremental operations and maintenance (O&M) cost is limited to additional expenditures. Generation loss due to implementation of these measures is presented in Table 8.0-1.

<sup>2</sup> Estimate is dependent upon completion of the Phase II survey activities and associated consultation scheduled for 2017.

### 5.0 VALUE OF PROJECT POWER

Power generated by the Project is sold through Independent System Operator New England (ISO New England) at prevailing market rates. GLHA estimates gross annual energy production of approximately 123,332 megawatt-hours (MWh) at the Project. Whereas the average market clearing price for energy can vary greatly, it is approximated at $40/MWh for the purposes of this application.

### 6.0 SOURCES AND EXTENT OF FINANCING AND ANNUAL REVENUES

If determined to be needed, GLHA’s general plan for financing the environmental enhancements and life-extension costs of the Project initially will be to issue short-term debt (either bank line of credit or commercial paper) and to generate internal funding consisting of depreciation, retained earnings, and deferred federal income taxes. If short-term financing options become unattractive, GLHA will issue permanent securities (i.e., long-term debt, preferred stock, and common stock) to replace short-term debt. This financing plan will adhere to GLHA’s overall corporate construction financing requirements.
7.0 COST TO DEVELOP LICENSE APPLICATION

GLHA estimates that the cost to develop the license application for the Mattaceunk Project, including studies, consultants and internal management and administrative costs, is approximately $1,200,000.

8.0 ESTIMATED AVERAGE DECREASE IN GENERATION

Table 8.0-1 presents the decrease in generation resulting from the proposed environmental measures for the Project.

<table>
<thead>
<tr>
<th>Item</th>
<th>Reduced Generation (MWh)</th>
<th>Annual Cost (2016 dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation of a trashrack having 1-inch clear spacing to the full depth of intake deployed during the fish passage season</td>
<td>15,450</td>
<td>$772,500</td>
</tr>
<tr>
<td>Annual nighttime turbine shutdowns (8 pm to 4 am) in combination with opening of the Project’s roller gate in support of downstream outmigration of silver eels</td>
<td>6,260&lt;sup&gt;1&lt;/sup&gt;</td>
<td>$313,000</td>
</tr>
<tr>
<td>Annual opening of the Project’s sluice gate (~690 cfs) in support of the Atlantic salmon smolt outmigration for three weeks</td>
<td>745</td>
<td>$37,250</td>
</tr>
<tr>
<td>Annual extended seasonal sluice gate operation (~690 cfs), April to November, once upstream passage for alosines is operational (expected year 16 of the new license)</td>
<td>6,840&lt;sup&gt;2&lt;/sup&gt;</td>
<td>$342,000</td>
</tr>
<tr>
<td>Install a new upstream passage facility, expected to be a fishlift, that will be suitable for alosines by year 15 of the new license.&lt;sup&gt;3&lt;/sup&gt;</td>
<td>3,580</td>
<td>$179,000</td>
</tr>
<tr>
<td>Continued operation of the Project’s downstream fish bypass structure and upstream fishway</td>
<td>1,030</td>
<td>$51,500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>33,905</strong></td>
<td><strong>$1,695,250</strong></td>
</tr>
</tbody>
</table>

<sup>1</sup> Assumed up to six weeks of spill.
<sup>2</sup> Assumed up to 690 cfs.
<sup>3</sup> Assumed up to 350 cfs.
EXHIBIT F
GENERAL DESIGN DRAWINGS
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>EXHIBIT F DRAWINGS</td>
<td>F-1</td>
</tr>
<tr>
<td>2.0</td>
<td>SUPPORTING DESIGN REPORT</td>
<td>F-1</td>
</tr>
<tr>
<td>3.0</td>
<td>CRITICAL ENERGY INFRASTRUCTURE INFORMATION</td>
<td>F-2</td>
</tr>
</tbody>
</table>
Exhibit F
General Design Drawings

1.0 EXHIBIT F DRAWINGS

The design drawings showing plans, elevations, and sections of the principal Mattaceunk Project works are included as follows:

<table>
<thead>
<tr>
<th>Sheet No.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheet 1</td>
<td>Plan and Sections of Dams and Station</td>
</tr>
<tr>
<td>Sheet 2</td>
<td>Plan and Sections of Powerhouse and Dike</td>
</tr>
</tbody>
</table>

As noted in Section 3.0 below, copies of these design drawings are being filed with the Federal Energy Regulatory Commission (FERC or Commission) as Critical Energy Infrastructure Information (CEII) within Volume VI of this application.

2.0 SUPPORTING DESIGN REPORT

18 Code of Federal Regulations (CFR) §4.41(g)(3) requires that an applicant for a new license file with the Commission two copies of a Supporting Design Report when the applicant files a license application. The purpose of the Supporting Design Report is to demonstrate that the existing structures are safe and adequate to fulfill their stated functions.

Given that the Project falls under the jurisdiction of the Commission’s Part 12 - Safety of Water Power Projects and Project Works program, updated Part 12 Dam Safety Inspection Reports have been filed with the Commission during the term of the current license. The Tenth Part 12 report was filed with FERC for approval on January 28, 2016. In addition, Great Lakes Hydro America, LLC (GLHA) has prepared and filed a Supporting Technical Information (STI) document for the Project, as well as has performed a Potential Failure Modes Analysis (PFMA) for the Project.
GLHA believes that the most recent Part 12 Report, along with the STI and the results of the PFMA, fulfill the requirements of 18 CFR §4.41(g)(3) for the Mattaceunk Hydroelectric Project. The Project’s Independent Consultant Safety Inspection Reports, including the STI and the results of the PFMA, are on file with FERC.

### 3.0 CRITICAL ENERGY INFRASTRUCTURE INFORMATION

In order to protect CEII, the Commission has enacted regulations to govern public access to certain information. The Exhibit F drawings and dam safety inspection reports and documents referenced herein contain sensitive and detailed engineering information that, if used improperly, may compromise the safety of the Project and those responsible for its operation. Therefore, the Exhibit F drawings have been labeled "Contains Critical Energy Infrastructure Information - Do Not Release" and have been filed with FERC within the Volume VI of this FLA. Agencies may file a CEII request under 18 CFR §388.113 to obtain the Exhibit F drawings or the Part 12 Independent Consultant Dam Safety Inspection Reports.
EXHIBIT G
PROJECT MAPS
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>PROJECT MAPS</td>
<td>G-1</td>
</tr>
</tbody>
</table>
Exhibit G
Project Maps

1.0 PROJECT MAPS

The Project Boundary maps referenced below show the Project vicinity, location, and boundary in sufficient detail to provide a full understanding of the Project’s location:

<table>
<thead>
<tr>
<th>Sheet No.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheet 1</td>
<td>Property Boundary Map</td>
</tr>
<tr>
<td>Sheet 2</td>
<td>Property Boundary Map</td>
</tr>
</tbody>
</table>

The Project Boundary maps have been prepared in accordance with the requirements of 18 Code of Federal Regulations (CFR) §§ 4.39 and 4.41(h) and applicable Federal Energy Regulatory Commission (FERC) guidance. The preparation of these boundary maps in support of obtaining a new license for the Project has provided Great Lakes Hydro America, LLC (GLHA) the opportunity to make the minor corrections and modifications listed below.

- The Project Boundary has been corrected to eliminate overlap between the Mattaceunk Project Boundary and the project boundary for the upstream Medway Project (FERC Project No. 2666).
- The Project Boundary has been adjusted to fully include the Project’s canoe portage route.

GLHA possesses the property and/or easement rights associated with all minor corrections and modifications, as well as all areas associated with the defined Project Boundary.

Consistent with FERC guidance, an electronic version of the project maps, along with the associated data files, are being filed with the FERC.
EXHIBIT H
DESCRIPTION OF PROJECT MANAGEMENT AND NEED FOR PROJECT POWER
# MATTACEUNK HYDROELECTRIC PROJECT
## FINAL LICENSE APPLICATION
### EXHIBIT H - DESCRIPTION OF PROJECT MANAGEMENT AND NEED FOR PROJECT POWER

## TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>INTRODUCTION ..................................................................................</td>
<td>H-1</td>
</tr>
<tr>
<td>2.0</td>
<td>INFORMATION TO BE SUPPLIED BY ALL APPLICANTS ...................................</td>
<td>H-1</td>
</tr>
<tr>
<td>2.1</td>
<td>Plans and Ability of Owners of Mattaceunk to Operate and Maintain the Project ..................................................</td>
<td>H-1</td>
</tr>
<tr>
<td>2.1.1</td>
<td>Plans to Increase Capacity or Generation .........................................</td>
<td>H-1</td>
</tr>
<tr>
<td>2.1.2</td>
<td>Plans to Coordinate the Operation of the Project with Other Water Resource Projects ..................................................</td>
<td>H-1</td>
</tr>
<tr>
<td>2.1.3</td>
<td>Plans to Coordinate the Operation of the Project with Other Electrical Systems ..................................................</td>
<td>H-3</td>
</tr>
<tr>
<td>2.2</td>
<td>Need for the Electricity Generated by the Project ................................</td>
<td>H-4</td>
</tr>
<tr>
<td>2.2.1</td>
<td>The Reasonable Costs and Availability of Alternative Sources of Power ........................................................................</td>
<td>H-4</td>
</tr>
<tr>
<td>2.2.2</td>
<td>Increase in Costs if the Licensee is not Granted a License ................</td>
<td>H-5</td>
</tr>
<tr>
<td>2.2.3</td>
<td>Effects of Alternative Sources of Power .........................................</td>
<td>H-5</td>
</tr>
<tr>
<td>2.3</td>
<td>Need, Reasonable Cost, and Availability of Alternative Sources of Power ..................................................</td>
<td>H-6</td>
</tr>
<tr>
<td>2.3.1</td>
<td>Average Annual Cost of Power ................................................................</td>
<td>H-6</td>
</tr>
<tr>
<td>2.3.2</td>
<td>Project Resources Required by the Applicant to Meet Short- and Long-Term Capacity and Energy Requirements ..................................................</td>
<td>H-6</td>
</tr>
<tr>
<td>2.4</td>
<td>Effect of Power on Licensee's Industrial Facility ................................</td>
<td>H-6</td>
</tr>
<tr>
<td>2.5</td>
<td>Need of Indian Tribe Licensee for Electricity Generated by the Project ..................................................</td>
<td>H-6</td>
</tr>
<tr>
<td>2.6</td>
<td>Impacts on the Operations and Planning of Licensee's Transmission System ..................................................</td>
<td>H-7</td>
</tr>
<tr>
<td>2.7</td>
<td>Statement of Need for Modifications ................................................</td>
<td>H-7</td>
</tr>
<tr>
<td>2.8</td>
<td>Financial and Personnel Resources ..................................................</td>
<td>H-7</td>
</tr>
<tr>
<td>2.9</td>
<td>Notification of Affected Land Owners ...............................................</td>
<td>H-8</td>
</tr>
<tr>
<td>2.10</td>
<td>Applicant's Electricity Consumption Efficiency Improvement Program ..................................................</td>
<td>H-8</td>
</tr>
<tr>
<td>2.11</td>
<td>Identification of Indian Tribes Affected by the Project .....................</td>
<td>H-8</td>
</tr>
<tr>
<td>3.0</td>
<td>INFORMATION TO BE PROVIDED BY AN APPLICANT WHO IS AN EXISTING LICENSEE ..................................................</td>
<td>H-8</td>
</tr>
<tr>
<td>3.1</td>
<td>Measures Planned to Ensure Safe Management, Operation, and Maintenance of the Project ..................................................</td>
<td>H-8</td>
</tr>
<tr>
<td>3.1.1</td>
<td>Existing and Planned Operation of the Project during Flood Conditions ........................................................................</td>
<td>H-8</td>
</tr>
<tr>
<td>3.1.2</td>
<td>Warning Devices Used to Ensure Downstream Public Safety ....................</td>
<td>H-10</td>
</tr>
<tr>
<td>3.1.3</td>
<td>Proposed Changes Affecting the Existing Emergency Action Plan ............</td>
<td>H-10</td>
</tr>
<tr>
<td>3.1.4</td>
<td>Existing and Planned Monitoring Devices ..........................................</td>
<td>H-11</td>
</tr>
<tr>
<td>3.1.5</td>
<td>Project's Employee and Public Safety Record .....................................</td>
<td>H-11</td>
</tr>
<tr>
<td>Table</td>
<td>Title</td>
<td>Page No.</td>
</tr>
<tr>
<td>-------</td>
<td>-----------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>3.2</td>
<td>Current Operation of the Project</td>
<td>H-11</td>
</tr>
<tr>
<td>3.3</td>
<td>Project History</td>
<td>H-11</td>
</tr>
<tr>
<td>3.4</td>
<td>Lost Generation Due to Unscheduled Outages</td>
<td>H-12</td>
</tr>
<tr>
<td>3.5</td>
<td>Record of Compliance</td>
<td>H-13</td>
</tr>
<tr>
<td>3.6</td>
<td>Actions Affecting the Public</td>
<td>H-13</td>
</tr>
<tr>
<td>3.7</td>
<td>Ownership and Operating Expenses That Would Be Reduced if the License</td>
<td>H-13</td>
</tr>
<tr>
<td></td>
<td>Were Transferred</td>
<td></td>
</tr>
<tr>
<td>3.8</td>
<td>Annual Fees for Use of Federal or Native American Lands</td>
<td>H-14</td>
</tr>
</tbody>
</table>
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TABLE 2.1-1</td>
<td>HYDROELECTRIC PROJECTS DAMS LOCATED ON THE WEST BRANCH AND MAIN STEM OF THE PENOBSCOT RIVER</td>
<td>H-2</td>
</tr>
<tr>
<td>TABLE 2.2-1</td>
<td>POUNDS OF CARBON DIOXIDE AVOIDED THROUGH OPERATION OF THE MATTACEUNK PROJECT</td>
<td>H-5</td>
</tr>
<tr>
<td>TABLE 2.3-1</td>
<td>SUMMARY OF ESTIMATED ANNUAL COSTS (2015)</td>
<td>H-6</td>
</tr>
<tr>
<td>TABLE 3.4-1</td>
<td>SUMMARY OF OUTAGES LONGER THAN 24 HOURS FOR THE MATTACEUNK PROJECT</td>
<td>H-12</td>
</tr>
</tbody>
</table>
Exhibit H
Description of Project Management and Need for Project Power

1.0 INTRODUCTION

The Mattaceunk Project is an existing hydroelectric project owned by and licensed to Great Lakes Hydro America, LLC (GLHA or Licensee), an affiliate of Brookfield Renewable Partners, L.P. (Brookfield Renewable). The Licensee is an independent power producer and, therefore, does not provide electric service to any particular group or class of customers. The Project generates renewable power, which is sold to the New England wholesale market that is administered by the non-profit Independent System Operator New England (ISO New England). ISO New England administers all significant aspects of the New England Power Pool (NEPOOL) including 1) the NEPOOL Open Access Transmission Tariff; 2) the dispatch, billing, and settlement system for interchange power in NEPOOL; 3) NEPOOL energy and automatic generation control markets; and 4) the NEPOOL installed capability market.

2.0 INFORMATION TO BE SUPPLIED BY ALL APPLICANTS

2.1 Plans and Ability of Owners of Mattaceunk to Operate and Maintain the Project

2.1.1 Plans to Increase Capacity or Generation

GLHA has no current plans to increase the capacity or generation of the Project. However, as economic conditions change, GLHA routinely performs periodic evaluations of generating facilities regarding potential upgrades and will continue to do so into the future. Normal routine maintenance will be performed as needed during the remainder of the license term and during any new license term.

2.1.2 Plans to Coordinate the Operation of the Project with Other Water Resource Projects

There are four Federal Energy Regulatory Commission (FERC or Commission) licensed hydroelectric projects located on the West Branch of the Penobscot River, and six dams
associated with five FERC-licensed hydroelectric projects located on the main stem of the Penobscot River, including the Mattaceunk Project (Table 2.1-1). The Medway Dam (FERC Project No. 2666) is the first dam located upstream of the Project on the West Branch of the Penobscot River, and the West Enfield Dam (FERC Project No. 2600) is the first dam located downstream of the Project on the main stem of the Penobscot River. As affiliates of Brookfield Renewable, the licensees for each of these projects, including GLHA, coordinate internally to provide the appropriate means of safe and efficient operation for these facilities.

### TABLE 2.1-1
HYDROELECTRIC PROJECTS DAMS LOCATED ON THE WEST BRANCH AND MAIN STEM OF THE PENOBSCOT RIVER

<table>
<thead>
<tr>
<th>Dam</th>
<th>Licensee, or Co-Licensee</th>
<th>Location</th>
<th>FERC Project No.</th>
<th>Capacity (Megawatts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Branch of the Penobscot River</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada Falls Dam (part of Storage Project)</td>
<td>GLHA</td>
<td>T2R4 NBKP - Pittston Academy Grant</td>
<td>P-2634</td>
<td>0</td>
</tr>
<tr>
<td>Caucomgomoc Lake Dam (part of Storage Project)</td>
<td>GLHA</td>
<td>T6R14 WELS</td>
<td>P-2634</td>
<td>0</td>
</tr>
<tr>
<td>Dole Pond Dam (part of Storage Project)</td>
<td>GLHA</td>
<td>T3R5 NBKP - Dole Brook Township</td>
<td>P-2634</td>
<td>0</td>
</tr>
<tr>
<td>Harrington Dam (part of Storage Project)</td>
<td>GLHA</td>
<td>T4R11 WELS</td>
<td>P-2634</td>
<td>0</td>
</tr>
<tr>
<td>Long Pond Dam (part of Storage Project)</td>
<td>GLHA</td>
<td>T3R5 NBKP - Dole Brook Township</td>
<td>P-2634</td>
<td>0</td>
</tr>
<tr>
<td>Loon Dam (part of Storage Project)</td>
<td>GLHA</td>
<td>T6R15 &amp; T6R14 WELS</td>
<td>P-2634</td>
<td>0</td>
</tr>
<tr>
<td>Penobscot Lake Dam (part of Storage Project)</td>
<td>GLHA</td>
<td>T4R4 NBKP - Prentiss Township</td>
<td>P-2634</td>
<td>0</td>
</tr>
<tr>
<td>Ragged Lake Dam (part of Storage Project)</td>
<td>GLHA</td>
<td>T2R13 WELS</td>
<td>P-2634</td>
<td>0</td>
</tr>
<tr>
<td>Seboomook Dam (part of Storage Project)</td>
<td>GLHA</td>
<td>T0R4 NBKP - Seboomook Township</td>
<td>P-2634</td>
<td>0</td>
</tr>
<tr>
<td>Ripogenus Dam</td>
<td>GLHA</td>
<td>T3 R11 WELS</td>
<td>P-2572</td>
<td>37.5</td>
</tr>
<tr>
<td>Umbazooksus Dam (part of Ripogenus Project)</td>
<td>GLHA</td>
<td>T6R13 WELS</td>
<td>P-2572</td>
<td>0</td>
</tr>
<tr>
<td>North Twin Dam (part of Penobscot Mills Project)</td>
<td>GLHA</td>
<td>Indian Purchase #3</td>
<td>P-2458</td>
<td>7.0</td>
</tr>
<tr>
<td>Stone Dam (part of Penobscot Mills Project)</td>
<td>GLHA</td>
<td>Millinocket</td>
<td>P-2458</td>
<td>35.9</td>
</tr>
<tr>
<td>East Millinocket Dam (part of Penobscot Mills Project)</td>
<td>GLHA</td>
<td>East Millinocket</td>
<td>P-2458</td>
<td>6.98</td>
</tr>
<tr>
<td>Dolby Dam (part of Penobscot Mills Project)</td>
<td>GLHA</td>
<td>East Millinocket</td>
<td>P-2458</td>
<td>20.9</td>
</tr>
<tr>
<td>Millinocket Lake Dam (part of Penobscot Mills Project)</td>
<td>GLHA</td>
<td>T1R8 WELS</td>
<td>P-2458</td>
<td>0</td>
</tr>
<tr>
<td>Medway Dam</td>
<td>Black Bear Hydro Partners, LLC</td>
<td>Medway</td>
<td>P-2666</td>
<td>3.4</td>
</tr>
</tbody>
</table>
### Plans to Coordinate the Operation of the Project with Other Electrical Systems

GLHA is an independent power producer and member of NEPOOL that currently sells power from the Project wholesale to ISO New England. NEPOOL is a voluntary association whose members include not only traditional vertically integrated electric utilities, but independent power producers, such as the Licensee, that are participating in the competitive wholesale electricity marketplace. ISO New England serves as the independent system operator to operate the regional bulk power system and to administer the wholesale marketplace. ISO New England’s primary responsibilities are to coordinate, monitor, and direct the operations of the major generating and transmission facilities in the region. The objective of ISO New England is to promote a competitive wholesale electricity marketplace while maintaining the electrical system’s integrity and reliability. ISO New England seeks to assure both maximum reliability and economy of the bulk power supply for New England.

Therefore, the electric facilities of NEPOOL member companies are operated as if they comprised a single power system. ISO New England accomplishes this by central dispatching of available power resources and by using the lowest cost generation and transmission equipment available at any given time consistent with meeting reliability requirements. As a result of this economic dispatch, utilities and their customers realize significant savings annually. NEPOOL participants also have strengthened the reliability of the bulk power system through shared operating reserves and coordinated maintenance scheduling.
The ISO New England staff constantly monitors and directs the operation of more than 300 generators and more than 7,600 miles of transmission lines in New England. ISO New England is also responsible for forecasting the various levels of daily electricity demand that will occur throughout the region and for scheduling resources to meet the demand.

2.2 Need for the Electricity Generated by the Project

2.2.1 The Reasonable Costs and Availability of Alternative Sources of Power

The Project generates renewable power. The electrical output from the Project is sold wholesale into the ISO New England administered market. The replacement of energy and capacity provided by the Project would be met through other sources, likely to be fossil-fired generating units, whose fuel and other variable costs would be significantly higher than those of the Project over the life of the new license. As often the lowest variable cost resource among power supply alternatives, hydroelectric assets such as the Project can bid energy into the ISO New England market at lower prices than alternative resources. Thus, loss of a low-variable cost resource such as the Project would result in upward pressure on the clearing prices in the NEPOOL market and on the prices ultimately paid by electric consumers in New England.

The Project provides renewable power without the emissions of air pollutants or greenhouse gases that marginal fossil fuel plants produce. This is an increasingly important fact in New England, where all six New England states have enacted legislation to reduce the dependence on fossil-fired generation through the introduction of Renewable Portfolio Standards (RPS), or similar legislation, that encourages and requires the use of renewable power sources in each individual state’s total resource output. Many of these RPS programs include an annual escalating supply requirement to further encourage reliance on renewable power sources. These enacted legislations are designed to increase the amount of renewable power supply in the region’s mix of generation resources or, alternatively, reduce the amount of fossil-fired generation as a percentage of the total resource output. Table 2.2-1 provides an estimate of the pounds of carbon dioxide avoided through operation of the Project.
2.2.2 Increase in Costs if the Licensee is not Granted a License

If GLHA is not granted a license, this Project would cease to provide clean, renewable, and affordable electricity to the NEPOOL from its generation. Consequently, an unquantified increase in costs would likely occur to New England electric consumers if a license for continued operation of the Project was not granted.

2.2.3 Effects of Alternative Sources of Power

2.2.3.1 Effects on Licensee’s Customers

This section is not applicable to GLHA, because GLHA is a wholesale supplier.

2.2.3.2 Effect on Licensee’s Operating and Load Characteristics

GLHA is an independent power producer and, as such, does not maintain a separate transmission system that could be affected by replacement or alternative power sources.

2.2.3.3 Effect on Communities Served by the Project

See Sections 2.2.1 and 2.2.2 regarding the loss of generation if GLHA is not granted a new license for the Project. Because GLHA cannot predict with any certainty the actual type or location of a potential alternative facility to provide replacement power, it cannot specifically discuss potential effects on any particular community.
2.3 Need, Reasonable Cost, and Availability of Alternative Sources of Power

2.3.1 Average Annual Cost of Power

Annual costs associated with the Mattaceunk Project include labor, materials, expenses, and overhead associated with routine operation and maintenance; the annualized cost of capital leases and repairs/replacements; and annual insurance, taxes, fees, and administration. A summary of the estimated annual costs for the Mattaceunk Project in 2015 is provided in Table 2.3-1.

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual operation, maintenance, expenses, fees, insurance, overhead, and depreciation</td>
<td>$1,797,906</td>
</tr>
<tr>
<td>Taxes</td>
<td>$626,853</td>
</tr>
<tr>
<td>Totals</td>
<td>$2,424,759</td>
</tr>
</tbody>
</table>

2.3.2 Project Resources Required by the Applicant to Meet Short- and Long-Term Capacity and Energy Requirements

The Project and other electric generating facilities on the West Branch of the Penobscot River are owned and operated by GLHA, a wholesale electric power producer. Power at the Project is sold through to the New England wholesale market that is administered by ISO New England to meet consumer demands.

2.4 Effect of Power on Licensee's Industrial Facility

Use of electricity generated at the facility is limited to station service to generate electricity, as compared to other industrial uses, and thus, this section is not applicable.

2.5 Need of Indian Tribe Licensee for Electricity Generated by the Project

GLHA is not an Indian Tribe, so this section is not applicable.
2.6 Impacts on the Operations and Planning of Licensee's Transmission System

GLHA is an independent power producer and does not own the local transmission system. Power generated by the Project is currently transmitted to the Powersville substation (and then onto the New England electric grid) via the No. 7 line. GLHA maintains a single-line diagram for the Project that is considered Critical Energy Infrastructure Information (CEII) in accordance with the Commission’s regulations, and thus GLHA is filing a copy of the Project’s single-line diagram as CEII with the Commission within Volume VI of this application.

2.7 Statement of Need for Modifications

GLHA is not proposing any fundamental changes to the Project facilities or operation.

2.8 Financial and Personnel Resources

GLHA has considerable experience operating not only the Project but other licensed hydroelectric and water storage projects in the region as well. As a corporation with multiple hydroelectric plants located throughout the region and the State of Maine, GLHA either has or can acquire the necessary resources to continue the operation and maintenance of the Mattaceunk Hydroelectric Project.

The Applicant is an affiliate of Brookfield Renewable, which possesses more than 100 years of experience as an owner, operator, and developer of hydroelectric power facilities. Brookfield Renewable is owned by Brookfield Asset Management, Inc. (BAM), which is listed on the New York and Toronto Stock Exchanges under the symbol BAM, as well as on the Euronext Amsterdam exchange under the symbol BAMA. Brookfield manages assets worth approximately $150 billion and Brookfield Renewable owns or has interests in over 130 hydroelectric facilities (including hydroelectric pumped storage) in the United States.

Brookfield Renewable has a complete staff of engineers, biologists, operators, mechanics, and electricians that are trained and experienced in the operation of hydroelectric projects. Additionally, staff can also be utilized from other nearby Brookfield Renewable facilities, or
contractors can be retained to undertake larger scale maintenance or upgrade projects. In addition, the Licensee has available the administrative, licensing, and support personnel that are needed to maintain compliance with the terms of the license.

Information regarding the Project’s expected annual costs and value is provided in Exhibit D of the License Application.

2.9 Notification of Affected Land Owners

GLHA does not propose to expand Project lands associated with this license application beyond property currently owned by GLHA.

2.10 Applicant's Electricity Consumption Efficiency Improvement Program

As stated previously, GLHA is a wholesale electric power producer. GLHA uses a small portion (between 1 and 2 percent) of the power produced at the facility for station service and continues to strive for efficient use of electric consumption. Power at the Project is sold through to the New England wholesale market that is administered by ISO New England.

2.11 Identification of Indian Tribes Affected by the Project

There are no Indian tribes reservation lands located within the Mattaceunk Project Boundary. The federally-recognized Indian tribes likely to be interested in the relicensing are included on the current distribution list for the Project.

3.0 INFORMATION TO BE PROVIDED BY AN APPLICANT WHO IS AN EXISTING LICENSEE

3.1 Measures Planned to Ensure Safe Management, Operation, and Maintenance of the Project

The Project is operated remotely from Brookfield Renewable’s control center in Marlborough, Massachusetts. Dispatchers are on duty at the control center 24 hours a day, seven days a week.
The Project is normally visited by maintenance personnel each workday, Monday through Friday. In addition, local personnel can be called out to the Project at any time on an as-needed basis. GLHA attains its safety goals at the Project by:

- Providing an in-depth management and technical support organization;
- Establishing and implementing specific operating procedures, including standard bulletins;
- Training operations and maintenance personnel;
- Inspecting all Project facilities regularly, and monitoring indicators of Project condition and safety;
- Implementing a rigorous inspection and maintenance program for operating equipment and facilities vital to safety;
- Limiting public access and providing warning signs where Project operations could endanger the public; and
- Complying with all applicable local, state, and federal laws and regulations regarding the safe operation of industrial and electric utility facilities.

These measures have been consistently applied and expanded as appropriate to ensure the safe, continued operation of the Project.

FERC’s New York Regional Office conducts an environmental inspection every few years. GLHA completes all necessary corrective actions to address comments and recommendations arising from FERC inspections in a timely manner. The dam is inspected annually by GLHA’s Engineering and Operations staff, as well as after floods in the Project vicinity. In addition, routine repairs are performed as needed. GLHA maintains an Emergency Action Plan (EAP) for the Project. GLHA maintains and annually verifies the accuracy of the EAP contact list to be used in the event of a dam failure at the Project. GLHA’s staff reviews the EAP at least annually, and there is annual EAP training for Project personnel.
3.1.1 Existing and Planned Operation of the Project during Flood Conditions

Whenever possible, the Project is operated at full turbine output in order to maximize electricity generation. Flows greater than turbine capacity can be passed over the spillway or through the roller gate, log sluice, or fishways.

3.1.2 Warning Devices Used to Ensure Downstream Public Safety

GLHA has developed a Public Safety Plan for the Project that illustrates the location of safety signs, sirens, barriers, and other safety devices; the Public Safety Plan also includes measures required by FERC, or installed by GLHA on its own initiative, to warn and/or protect the public in its use of Project lands and waters. GLHA’s Public Safety Plan for the Project was filed with the Commission on November 23, 2015, and is considered CEII in accordance with the Commission’s regulations; thus, it is not being distributed with this FLA.

GLHA has numerous public safety devices at the Project, including:

1. Warning signs posted at appropriate points upstream and downstream of the Project’s dam to inform the public of potential public safety hazards;
2. A boater barrier upstream of Weldon Dam during the open water recreation season to warn boaters of the presence of the Project’s powerhouse intake and spillway;
3. A siren that sounds for two minutes prior to the roller gate opening and while the gate is moving; and
4. A public safety camera which allows GLHA to view any activity within the Project tailrace.

All safety-related devices and features are inspected and tested annually. During inspections, signs are checked for damage, fences are inspected for stability, and sirens and other mechanical warning devices are tested to ensure they are audible and in working order.
3.1.3 Proposed Changes Affecting the Existing Emergency Action Plan

GLHA submitted the Project’s EAP to FERC in 2015. GLHA does not propose any modifications to the EAP as a result of issuance of a new license for the Project.

3.1.4 Existing and Planned Monitoring Devices

Over the years, GLHA has deployed water level sensors and staff gauges to monitor the impoundment and tailwater levels associated with the Project. Headpond elevation is monitored remotely by Brookfield Renewable’s North American System Control Center on a continual basis. In addition, the aforementioned instrumentation is subject to annual visual inspections.

Additional information regarding dam safety and monitoring devices is classified as CEII and can be found in the Mattaceunk Project’s Dam Safety and Surveillance Monitoring Plan and Reports, which have been filed with the Commission’s New York Regional Office.

3.1.5 Project's Employee and Public Safety Record

No lost-time accidents have occurred at the Project within the period of recordkeeping for the facility. There have been no project-related deaths or serious injuries to members of the public within the Project Boundary during the past 5 years. No accidents attributable to Project operations have occurred within the period of recordkeeping for the facility.

3.2 Current Operation of the Project

A description of the Project operation is contained in Exhibit B – Project Operation and Resource Utilization of this FLA.

3.3 Project History

A description of the Project history is contained in Exhibit C – Construction History of this FLA.
3.4 Lost Generation Due to Unscheduled Outages

Table 3.4-1 presents a summary of outages greater than 24 hours for a five-year period of time (2010 through 2015).

<table>
<thead>
<tr>
<th>Unit</th>
<th>Outage Start Time</th>
<th>Outage End Time</th>
<th>Duration (Hours:Mins)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>03 Jan 2010 03:04</td>
<td>04 Jan 2010 12:41</td>
<td>33:37</td>
<td>Utility tie/Powersville substation outage</td>
</tr>
<tr>
<td>4</td>
<td>03 Jan 2010 03:04</td>
<td>04 Jan 2010 14:01</td>
<td>34:57</td>
<td>Utility tie/Powersville substation outage</td>
</tr>
<tr>
<td>1</td>
<td>22 Jun 2011 06:05</td>
<td>29 Jun 2011 11:14</td>
<td>173:09</td>
<td>Trip broken governor</td>
</tr>
<tr>
<td>4</td>
<td>05 Jul 2011 14:22</td>
<td>06 Jul 2011 14:40</td>
<td>24:18</td>
<td>Governor piping failure</td>
</tr>
<tr>
<td>1</td>
<td>05 Sep 2011 00:04</td>
<td>06 Sep 2011 16:04</td>
<td>40:00</td>
<td>Trip due to lightning strike at Powersville substation</td>
</tr>
<tr>
<td>2</td>
<td>05 Sep 2011 00:04</td>
<td>06 Sep 2011 15:12</td>
<td>39:08</td>
<td>Trip due to lightning strike at Powersville substation</td>
</tr>
<tr>
<td>3</td>
<td>05 Sep 2011 00:04</td>
<td>06 Sep 2011 13:25</td>
<td>37:21</td>
<td>Trip due to lightning strike at Powersville substation</td>
</tr>
<tr>
<td>4</td>
<td>05 Sep 2011 00:04</td>
<td>06 Sep 2011 13:14</td>
<td>37:10</td>
<td>Trip due to lightning strike at Powersville substation</td>
</tr>
<tr>
<td>1</td>
<td>15 Jun 2012 05:05</td>
<td>19 Jun 2012 20:50</td>
<td>111:45</td>
<td>Offline for Bangor Hydro transmission work</td>
</tr>
<tr>
<td>2</td>
<td>15 Jun 2012 05:05</td>
<td>19 Jun 2012 20:47</td>
<td>111:42</td>
<td>Offline for Bangor Hydro transmission work</td>
</tr>
<tr>
<td>3</td>
<td>15 Jun 2012 05:08</td>
<td>19 Jun 2012 20:38</td>
<td>111:30</td>
<td>Offline for Bangor Hydro transmission work</td>
</tr>
<tr>
<td>4</td>
<td>15 Jun 2012 05:14</td>
<td>19 Jun 2012 20:30</td>
<td>111:16</td>
<td>Offline for Bangor Hydro transmission work</td>
</tr>
<tr>
<td>1</td>
<td>27 Jun 2012 06:07</td>
<td>28 Jun 2012 16:04</td>
<td>33:57</td>
<td>Offline for cooling coil work</td>
</tr>
<tr>
<td>3</td>
<td>23 Jul 2012 07:00</td>
<td>24 Jul 2012 12:33</td>
<td>29:33</td>
<td>Brake repairs</td>
</tr>
<tr>
<td>1</td>
<td>27 Nov 2012 07:57</td>
<td>01 Jan 2013 00:00</td>
<td>832:03</td>
<td>Maintenance</td>
</tr>
<tr>
<td>1</td>
<td>01 Jan 2013 00:00</td>
<td>03 Jan 2013 08:33</td>
<td>56:33</td>
<td>Maintenance</td>
</tr>
<tr>
<td>1</td>
<td>01 Mar 2013 11:28</td>
<td>06 Mar 2013 12:33</td>
<td>121:05</td>
<td>Brake pad sticking</td>
</tr>
<tr>
<td>1</td>
<td>19 Jul 2013 19:38</td>
<td>24 Jul 2013 10:03</td>
<td>110:25</td>
<td>Tripped due to storm</td>
</tr>
</tbody>
</table>

TABLE 3.4-1
SUMMARY OF OUTAGES LONGER THAN 24 HOURS FOR THE MATTACEUNK PROJECT
### Exhibit H

**Description Of Project Management And Need For Project Power**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Outage Start Time</th>
<th>Outage End Time</th>
<th>Duration (Hours:Mins)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30 Jul 2013 21:36</td>
<td>03 Aug 2013 12:37</td>
<td>87:01</td>
<td>Cooling water trouble due to low head</td>
</tr>
<tr>
<td>2</td>
<td>06 Aug 2013 10:55</td>
<td>07 Aug 2013 13:35</td>
<td>26:40</td>
<td>Cooling water trouble due to low head</td>
</tr>
<tr>
<td>2</td>
<td>30 Nov 2013 05:39</td>
<td>01 Dec 2013 10:00</td>
<td>28:21</td>
<td>Unit tripped</td>
</tr>
<tr>
<td>1</td>
<td>04 Aug 2014 08:17</td>
<td>06 Aug 2014 14:00</td>
<td>53:43</td>
<td>Annual inspection</td>
</tr>
<tr>
<td>2</td>
<td>11 Aug 2014 07:18</td>
<td>06 Sep 2014 03:29</td>
<td>620:11</td>
<td>Annual inspection</td>
</tr>
<tr>
<td>4</td>
<td>16 Sep 2014 16:40</td>
<td>18 Sep 2014 11:46</td>
<td>43:06</td>
<td>Unit 4 tripped on over speed</td>
</tr>
<tr>
<td>4</td>
<td>13 Oct 2014 06:33</td>
<td>16 Oct 2014 14:37</td>
<td>80:04</td>
<td>Unit offline for dewater inspection</td>
</tr>
<tr>
<td>1</td>
<td>13 Oct 2014 07:42</td>
<td>14 Oct 2014 08:31</td>
<td>24:49</td>
<td>Unit offline for station breaker rack out</td>
</tr>
<tr>
<td>1</td>
<td>02 Dec 2014 08:45</td>
<td>03 Dec 2014 13:37</td>
<td>28:52</td>
<td>Tripped due to low governor oil pressure</td>
</tr>
</tbody>
</table>

#### 3.5 Record of Compliance

A review of the Licensee’s records indicates no violations of the terms and conditions of the license. In addition, GLHA has not received any communication from the Commission indicating possible noncompliance.

#### 3.6 Actions Affecting the Public

GLHA has strong ties with the communities in the region, as a generator of electric power and as a major employer and taxpayer in the region. The Mattaceunk Project is important locally as a clean and reliable energy source.

GLHA allows public access to the Project lands and waters for recreational purposes, as discussed in Exhibit E.

#### 3.7 Ownership and Operating Expenses That Would Be Reduced if the License Were Transferred

GLHA is applying for a long-term license to continue to maintain and operate the Project. There are no competing applications for the Project or proposals to transfer the Project license; therefore, this section is not applicable to the Project.
3.8 Annual Fees for Use of Federal or Native American Lands

Given that there are no federal or Indian lands associated with the Project, this section is not applicable to the Project.

Literature Cited
