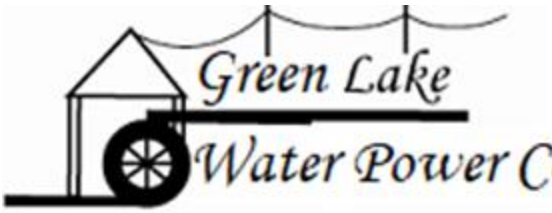

120 Hatchery Way, Ellsworth, ME 04605-3501

June 20, 2023

Director

Office of Environmental Policy and Compliance

Department of the Interior

1849 C Street, NW, Mail Stop 2629

Washington, DC 20240

Re: Green Lake Water Power Company Comments, Alternatives to Mandatory Conditions and Prescription and Request for Trial-Type Hearing, Green Lake Hydroelectric Project, FERC Project No. P-7189-015

Re: ER 23/0114

Dear Sir or Madam,

Pursuant to Section 241 of the Energy Policy of 2005 and 43 CFR Part 45, Green Lake Water Power Co. (GLWP) submit comment, alternatives to mandatory conditions and prescriptions and request for trial-type hearing for the Green Lake Project, FERC No. 7189-015. Section 45.1(d) of the Department of the Interior's (DOI or Department) regulations provides that the alternative prescription and trial-type hearing provisions of

Section 241 apply "to any hydropower proceeding for which the license has not been issued as of November 1, 2005 and for which one or more preliminary conditions, conditions, preliminary prescriptions, or prescriptions have been or are filed with FERC." Section 4.5 further provides that for such applications any request for a hearing or for an alternative prescription must be filed by June 21, 2023. A subsequent license has not yet been issued for the Green Lake Project and the DOI filed a preliminary fishway prescription for the project on May 22, 2023. Therefore, GLWP is entitled to propose an alternatives to mandatory conditions and Section 18 prescriptions and request a trial type hearing under Section 241 and Part 45 of the Department's regulations.

GREEN LAKE HYDROELECTRIC PROJECT (P-7189)

COMMENTS ON, PROPOSED ALTERNATIVES TO UNITED STATES DEPARTMENT OF THE INTERIOR PRELIMINARY MANDATORY CONDITIONS AND FISHWAY PRESCRIPTIONS AND REQUEST FOR TRIAL-TYPE HEARING ON DISPUTED ISSUES OF MATERIAL FACT

I. INTRODUCTION AND BACKGROUND

The Green Lake Hydroelectric Project ("Green Lake") is a 425kW hydroelectric project located at the outlet of Green Lake and Reeds Brook, an intermittent stream, in the town of Ellsworth, Hancock County, Maine. The project is owned by Green Lake Water Power Company. The project was constructed utilizing an existing 7.5 high, 272.7-foot-long dry stone,

timber, sheet steel, and concrete dam. The dam includes an integral 20.2-foot section containing two lift gates controlling discharges from Green Lake into Reeds Brook, as well as a 12-foot long intake structure. In accordance with Article 28 of the project license, the dam also includes a trash rack with 1 inch clear spacing between the bars of the trash rack, which serves as an intake screen. This screening was approved by the fisheries agencies and deemed sufficient to protect adult salmon. See, 30 FERC ¶62,065.

The Green Lake dam impounds a 3312-acre reservoir with a usable storage capacity of approximately 10,136-acre feet at elevation 160.7 feet U.S.G. datum. The project includes a 1,744 foot long, 4-foot diameter concrete and wood stave penstock with a hydraulic capacity of 115 cfs at the powerhouse. The powerhouse contains two turbine generators with a total rated capacity of 425-kW, generator leads, a 500 kVA transformer and a 600-foot 12.47 kV underground transmission line. The tailrace exits to Reeds Brook near Graham Lake.

License Article 27 requires Green Lake to release a continuous minimum flow of 1.0 cfs, as measured immediately downstream of the project dam, or inflow to the reservoir, whichever is less. Note that Section 3 of the Licensed Project Development Agreement conflicts with this requirement and requires the release of a minimum flow of 1.0 cfs.

Prior to project licensing, the dam was owned by Bangor-Hydro Electric Company and was operated to provide storage capacity for Bangor-Hydro Electric's Ellsworth Hydroelectric Project, located downstream on the Union River. The United States Department of the Interior owned and operated its Green Lake Fish Hatchery on property adjacent to the dam, obtaining

water for fish hatchery operations via a set of two underground intake pipes stretching from the lake, under the dam, to the fish hatchery. The fish hatchery's use of Bangor-Hydro and now Green Lake's property for its intake has been permissive: to Green Lake Water Power Company's knowledge, the fish hatchery does not have real property rights to site its intake pipes on Green Lake Water Power Company's property.

The DOI was a party to the original licensing proceeding and appealed the Director of Hydropower's original April 5, 1984, license order (27 FERC ¶62,023) to the full Commission with respect to conditions deemed necessary by DOI for the adequate protection and utilization of the hatchery. Following the appeal, DOI and Green Lake Water Power Company entered into the Licensed Project Development Agreement, dated June 4, 1984, contemplated by the original license order. By license order issued May 25, 1984 (FERC Accession No. 19840601-0182), Articles 29, 32 and 37 of the original license order were modified, new Articles 38, 40, 41, 42 and 43 were added and other changes were made to conform the project license to the draft Licensed Project Development Agreement to be executed by the parties.

The May 25, 1984 FERC license and the June 4, 1984 Licensed Project Agreement included provisions to prevent the Project from adversely affecting hatchery operations. Significant requirements include: (1) ensuring the hatchery has priority use of up to 30 cfs from the project reservoir; (2) reservoir drawdown limitations intended to maintain water pressure in the hatchery's existing water supply lines; and (3) the installation of a penstock tap to provide water when the hatchery's use of 30 cfs is unavailable through its existing water supply lines (with the limitation that the hatchery not draw water through the penstock tap as an alternative to

proper, continued use of its existing water supply lines) and power generation limitations to assure the proper pressure gradient on the penstock tap when it is in use.

Over time, the hatchery has come to rely on the use of the penstock tap to provide warmer, more oxygenated water on a regular basis, in violation of the contract limitation that the hatchery does not draw water through the penstock tap as an alternative to proper, continued use of its existing water supply lines. Such use apparently improves hatchery productivity and may also provide additional operational benefits.

The Licensee estimates the Hatchery's use of water from the lake has cost the Licensee 298 megawatt-hours of generation annually, or approximately $30,000 per year in 2023 dollars. The Licensee estimates that the cost of the lost generation will be about $40,000 per year for the foreseeable future with the electric rates that are currently anticipated. See, Attachment 1, "Report on the Effect of Hatchery Withdrawal from the Lake", June 11, 2023.

Note that, pursuant to Article 10 of FERC Form L-16, Terms and Conditions of License for Constructed Minor Project Affecting Lands of the United States, the Licensee is entitled to apply to FERC to obtain reasonable compensation for the reasonable use and value of its reservoir and facilities, to include at least full reimbursement for any damages or expenses which the Joint Use causes the Licensee to incur. During the current license term, the Licensee did not make a filing to recover such costs. The Licensee intends to request such compensation in connection with any new license and proposes as an alternative that the mandatory condition regarding Hatchery withdrawals include payment for the value of lost generation. See, *e.g*. *Order*

Approving Withdrawal of Project Water for Non-Project Use, Public Service Company of New Hampshire and Manchester Water Works (P-1893-022)(FERC Accession No. 19910424-0213).

Section 12 of the Licensed Project Development Agreement addresses the term and termination of the agreement. The Agreement provides that if the FERC license expires and a new license is not sought for power or non-power purposes, the dam shall revert to Bangor-Hydro as provided in the Contract of Sale dated June 1, 1984, and attached to the Licensed Project Development Agreement as Attachment E. The License notes that the Contract of Sale, Section 9, actually provides "The Seller shall have and retain the option to repurchase the premises and any improvements thereon in the event the facilities referred to in paragraph 7 above (i.e. project facilities for sale of electric power) are not operated to produce electric power by the Buyer or its successors or assignees for a period of twelve consecutive months." Bangor-Hydro has an elective option to repurchase the premises, and it may or may not elect to do so.

Section 12 also provides that Green Lake Water Power Company's Right-of-Way, together with all improvements, shall revert to DOI with no compensation paid by Interior, and upon such reversion, Interior may compel the Developer to restore the land to its original condition to Interior's satisfaction, so far as it is reasonably possible to do so, unless the requirement is waived in writing by the Regional Director, Region 5, U.S. Fish and Wildlife Service. This provision is also included in the Right-of-Way Agreement. See, Attachment 2, Right-of-Way Agreement, dated June 4, 1984, as modified October 5, 1984 and October 27, 1986 to reflect location of constructed facilities.

Green Lake currently has a surface area of approximately 3,312 acres. The Green Lake watershed has an area of approximately 46 square miles and constitutes approximately 8.5 % of the Union River watershed (not including the Phillip's Lake area).

A Maine history document from 1889, "Ellsworth, Maine, the Picturesque City of the East, and Green Lake, the Tourist's, Angler's and Hunter's Paradise" by George H. Haynes, pp. 19-24, included as Attachment 3, describes Green Lake and Reeds Brook prior to the construction of the downstream dams on the Union River. Green Lake had an upper and lower lake connected by "the narrows" and in some places reached a depth of two hundred feet. It was roughly half a mile from Green Lake to the Union River via Reeds Brook. Green Lake was described as teeming with landlocked salmon and bass (introduced non-native species). Tributary brooks were filled with "speckled beauties," assumed to be brook trout. At the confluence of Reeds Brook and the Union River were celebrated duck marshes two miles wide and extending up the river more than 20 miles, with duck grass growing in profusion. Indian tradition said the Green Lake area was known as Mar-las-sic – "good place for moose and deer".

Historically, limited numbers of American eels probably migrated up intermittent Reeds Brook from the marshes. The intermittent nature of the stream, the size of the watershed and low water in the fall likely prevented Green Lake from making a substantial contribution to American eel populations. Blueback herring spawn in free-flowing riverine habitat, which was not historically present in the Green Lake watershed. Blueback herring may have spawned further downstream in the Union River. American shad also spawn in free-flowing riverine habitat; thus, it is extremely doubtful American shad spawned in Green Lake or its historic habitat. The Maine

Department of Marine Resources American Shad Habitat Plan (2014) identifies the Union River as current American shad habitat but does not identify the Green Lake watershed as either historic or current habitat. See, Attachment 4.

Green Lake Water Power Company operates the only hydroelectric generating facility in the watershed, other than the two downstream Ellsworth project dams. Based on the likely small contribution this watershed made to the overall migratory fish population, lack of fish or eel passage at the project dam will have minimal adverse effects on the recovery of fish and eel populations in the watershed.

Finally, as noted above, due to the size of the watershed, the profile of the lake, low water in the fall and the intermittent nature of Reeds Brook, the project does not have enough flow to meet the design criteria for successful fish passage facilities. While it is possible the natural and impounded flows from Green Lake might be able to accommodate 30 cfs fish hatchery water use, maintenance of lake levels allowing for recreational and fish hatchery use, upstream and downstream eel passage with limited seasonal flows and economic hydroelectric generation, to do so will require delicate balancing of flow allocation, timing of various operations and careful consideration of the cost and benefits of additional investment in hydroelectric project facilities. In the end, surrender of the project license and dismantling and removal of the generating facilities or their takeover by the federal government pursuant to the Licensing Development and Right-of-Way Agreements may be the option that makes the most sense for the Licensee.

II. JUSTIFICATION FOR ALTERNATIVE CONDITIONS AND PRESCRIPTIONS

As described above, the Licensee operates this Project for the generation of electricity, for the benefit of the Green Lake Fish Hatchery by providing up to 30 cfs of warmer, oxygenated surface water via the project penstock and for the enhancement of recreational use of Green Lake. To continue to operate this small project, the Licensee (1) needs reasonable certainty with respect to the capital investment required to continue project operation under a new license, (2) reasonable certainty regarding the flows required for environmental protection, and (3) the ability to periodically schedule project maintenance and any construction in advance (and on an emergency basis) as necessary during periods of time with longer days and warmer weather. This project is in Maine and not all project construction and maintenance can be scheduled and completed during the month of October. The Licensee's requests for alternative conditions and prescriptions address these issues. Addressing these issues may enable continued project operations under a new license, continuing the benefits the project currently provides to the Green Lake Fish Hatchery and the recreational experience at Green Lake, and potentially providing enhanced fishery protection. If these issues cannot be cooperatively addressed, the likely result is surrender of the current project license at the end of the license term.

Note that although the Licensee responds to various mandatory conditions and prescriptions related to the installation of upstream and downstream eel passage, the Licensee's primary position is that upstream and downstream eel passage is not necessary and should not be required as noted in the Licensee's Requests for Hearing on Disputed Issues of Material Fact.

III. ALTERNATIVES TO MANDATORY 4(e) CONDITIONS

Alternative to Mandatory Condition 3.1 – Licensed Project Development Agreement

Mandatory Condition 3.1 incorporates as mandatory limited conditions from the Licensed Project Development Agreement, leaving out fundamental provisions that provide important context and protections for Green Lake. Green Lake Water Power requests that all currently applicable provisions of Sections 1(a) of the Licensed Project Development Agreement be incorporated as mandatory conditions to any new project license (or otherwise as FERC License Terms and Conditions). Section 1(a) sets forth the original purposes of the Licensed Project Development Agreement: insuring that drawdown of the project impoundment for power generation would not interfere with the ability of the Hatchery to draw water in an amount up to 30 cfs from the Lake via its existing water supply lines and providing for an alternative penstock tap whenever the Hatchery's priority use of up to 30 cfs is unavailable through its existing water supply lines.

Justification

Over time, the hatchery has come to rely more on the use of the penstock tap to provide warmer, more oxygenated water on a regular basis, in violation of the contract limitation that the hatchery not draw water through the penstock tap as an alternative to proper, continued use of its existing water supply lines. Such use apparently improves hatchery productivity and may also provide additional operational benefits.

The Licensee estimates the Hatchery's use of water from the lake has cost the Licensee 298 megawatt-hours of generation annually, or approximately $30,000 per year in 2023 dollars. The Licensee estimates that the cost of the lost generation will be about $40,000 per year for the

foreseeable future with the electric rates that are currently anticipated. See, Attachment 1, "Report on the Effect of Hatchery Withdrawal from the Lake", June 11, 2023. The Licensee requests as an alternative/addition to this condition that the Hatchery also be required to meter its monthly penstock usage and pay the Licensee the value of lost generation pursuant to Article 10 of Standard Form L-16.

Alternative to Mandatory Condition 3.2 - Hatchery Water Supply and Minimum Stream Flow

Section 1 of this condition provides for minimum flow of 1 cfs, or inflow to the reservoir, whichever is less. Green Lake agrees that this is an appropriate condition, as historically, Reeds Brook was an intermittent stream and would remain an intermittent stream today but for minimum flow requirements and hatchery outflow. Mandatory Condition 3.1 also incorporates Paragraph 3 of the Licensed Project Development Agreement, which is inconsistent with Section 1 in that it provides for minimum flow of 1 cfs. Allowing for an economic amount of generation, the provision of 30 cfs to Fish Hatchery on demand, the requirement to maintain the lake level between 159.7 and 160.7 between June 1 and Labor Day (or a later date *sic*, see below) and the requirement to limit the drawdown for power generation to no lower than 157.5 feet, a minimum flow of 1 cfs, or inflow to the reservoir is necessary and appropriate.

Section 2 of this condition requires that the Licensee shall provide the Hatchery with up to 30 cfs of water from the penstock on a priority basis at any time. The requirement that this 30 cfs of water be available from the penstock on a continuous basis does not reasonably allow for scheduled project maintenance. As an alternative, the Licensee requests this condition include

an exception for scheduled maintenance requested by the Licensee and agreed upon by the hatchery, which agreement shall not be unreasonably withheld. The Licensee also requests a requirement that the Hatchery continue to maintain its alternative supply lines in good working order to provide a supply of water that will allow for penstock maintenance and be available in the event the penstock tap is unavailable for other reasons.

Section 3 of this condition limits the drawdown of Green Lake for power generation to no lower than 157.5 feet NGVD 29 (4.0 feet on the staff gauge) and provides that "This elevation may be temporarily modified if required by conditions beyond the control of the Licensee, for inspection and maintenance and for short periods upon mutual agreement between the Licensee, the Service, and the Maine Department of Environmental Protection." The final sentence provides that "Furthermore, the Hatchery Manager retains the absolute discretion to restrict the time and duration of any such temporary drawdown, and moreover, retains the absolute discretion to totally deny such drawdown". This provision leaves open the possibility the Hatchery Manager (not included in the list of parties who must agree to a temporary drawdown) has the discretion to restrict or totally deny a drawdown that has been previously agreed upon by the Licensee, the Service, and the Maine Department of Environmental Protection. This proposed modification is unworkable from a maintenance perspective. The Licensee cannot schedule or contract for maintenance if the Hatchery Manager retains the ability to restrict or deny an agreed upon, scheduled drawdown. Additionally, to the extent that necessary maintenance requires a drawdown below 157.5 NGVD 20 (4.0 on the staff gauge), this language enables the Hatchery Manager to deny a drawdown for such maintenance indefinitely. The Licensee suggests adding the following additional sentence to address this situation.

"Notwithstanding the foregoing, the Hatchery Manager may not restrict or deny an agreed upon scheduled drawdown, deny a drawdown for maintenance indefinitely or otherwise limit such a drawdown to periods when weather conditions are likely to be inappropriate for such work."

Section 4 of this condition provides that the Licensee shall limit the drawdown in order that the lake level remain between 159.7 feet and 160.7 feet NGVD 29 (6.2 feet and 7.2 feet on the staff gauge) between June 1 and Labor Day or a later date. By footnote, the Department notes that the postponement of the fall drawdown (currently required on October 15th) would not adversely impact Hatchery operations. This change to this condition is apparently intended to authorize Green Lake Water Power Company to determine the timing of the September drawdown but does not explicitly say that. Green Lake requests that the language be changed to "between June 1 and Labor Day or a later date as determined by the Green Lake Water Power Company" and continuing the footnote to resolve this ambiguity. If the intent is that the later date be determined in some other way, the language should clearly state how and by whom the later date is to be determined.

Justification

The Licensee must be able to reasonably maintain the project facilities. This and other proposed conditions do not reasonably allow for project maintenance in acceptable weather conditions and under acceptable circumstances.

Alternative to Mandatory Condition 3.3 Approval of Project Structures and Modifications

Generally, this section fails to distinguish between new construction and maintenance, which makes it unclear as to what, if any, approvals are required for which activity. It references Article 5 of the original agreement, the bulk of which was clearly intended to address initial design and construction of the newly licensed project. The Licensee requests the following changes to clarify the applicable requirements.

Section 1 should be changed to "The Licensee shall consult with and obtain the approval of the U.S. Fish and Wildlife Service before commencing the design and construction of any new Project structures or the replacement of all or significant parts of any existing Project structures. Such approval includes but is not limited to, design and materials of new or replacement structures, insofar as design or materials may affect the Hatchery or any fish or wildlife species under the jurisdiction of the Service. Approval of the Commission of such design and new or replacement construction shall be obtained in accordance with the terms and conditions of the license."

Section 2 should be changed to "The Agreement between the Licensee and the Contractor or Contractors who will construct approved Project structures shall be submitted to the U.S. Fish and Wildlife Service for approval. This approval, which shall be provided promptly and shall not be unreasonably withheld, must be obtained before construction may proceed on any portion of the project."

Section 3 should be changed to "U.S. Fish and Wildlife shall cooperate with the Licensee with respect to scheduling the construction of new Project structures or the replacement of all or significant parts of any existing Project structures and if necessary, shall modify or cease Hatchery Operations to provide the Licensee construction window(s) during periods when the weather is reasonably likely to be appropriate for the planned construction activities."

The Licensee requests the addition of Section 5 providing that "The Licensee shall maintain the Project in accordance with the terms and conditions of the new FERC license. The Licensee shall consult with the Hatchery Manager with respect to any maintenance activities involving design, materials or activities that may affect the Hatchery or any fish or wildlife species under the jurisdiction of the Service. U.S. Fish and Wildlife and the Hatchery Manager shall cooperate with the Licensee with respect to scheduling significant maintenance activities to enable them to occur at appropriate lake levels and when the weather is reasonably likely to permit the performance of the proposed activities" should be added.

Justification

Assuming potential new penstock construction and increased use of the penstock by the Hatchery, the Licensee, DOI, the Hatchery and potentially other parties must cooperate with respect to construction and maintenance activities.

Alternative to Mandatory Condition 3.4 - Wood Stave Penstock

Section 3.4 requires that the wood section of the wood-stave penstock be replaced in its entirety within 3 years because it leaks. All wood-stave penstocks leak. Some penstocks leak

more than others. Some penstock leaks require maintenance and repair or replacement of components. Other penstock leaks require replacement of a leaky section. The appropriate question is whether the penstock leaks indicate that all or part(s) of the Project penstock require replacement now. Many wood-stave penstocks and similarly constructed water mains have been operational for decades beyond their typical useful lives.

The Licensee requests alternative timing of this condition to require the submittal of 90% design plans to the U.S. Fish and Wildlife Service within 5 years of the effective date of the new license and replacement of the wooded section of the penstock within 7 years following the effective date of the new license.

Justification

Assuming penstock repair can be scheduled, it is likely the penstock can continue in service for some time without substantial risk of penstock failure. At this time, the requirements proposed for this 425-kW project include replacement of the wooded section of the penstock, installation of upstream and downstream eel passage (arguably installation of upstream and downstream fish passage) and other revenue reducing conditions. This project needs time to arrange financing to support these proposed requirements.

Alternative to Mandatory Condition 3.5 – Concrete Transition Block

The Licensee requests that this mandatory condition be eliminated.

Justification

The superficial wear on the concrete and steel rebar transition block does not compromise its integrity and it does not constitute a likely source of penstock failure.

Alternative to Mandatory Condition 3.6 - Interim Penstock Maintenance Plan

The Licensee requests alternative timing of this condition to require development of an Interim Penstock Maintenance Plan within 6 months of the effective date of the new license. Additionally, the Licensee requests this condition include a requirement that the Hatchery cooperate with the Licensee in scheduling routine penstock maintenance and necessary repairs, including scheduling periods when the penstock tap is not used to allow for such maintenance.

Justification

A significant issue for the Licensee with respect to both routine maintenance and more substantial repairs to the wood stave penstock is the difficulty in scheduling such activities in compliance with license terms and conditions; without impacting preferred hatchery operations, when the lake level is appropriate and during appropriate weather.

Alternative to Reservation of Section 4(e) Authority Language

The Licensee requests that that this reservation be eliminated. Alternatively, the Licensee requests that language requiring that such changes be made after notice and opportunity to be heard before the Federal Energy Regulatory Commission.

Justification

The purpose of establishing license terms and conditions is for the Licensee to understand its obligations over the terms of the License and to enable it to make an informed decision regarding license acceptance. A reservation of authority to modify section 4(e) terms and conditions is inconsistent with this purpose. More importantly, it is unnecessary as FERC regulations allow for license amendments under appropriate, limited circumstances with due process, after notice and opportunity to be heard.

Alternative to Suggested Standard L Form License Terms and Conditions

At the beginning of Section 3, Preliminary Mandatory Conditions, DOI has suggested FERC Standard Form L-05, Terms and Conditions of License for Constructed Major Project Affecting Navigable Waters of the United States be included as license terms and conditions in a new license for the project. The Licensee's understanding is FERC practice would require the use of Standard Form L-16, Terms and Conditions of License for Constructed Minor Project Affecting Lands of the United States for this project. The Licensee suggests use of the applicable form L-16 as an alternative (if an alternative to this is necessary) as the project is a minor, not a major, constructed project and is located on an intermittent stream, not navigable waters of the United States as that term is commonly applied in connection with the use of the Standard L Forms. Assuming FERC would even entertain such a request, the Licensee takes the position DOI must provide specific and sufficient justification to vary from FERC's standard practice to support this unusual request.

IV. ALTERNATIVES TO FISHWAY PRESCRIPTION

General Alternative to All Conditions

It is difficult for the Licensee to tell if this Prescription requires eel passage only, or if it is also requiring fish passage. Most sections of the Prescription refer to fishways, not eelways or eel passage. Throughout the document the requirement that "structures be consistent with USFWS Engineering Criteria (USFWS 2019), notwithstanding site-specific limitations as determined by the USFWS" is repeated. This project is located on an intermittent stream and even using the limited storage flow fishways cannot be designed and economically operated in conformance with USFSW Engineering Criteria. There is insufficient flow to accommodate reasonable recreational use, eel or fish passage facilities meeting USFWS Engineering Criteria and economic generation. Although the Licensee does not believe eel passage is necessary at this location, the Licensee cannot make an informed decision regarding project licensing without a prescription that clearly defines USFW eel and fish passage construction and flow requirements for this location.

Alternative to Condition 1 – Revision of Section 18 Fishway Prescription

Condition 1 reserved the right, after notice and opportunity for comment, to require changes in the Project and its operation through revision of this Section 18 Prescription to protect and enhance fish passage at the Project and reserves the right to modify these conditions, if necessary to respond to any significant changes that warrant a revision of this Prescription. The Licensee requests the following alternative language for Condition 1: "The Secretary of the Department reserves the right, after notice and opportunity for hearing, to require changes in the Project and its operation through revision of this Section 18 Fishway Prescription to protect and enhance eel passage at the Project. The Secretary also reserves the right to modify these

conditions, after notice and opportunity for hearing, if necessary to respond to any significant changes that warrant a revision of this Prescription."

Justification

The Secretary of the Department has apparently prescribed upstream and downstream eel passage at this Project, not fish passage. The Licensee agrees that fish passage is unwarranted at this Project because the Project is located on an intermittent stream that does not have sufficient flow to successfully operate a fish passage facility. Natural flows at this Project do not meet the Service's flow requirements for fish passage facilities. Use of storage flows for fish passage at this Project makes the Project uneconomic. Even if storage flows were used for fish passage, the fish passage facilities could only be operated on a limited basis due to other project requirements. Fish passage has not been prescribed at this Project, thus any future revisions to the Prescription should be related to and address eel passage, not fish passage. Any "modifications" to require fish passage after new license issuance, as opposed to eel passage, at this project would constitute an amendment to license terms and conditions. To meet due process standards, any such change should be considered and processed as an amendment, follow license amendment procedures and require notice and opportunity for hearing.

Alternative to Condition 2 – Operating Periods

Condition 2 also erroneously refers to fishways, when the prescribed operating periods are for eel passage. These references should be changed. The Service recognizes that the eel passage season varies based on a variety of factors and may change. If passage is required, the Licensee requests an alternative that provides for consultation between the Licensee and Service

regarding the project specific upstream and downstream eel passage season and enables the Licensee and the Service to agree upon changes to the prescribed upstream and downstream eel passage seasons annually, or permanently when downstream or project eel passage data supports such a change. Because it is known that final license conditions for the downstream Ellsworth Project dams have the potential to significantly impact eel passage at the project, the Licensee requests that Condition 2 also provide for modification of the project eel passage seasons if eel passage license conditions at the downstream Ellsworth Project dams provide for shorter eel passage seasons.

Justification

A small project such as this needs to be able to generate whenever possible and use all reasonably available flows. Authorizing a change in operating periods when it becomes clear that the actual passage season is shorter than initially estimated (either annually or permanently) is no less protective than the proposed license conditions.

Alternative to Condition 4 – Maintenance and Repair

The Licensee requests as an alternative to Condition 4 the addition of the following language: “Debris shall be cleaned from the trash racks and eelway daily during the periods when eel passage is required. At other times the trash racks shall be cleaned periodically as necessary to allow for generation of electricity and operation of the penstock tap.

Justification

This small project has no electricity at the dam and personnel can only rake trash racks once a day when necessary. Occasionally during particular weather conditions, leaves and debris will collect much more than during other times.

Alternative to Condition 5 – Fishway Operation and Maintenance

If passage is required, the Licensee requests that Condition 5 be titled Eel Passage Operation and Maintenance Plan. The Licensee requests an alternative that requires both the original Eelway Operation and Maintenance Plan and any plan modifications to be approved by the USFWS and submitted to the FERC for approval. The final paragraph of Condition 5 requires the Licensee to accept a unilateral modification of the Eelway Operation and Maintenance Plan with no opportunity for consultation or discussion. The Licensee requests an alternative that requires the Licensee to be included in any consultation regarding modifications to the Eelway Operation and Maintenance Plan. Maintenance Plan disputes are FERC jurisdictional and are appropriately resolved by the FERC.

Justification

The Licensee is responsible for project Operation and Maintenance and must understand plan requirements. USFW personnel may or may not understand all the details of project operation and maintenance requirements. Consultation with the Licensee before unilaterally requiring modification of an existing plan will avoid taking plan modification disputes to FERC unnecessarily.

Alternative to Condition 7 – Design Plans

If passage is required, the Licensee requests that this provision be titled Eelway Design Plans. This provision provides that Designs shall be consistent with the USFWS Engineering Criteria (USFSW 2019) or other updated version or guidance, as determined by the USFSW. The Licensee requests an alternative that requires consistency with currently available information only and eliminates the applicability of unknown requirements. The Licensee also notes that it is likely impossible to comply with the requirement that designs shall be consistent with the USFWS Engineering Criteria (USFWS, 2019) as the project is located on an intermittent stream with insufficient flow to meet design standards.

Justification

An understanding of the details of passage and flow requirements required in a new license for this project is critical to the Licensee's determination of whether to surrender the existing license or accept a new license.

Alternative to Condition 9 – Downstream Fish Exclusion

The Licensee requests that this provision be titled Downstream Eel Exclusion. The Licensee requests an alternative that provides for eliminating the 2-inch gap on the side of the existing trash racks and leaving one inch clear spacing on the trash racks.

Justification

Potential engineering effects on project operations resulting from this condition will require further investigation. Modification of the trash racks requires an analysis to determine how much head loss will result from the trash rack spacing change, which impacts project generation and

revenue. Modification may also be impractical given the restrictions at the headworks. This proposed change will also impact pressure changes when the Hatchery is using the penstock tap. Additionally, the Project experiences difficulties with leaves accumulating on the trash racks during the fall under certain weather conditions, despite best efforts to keep the trash racks clear. These issues can result in turbine shutdown and potentially in blockage and shutdown of the penstock tap. Reducing the trash rack clear spacing to ¾ inch will only exacerbate these issues.

Alternative to Condition 11 – Downstream Route of Passage

The Licensee requests as its preferred alternative that downstream eel passage not be required, as discussed in its trial-type hearing request regarding disputed issues of material fact. If downstream eel passage is required, the Licensee requests that Condition 11 be titled Downstream Route of Eel Passage. If downstream eel passage is required, the Licensee requests an alternative Condition 11 providing "Within 2 years following the effective date of the new license, the Licensee shall maintain seasonal downstream passage for American eel by implementing a two-inch gap under one waste gate that is wide enough to pass the 1 cfs minimum flow. This downstream passage measure shall be operated as provided in Condition 8.2 (the alternative proposed by Licensee)."

Justification

The eel study performed during the relicensing process did not identify eels passing upstream at this Project. Absent large numbers of migrating eels, use of the existing waste gate provides a reasonable opportunity for eel passage providing species protection. The construction cost of

unspecified downstream eel passage, combined with other new project requirements, creates additional uncertainty with respect to capital expenditures and generation flows.

Alternative to Condition 12 – American Eel Siting Study

The Licensee requests an alternative to Condition 12 – American Eel Siting Study that requires deployment of eel ladders or ramps during the eel passage period for this Project. The eel passage siting study period is inconsistent with the period in other parts of the Prescription. Additionally, prior to conducting any eel passage siting study, eels should first be observed in the vicinity of the dam, not assumed to be present in sufficient numbers to justify passage on this intermittent stream.

Justification

The Licensee notes that there is no electricity at the dam and the most efficient way to provide water for an eel passage study is utilizing the float system proposed by Licensee.

Alternative to Condition 13 – Upstream Eel Passage

The Licensee requests as an alternative that upstream eel passage not be required, as discussed in its trial-type hearing request regarding disputed issues of material fact. In the event passage is require, the Licensee requests an alternative providing that "Within 2 years following the completion of the American eel siting study, the Licensee shall provide an upstream sloping eel ladder/ramp from a location the siting study has shown young eels pool, using a passive feed water system using a floating intake for water. The final location and design of the seasonal upstream eel ladder/ramp described above shall be developed in consultation with the Maine

Departments of Marine Resources and Inland Fish and Wildlife. The Licensee shall provide the USFWS and the Maine Departments of Marine Resources and Inland Fish and Wildlife with designs for the structure in accordance with the scheduling provisions of Section 9."

Justification

The effects of improved eel passage at the Ellsworth Dam on the project and current eel populations at Green Lake are unknown. The eel study performed during the relicensing process did not identify eels moving upstream at the Project. The Project does not have electricity at the dam to enable pumping. Other upstream eel passage options will likely require more costly construction and require the provision of electricity at the dam. The construction cost of unspecified upstream eel passage, combined with other new project requirements, creates uncertainty with respect to capital expenditures and generation flows.

Alternative to Condition 15 – Fish Passage Effectiveness Study

As noted above and as discussed in Licensee's disputed issues of material fact, the Licensee's preferred alternative is that eel passage and also effectiveness studies not be required. If passage and effectiveness studies are required, the Licensee requests that this Condition be titled Eel Passage Effectiveness Study. The Licensee also requests a secondary alternative that modifies the item (2) to read "that the minimum bypass flow of 1 cubic feet per second provides safe, timely and effective downstream passage to migrating eels (i.e. does not strand eels)." The Licensee also requests that the following sentence be added after said item (2): "Notwithstanding the foregoing, if it is determined that the minimum bypass flow of 1 cubic feet per second does not provide safe, timely, and effective downstream passage to migrating eels, in no event shall

minimum flows for eel passage be increased to more than 3 cubic feet per second, or inflow if less."

Justification

As discussed in the Licensee's disputed issues of material fact, the Licensee is concerned that insufficient eels will be present to conduct effectiveness studies. The construction cost of unspecified downstream and upstream eel passage and the related potential for reduced generation flows, combined with other new project requirements, creates additional uncertainty with respect to capital expenditures and generation flows. Any study that depends on the availability of manpower on an ongoing basis is likely to be cost prohibitive. An operator is present at the dam for 15-30 minutes per day.

Alternative to Condition 16 – Modifications

The Licensee's preferred alternative is that eel passage and effectiveness studies not be required, as discussed in its disputed issues of material fact. In the event passage is required, the Licensee requests an alternative condition with the last sentence of Condition 16 amended to read as follows: "Such modifications to eel passage facilities may include structure and flow changes with an appropriate cost benefit ratio given the cost of the modification and its impact on project economics vs the projected improvement to overall eel populations in the Union River Basin."

Justification

The potential for modifications to installed downstream and upstream eel passage and the related potential for reduced generation flows, combined with other new project requirements, creates uncertainty with regarding capital expenditures,generation flows, and availability of water to the Hatchery.

Alternative to Condition 17 – Exceptions

The Licensee requests as an alternative that the first paragraph of Condition 17 be amended to read as follows: "Except in connection with the construction of significant new project facilities, the Licensee may curtail or suspend fish passage and exclusion measures for no more than three successive weeks at a time upon mutual agreement between the Licensee, the USFWS, and the Maine Departments of Marine Resources and Inland Fish and Wildlife. Consent of the agencies shall not be unreasonably withheld."

Justification

This proposed alternative addresses potential construction of new project facilities, includes a requirement that consent of the agencies shall not be unreasonably withheld and clarifies that three successive weeks does not mean 21 days in a year.

Alternative to Condition 19 – Mitigation Measures

The Licensee requests that Condition 19 be eliminated as an alternative.

Justification

There are a wide variety of legitimate reasons why a Licensee may require an extension of time or an exception with respect to license compliance. Condition 19 has no standard of agency review and no requirement that mitigation be proportional to the degree of Licensee's culpability, or the harm caused by an extension or exception. More importantly, the powers of both federal and state agencies are prescribed by state and federal law and such agencies typically have no statutory authority to take the type of action set forth in this condition. To the extent they have such statutory authority, they can act based on the applicable statute and don't require a license condition or prescription. The Federal Power Act (FPA) includes provisions to address license non-compliance that rises to a level where mitigation is appropriate. Federal and state agencies can avail themselves of applicable FPA provisions and do not need to usurp existing federal and state law via conditions like this.

Alternative to Section 9 – Implementation Schedule

The Licensee requests as an alternative that the implementation schedule be modified to reflect the Licensee's preferred alternative of no modification to the trash racks. If trash rack modification is required, the Licensee requests the schedule be included as part of the Downstream Eel Passage Facilities design. The Licensee requests as an alternative that the implementation schedule be modified to reflect the Licensee's preferred alternative of no requirement for upstream and downstream fish or eel passage. If upstream and downstream eel passage is required, the Licensee requests as an alternative the design of upstream eel passage be completed within 3 years of the completion of the siting study, the downstream passage design be completed within 4 years of the effective date of the License, and the implementation schedules for eel passages be included in the respective designs. The Licensee also requests as

an alternative that these facilities be identified as eelways and that the Eelway Operation and Maintenance Plan be completed within one year after installation of the facilities. The Licensee requests as an alternative the time periods in Section 9 be checked against the remainder of the document and made consistent.

Justification

Trash rack modifications are part of the downstream eel passage facilities. The construction time and cost of an eelway can vary greatly depending on its design. Committing to a fixed schedule before the design is understood, especially when much of the design is subject to open-ended requirements, is not realistic. Including the implementation schedule in the design process allows tradeoffs between implementation schedule and potential features to be evaluated. Operation and Maintenance Plans cannot be drafted until design and construction of facilities and are better informed after there has been some experience with facility operation. DOI's time periods in Conditions 12 and 15 are inconsistent with the time periods in the Section 9 implementation schedule.

V. REQUEST FOR TRIAL-TYPE HEARING ON DISPUTED ISSUES OF MATERIAL FACT

DISPUTED ISSUES OF MATERIAL FACT

Whether the prescribed upstream and downstream protection measures in Section 8 of the eel passage prescription for the Green Lake Dam are necessary to support, enhance and restore an eel population in the Union River.

Whether American eel are present at the Green Lake dam in sufficient numbers to justify a passage siting study, upstream and downstream eel passage; and to evaluate the effectiveness of upstream and downstream eel passage.

DISPUTED ISSUE OF MATERIAL FACT NO. 1

Whether the prescribed upstream and downstream protection measures in Section 8 of the eel passage prescription for the Green Lake Dam are necessary to support, enhance and restore an eel population in the Union River.

Statements Made or Relied Upon by DOI (43 C.F.R. §45.21(b)(2)(i))

Section 8 of the DOI Prescription includes requirements for upstream and downstream eel passage and other protective measures. At Section 4, top of page 11, DOI asserts that to enhance and restore an eel population in the Union River, the upstream and downstream passage and protection measures are necessary. DOI Decision Document Preliminary Prescription for Fishways Pursuant to Section 18 of the Federal Power Act.

Why These Factual Statements are Unfounded or Erroneous (43 C.F.R. §45.21(b)(2)(ii))

Currently, the principal impediment to eel passage in the Union River basin is the presence of the Ellsworth Project dams on the mainstem of the Union River. Despite this impediment, eels are present in numerous areas in the Union River basin. Eels are generalists, with the ability to successfully use a wide variety of habitats. There is a sufficient eel population in Maine to allow for the commercial eel fishery with statewide landing data available, but landings for specific

locations, including the Union River, are considered proprietary information and not available. It is known the commercial harvests represent hundreds of silver eels, thousands of yellow eels and millions of glass eels. Green Lake and its watershed are connected to the Union River basin via an intermittent stream, limiting its accessibility and making it one of the more unlikely natural habitats for supporting a significant eel population. Even absent limited accessibility, it represents only 8.5% of the Union River watershed. When impediments to eel passage at the downstream Ellsworth Project are addressed, there will be significant eel habitat in the Union River basin and the limited, intermittent access to Green Lake will make an insignificant contribution to support, enhance and restore an eel population in the Union River.

Materiality of the Factual Dispute (43 C.F.R. §45.21(b)(2)(iii))

Whether or not eel passage at the Green Lake project is necessary to support, enhance and restore an eel population in the Union River basin is "material" as "it may affect the Department's decision to affirm, modify or withdraw" its preliminary prescription in this proceeding.

Supporting Information (43 C.F.R. §45.21(b)(2)(iv)

Green Lake Hydroelectric Project, FERC Project P-7189, Preliminary Application Document, Final License Application Document, Licensing Study Results, Responses to Additional Information Requests and Studies Related thereto, references associated with the above and attachments provided herein.

Witness Information and Narrative (43 C.F.R. §45.21(c)(1))

Testimony/Exhibits of Brandon Kulik, Senior Science Advisor, Kleinschmidt Group

Testimony/Exhibits of Bert Kleinschmidt, Executive and Principal Operator. Green Lake Water Power Company

Witness Information and Qualifications

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Brandon Kulik has 42 years of experience designing, performing, and reviewing environmental studies pertaining to fish passage, ecology, instream flow, and aquatic habitat. Brandon has experience leading agency consultations for scoping, design and execution of study plans; negotiating resolutions for issues including water quality, aquatic habitat, and fish passage; managing the collection and analysis of environmental and fisheries data; preparing related environmental exhibits required for license application and permit documents and providing biological input to the engineering design of fishways.

Brandon is certified in Instream Flow Incremental Methodology (IFIM), including Physical Habitat Simulation (PHABSIM) computer modeling, and is considered a national expert having conducted more than 50 IFIM studies. Brandon has also provided expert testimony on instream flow and fish passage issues.

Summary of Testimony and Exhibits

Mr. Kulik will provide testimony regarding fish and fish passage issues at the Green Lake Hydroelectric Project, based upon his experience and the Project record and Exhibits noted below.

Exhibits

Green Lake Hydroelectric Project, FERC Project P-7189, Preliminary Application Document, Final License Application Document, Licensing Study Results, Responses to Additional Information Requests and Studies Related thereto, references associated with the above and attachments provided herein. (Sections relating to project construction and operation, and eel and fish passage.) In the record.

United States Department of the Interior Decision Document Preliminary Prescriptions for Fishways Pursuant to Section 18 of the Federal Power Act for Green Lake Hydropower Project, FERC Project No. P-7189. In the record.

United States Department of the Interior Decision Document Preliminary Mandatory Conditions Pursuant to Section 4(e) of the Federal Power Act for the Green Lake Hydropower Project, FERC Project No. P-7189. In the record.

Green Lake Water Power Company, FERC Project No. 7189, Order Issuing License (Minor), dated April 5, 1984. In the record.

Green Lake Water Power Company, FERC Project No. 7189, Order on Appeal, dated May 25, 1984. In the record.

Maine Landlocked Salmon: Life History, Ecology and Management. David P. Boucher and Kendall Warner. Maine Department of Inland Fisheries and Wildlife, Division of Fisheries and Hatcheries. (2006 (Not in the record. Lengthy, readily available on line.)

Atlantic States Marine Fisheries Commission. 2017 American Eel Stock Assessment Update. (May be in or referenced in the record, familiar to agencies.)

Atlantic States Marine Fisheries Commission, Addendum V to the Interstate Fishery Management Plan for American Eel (May be in or referenced in the record, familiar to agencies).

Final Environmental Assessment for the Ellsworth Project (FERC P-2727)(Sections dealing with eel and fish passage, not in the record, familiar to agencies.)

Testimony/Exhibits of Bert Kleinschmidt, Executive and Principal Operator. Green Lake Water Power Company

Witness Information and Qualifications

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Robert (Bert) Kleinschmidt has 18 years of experience managing, operating, and maintaining the Green Lake Hydro Electric Project. He has a Bachelor's Degree with honors in Mechanical

Engineering from Harvard University. His technical coursework included courses and research in Electronics and Electrical Engineering as well as physics and mathematics. He received his first patent (for an electronic small hydro-electric governor) at the age of 24 and has been involved in technical research and development for over 40 years. Much of his work has been in computer software at a hardware level (drivers and hard disk utility software). Some of his work has included designing and building custom circuit boards and mechanical systems.

Mr. Kleinschmidt was involved with building the station in the mid-1980's, mainly doing wiring and controls. After many years on the other side of the country, he returned to the station in 2005 to debug problems when project personnel and an electrician were unable to bring the project back online after a lightning strike. Over the next 10 days, Mr. Kleinschmidt researched and fixed the station problems (including mistakes made by the electrician) and successfully brought the station online with all necessary controls and mechanical systems in operating order. Since then, he has operated and maintained the project. This includes routine generator and turbine maintenance, troubleshooting and improving ancillary systems at the power station, penstock and dam mechanical system maintenance, and occasional operator duties.

Mr. Kleinschmidt understands the project better than any person alive. During the relicensing work, he performed most of the studies, authored most of the documents submitted to the Commission, and produced a complete, new set of drawings for the Project including needed survey work.

Summary of Testimony and Exhibits

Mr. Kleinschmidt will provide testimony regarding engineering, construction, maintenance, operation and related issues associated with the Green Lake Hydropower Project based upon his

education and experience owning, operating and maintaining the Project, based on the Project record and Exhibits noted below.

Exhibits

Green Lake Hydroelectric Project, FERC Project P-7189, Preliminary Application Document, Final License Application Document, Licensing Study Results, Responses to Additional Information Requests and Studies Related thereto, references associated with the above and attachments provided herein. (In the record).

United States Department of the Interior Decision Document Preliminary Prescriptions for Fishways Pursuant to Section 18 of the Federal Power Act for Green Lake Hydropower Project, FERC Project No. P-7189. (In the record.)

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Green Lake Water Power Company, FERC Project No. 7189, Order on Appeal, dated May 25, 1984. (In the record).

Disputed Issue of Fact No. 2

Whether American eel are present at the Green Lake dam in sufficient numbers to justify an eel passage siting study, upstream and downstream passage; and to evaluate the effectiveness of upstream and downstream eel passage.

Statements Made or Relied Upon by DOI (43 C.F.R. §45.21(b)(2)(ii))

Section 8 of the DOI Prescription includes requirements for construction of upstream and downstream eel passage facilities, as well as study and evaluation of the effectiveness of constructed facilities. DOI Decision Document Preliminary Prescription for Fishways Pursuant to Section 18 of the Federal Power Act.

Why These Factual Statements are Unfounded or Erroneous (43 C.F.R. §45.21(b)(2)(ii))

Currently, the principal impediment to eel passage in the Union River basin is the presence of the Ellsworth Project dams on the mainstem of the Union River. Despite this impediment, eels are present in numerous areas in the Union River basin. Eels have been "observed" above the Green Lake dam but there is no information regarding the extent of the current eel population in Green Lake. Green Lake Water Power Company performed a study during the relicensing to determine the extent of upstream eel migration to Green Lake and did not observe any eels. Reeds Brook was historically an intermittent stream and currently has limited minimum flows. The extent of upstream eel migration to Green Lake via Reeds Brook, even assuming a significant increase in eel passage at the downstream Ellsworth Project, is unknown. It is quite likely that it will be insignificant.

Materiality of the Factual Dispute (43 C.F.R. §45.21(b)(2)(iii))

Whether or not there are or will be sufficient eel populations requiring upstream and downstream eel passage and sufficient populations to evaluate the effectiveness of any passage constructed is "material" as "it may affect the Department's decision to affirm, modify or withdraw" its preliminary prescription in this proceeding.

Supporting Information (43 C.F.R. §45.21(b)(2)(iv)

Green Lake Hydroelectric Project, FERC Project P-7189, Preliminary Application Document, Final License Application Document, Licensing Study Results, Responses to Additional Information Requests and Studies Related thereto, and references provided herein.

Witnesses and Exhibits (43 C.F.R. §45.21(c)(1))

Testimony/Exhibits of Brandon Kulik, Senior Science Advisor, Kleinschmidt Group

Witness Information and Qualifications

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environmental exhibits required for license application and permit documents and providing biological input to the engineering design of fishways.

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Exhibits

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Maine Landlocked Salmon: Life History, Ecology and Management. David P. Boucher and Kendall Warner. Maine Department of Inland Fisheries and Wildlife, Division of Fisheries and Hatcheries. (2006 (Not in the record. Lengthy, readily available on line.)

Final Environmental Assessment for the Ellsworth Project (FERC P-2727)(Sections relating to eel and fish passage. Not in the record. Familiar to agencies.)

Testimony/Exhibits of Bert Kleinschmidt, Executive and Principal Operator. Green Lake Water Power Company

Witness Information and Qualifications

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Mr. Kleinschmidt was involved with building the station in the mid-1980's, mainly doing wiring and controls. After many years on the other side of the country, he returned to the station in 2005 to debug problems when project personnel and an electrician were unable to bring the project back online after a lightning strike. Over the next 10 days, Mr. Kleinschmidt researched

and fixed the station problems (including mistakes made by the electrician) and successfully brought the station online with all necessary controls and mechanical systems in operating order. Since then, he has operated and maintained the project. This includes routine generator and turbine maintenance, troubleshooting and improving ancillary systems at the power station, penstock and dam mechanical system maintenance, and occasional operator duties.

Mr. Kleinschmidt understands the project better than any person alive. During the relicensing work, he performed most of the studies, authored most of the documents submitted to the Commission, and produced a complete, new set of drawings for the Project including needed survey work.

Summary of Testimony and Exhibits

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Exhibits

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Green Lake Water Power Company, FERC Project No. 7189, Order on Appeal, dated May 25, 1984. (In the record,)

Respectfully Submitted:

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Attachments: 01-20230611-Water-Report.pdf
02-104-001-DOI-Right-of-Way-Agreement.pdf
03-Ellsworth Maine the Picturesque City of the East and Green Lak.pdf
04-AmShadHabitatPlan_ME.pdf

CERTIFICATE OF SERVICE

I hereby certify that I have on the 20th day of June 2023, served by express mail for delivery on the next business day, or by email with consent, the foregoing document upon each party in the Federal Energy Regulatory Commission (FERC) Green Lake Hydroelectric Project Service List as well as the Secretary of FERC consistent with the requirements of Part 45 of the Department of the Interior's regulations.

Caroline Kleinschmidt
Relicensing Coordinator
Green Lake Water Power Co

Copies of the foregoing document were served to the following addresses:

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Report on the Effect of the Hatchery Withdrawal from the Lake:

June 11, 2023

For the 8 years (2011 – 2018) that we have, the Hatchery's water usage the average use is 14.15629cfs – continuously, all year. This represents 15.72921% of the 90cfs the turbine uses when it's running, this could be described as for every 6.36 hours of water the hatchery uses, the turbine loses 1 hour of generation.

There are times when this water would be wasted, due to the lake being too high, typically for a few days in late Spring and again in the late fall, this is taken into account in the following calculations.

Reviewing the lake levels and the GLWP generation over the 10 years (2011 – 2020) it can be seen that without the Hatchery drawing water GLWP would have generated additional hours – the following list describes how this would have worked for this period:

For each of the 10 years it has been determined how many additional hours could have been used for generating with the water if the Hatchery did not use it. The following list shows how much additional generation could have been done with the extra water and when this could have occurred:

2011: 739.90 hours – during June, July, August, October and November
2012: 1336.35 hours – during January to May, July and October
2013: 830.50 hours – during May, July, August, October and November
2014: 845.60 hours – during June, August, October and November
2015: 1374.10 hours – during April to December
2016: 992.83 hours – during June to December
2017: 830.50 hours – during June to December
2018: 785.20 hours – during January, and May to November
2019: 687.05 hours – during June to November
2020: 762.55 hours – during June to November

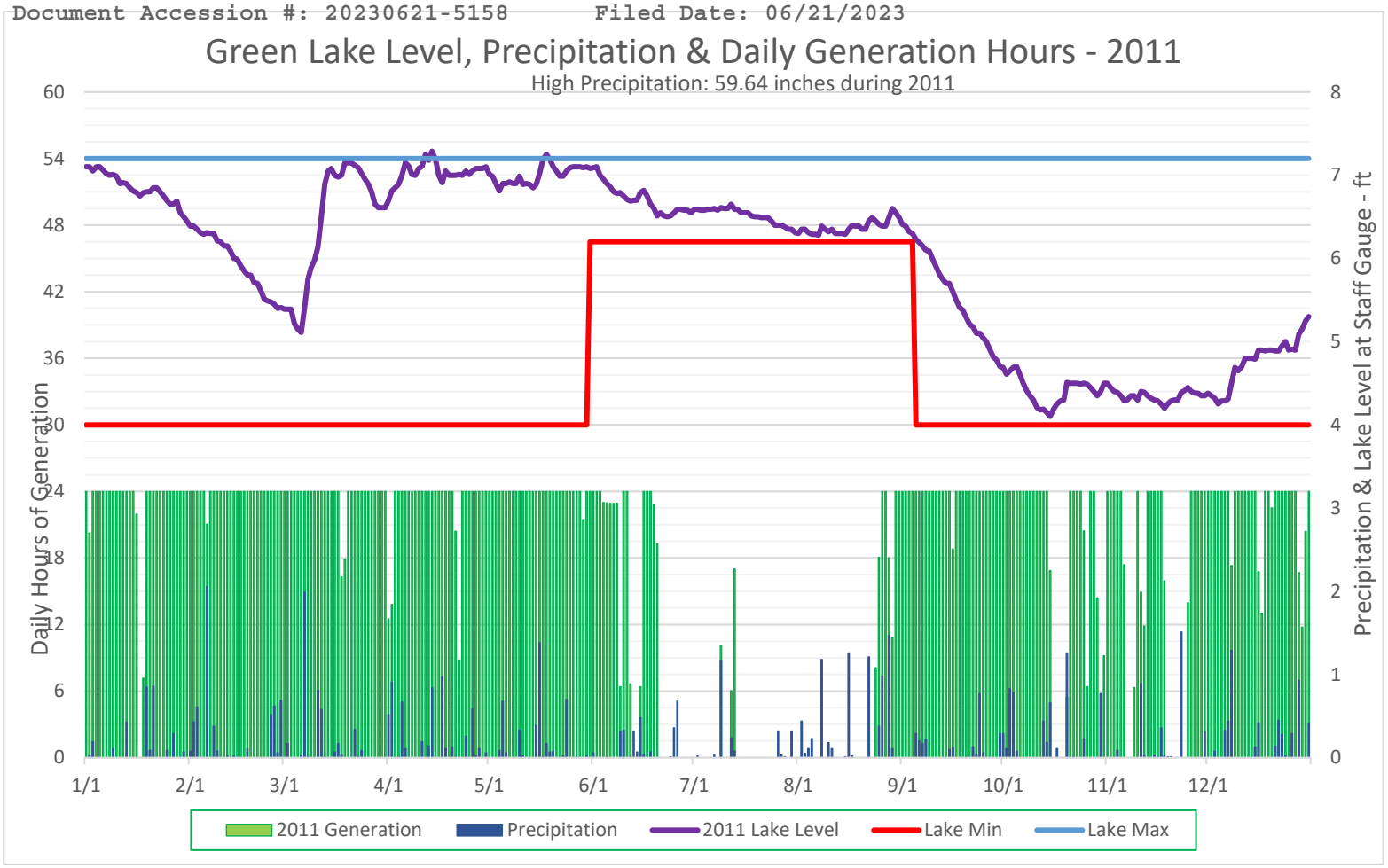
There are 24 hours in a day and GLWP's average generation is 325 kilowatts.

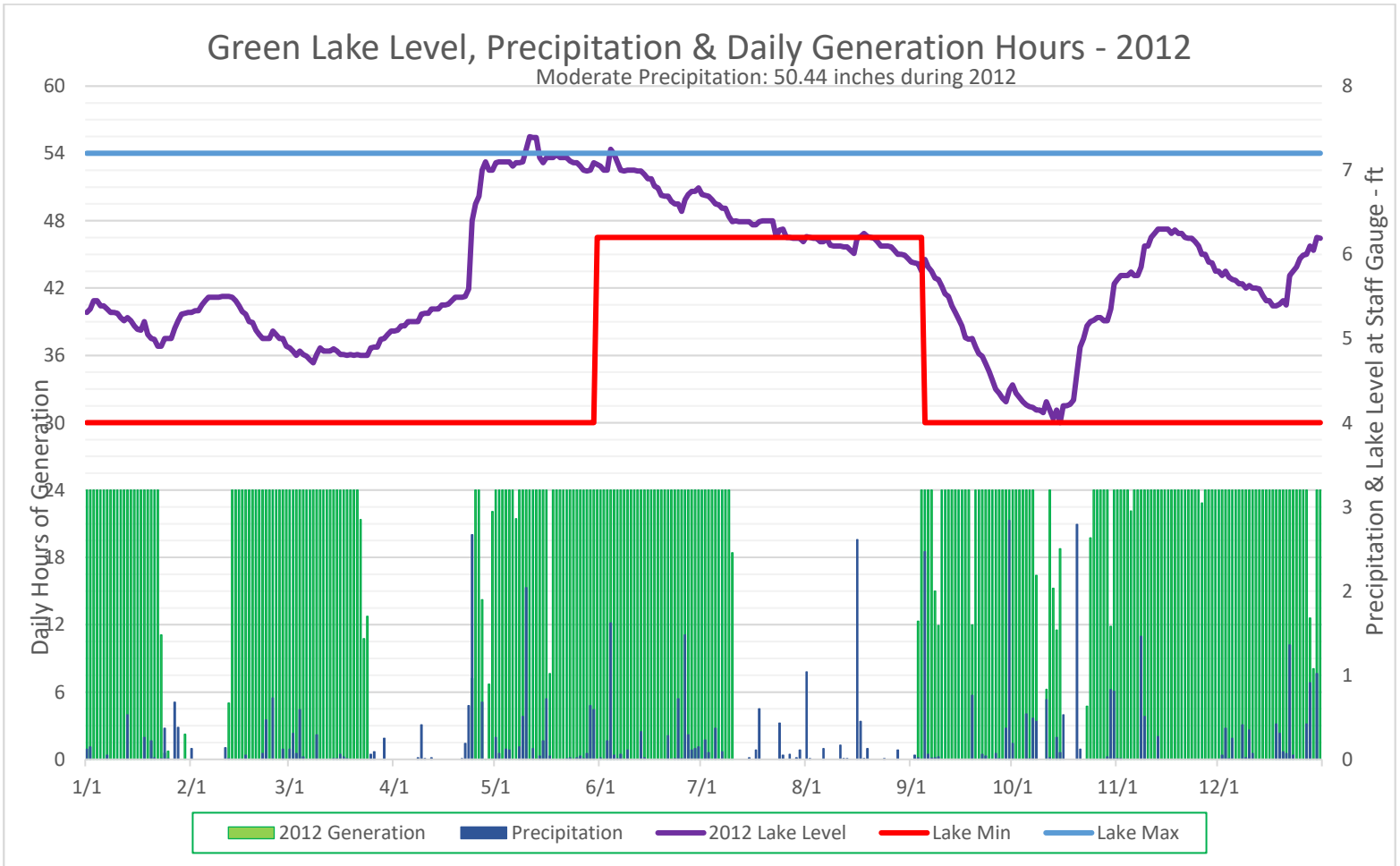
The Project estimates the Hatchery's use of water from the lake has cost the project 298 megawatt hours of generation annually, or approximately $30k per year in 2023 dollars. This is expected to amount to about $40k in lost income per year for the foreseeable future with the electric rates that are currently anticipated.

There is a potential that renewable energy credits could increase this number.

The following pages show how the lack of water affected the GLWP generation over 10 years.

Document Accession #: 20230621-5158 Filed Date: 06/21/2023





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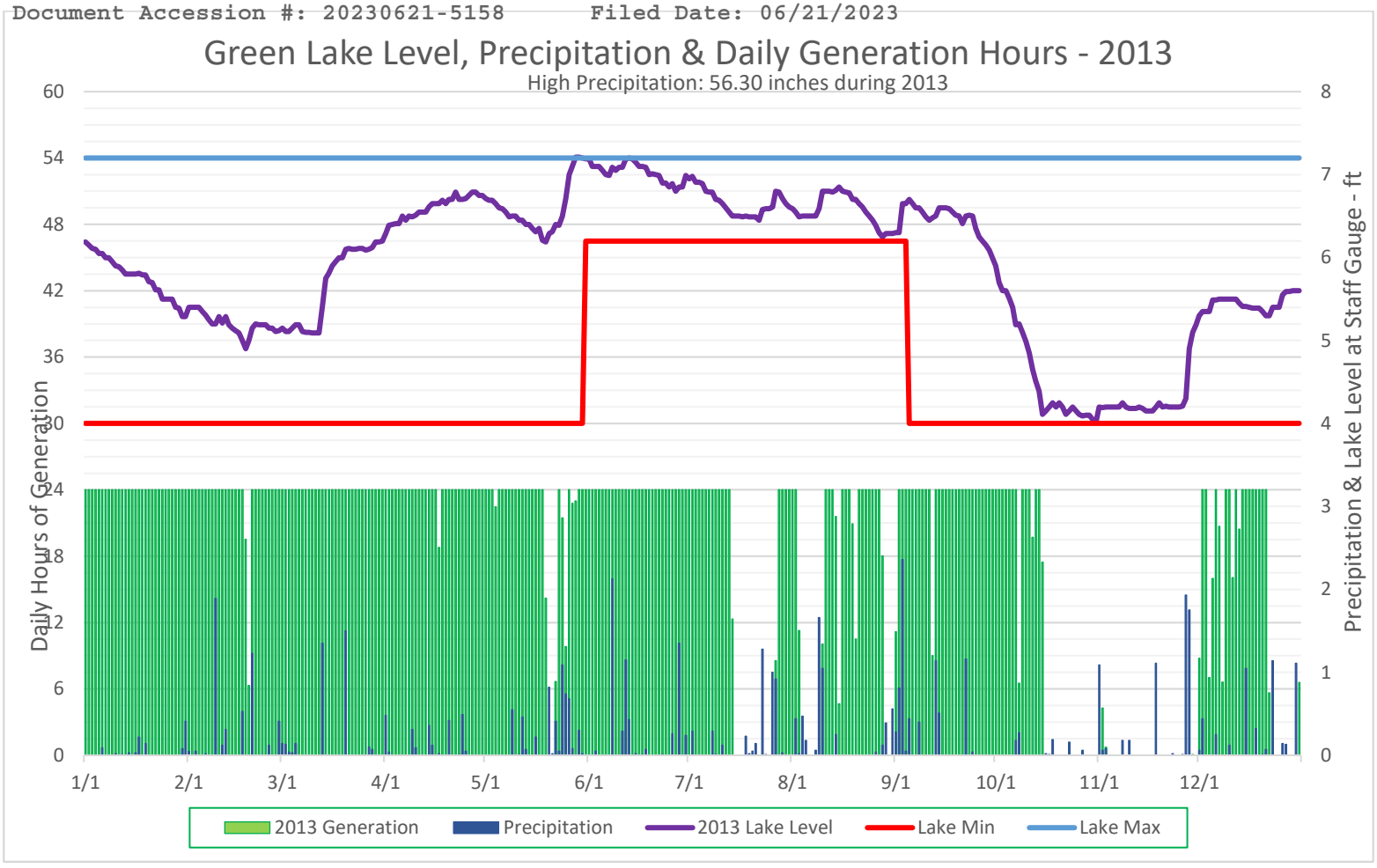
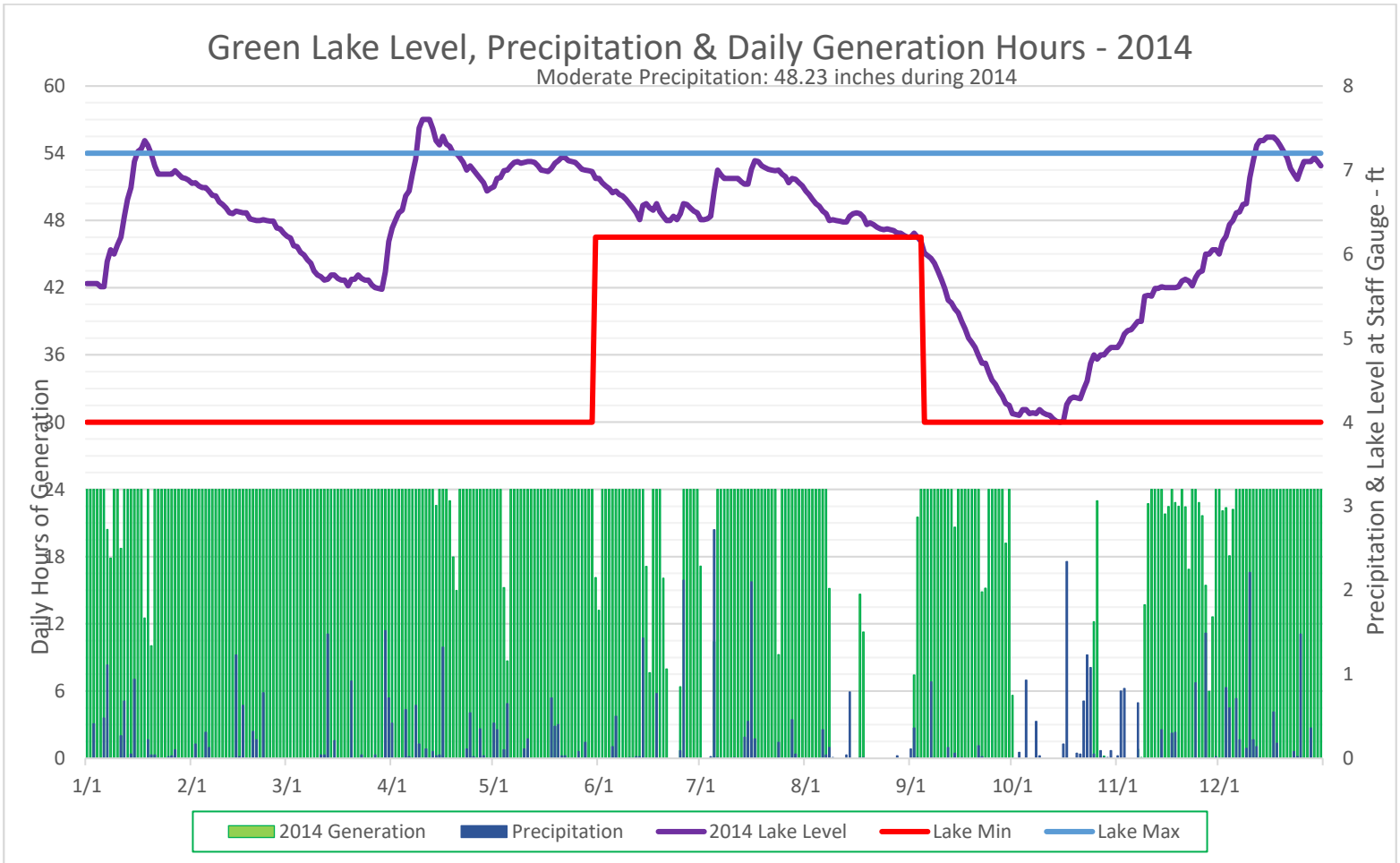
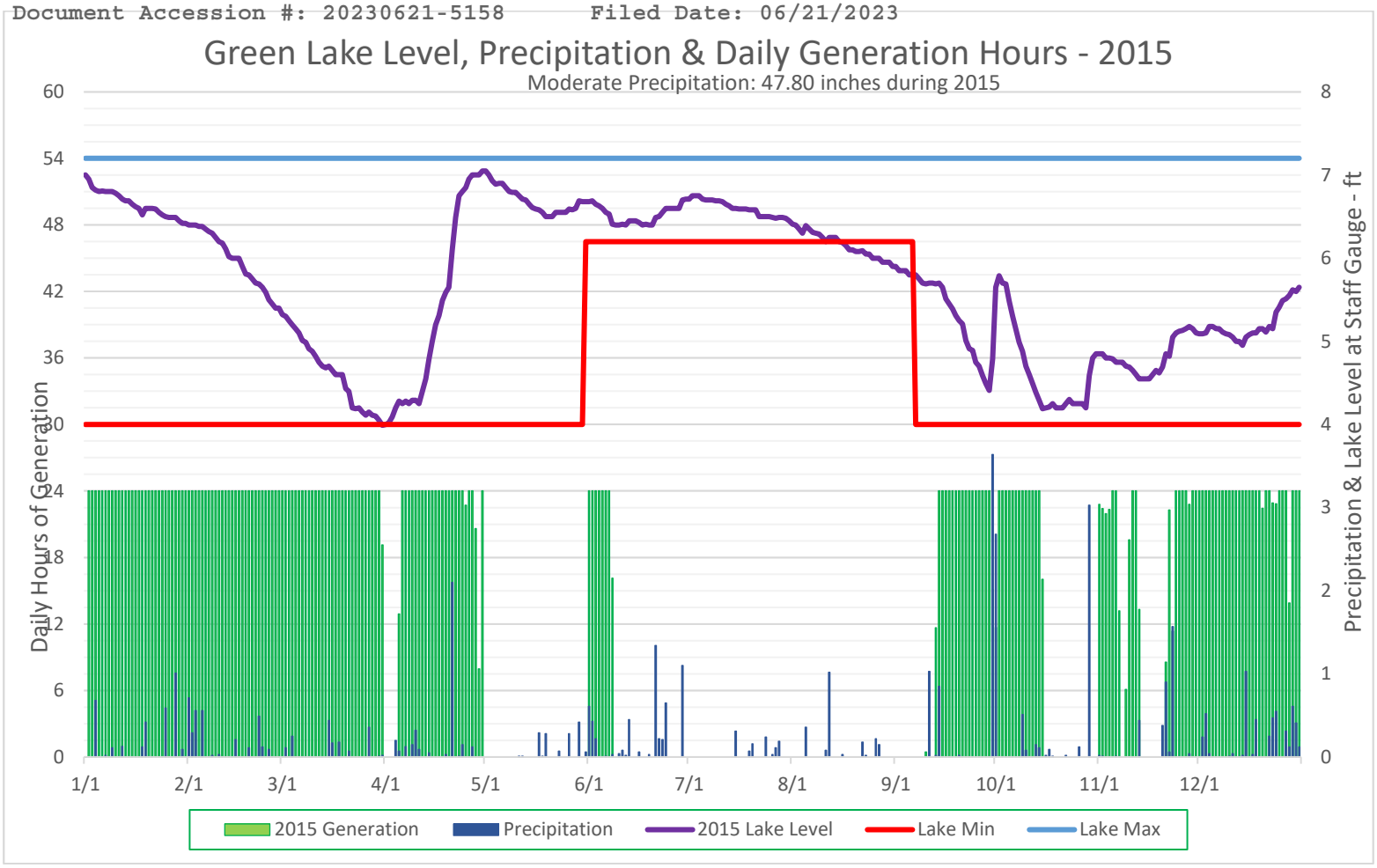
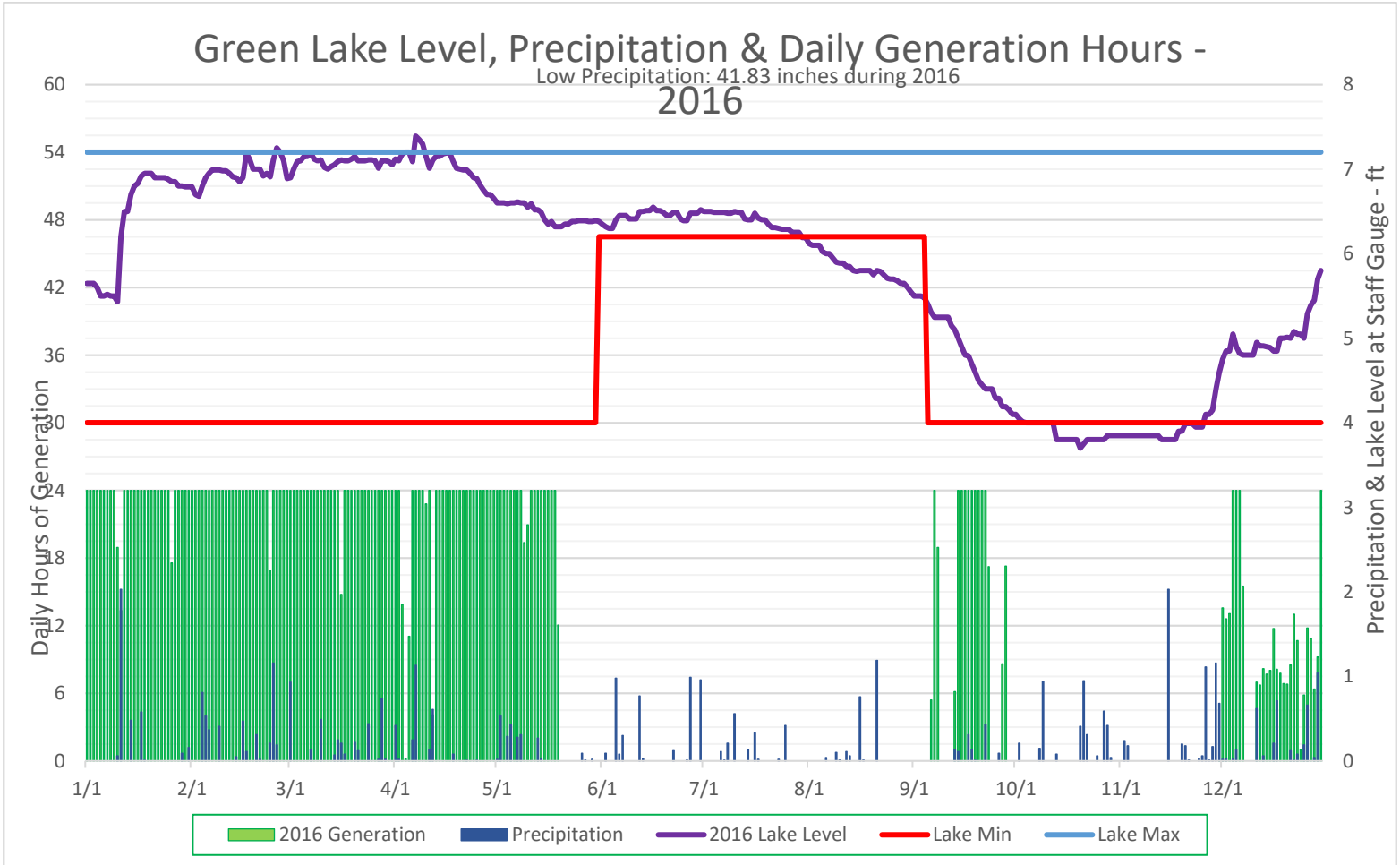




Document Accession #: 20230621-5158 Filed Date: 06/21/2023





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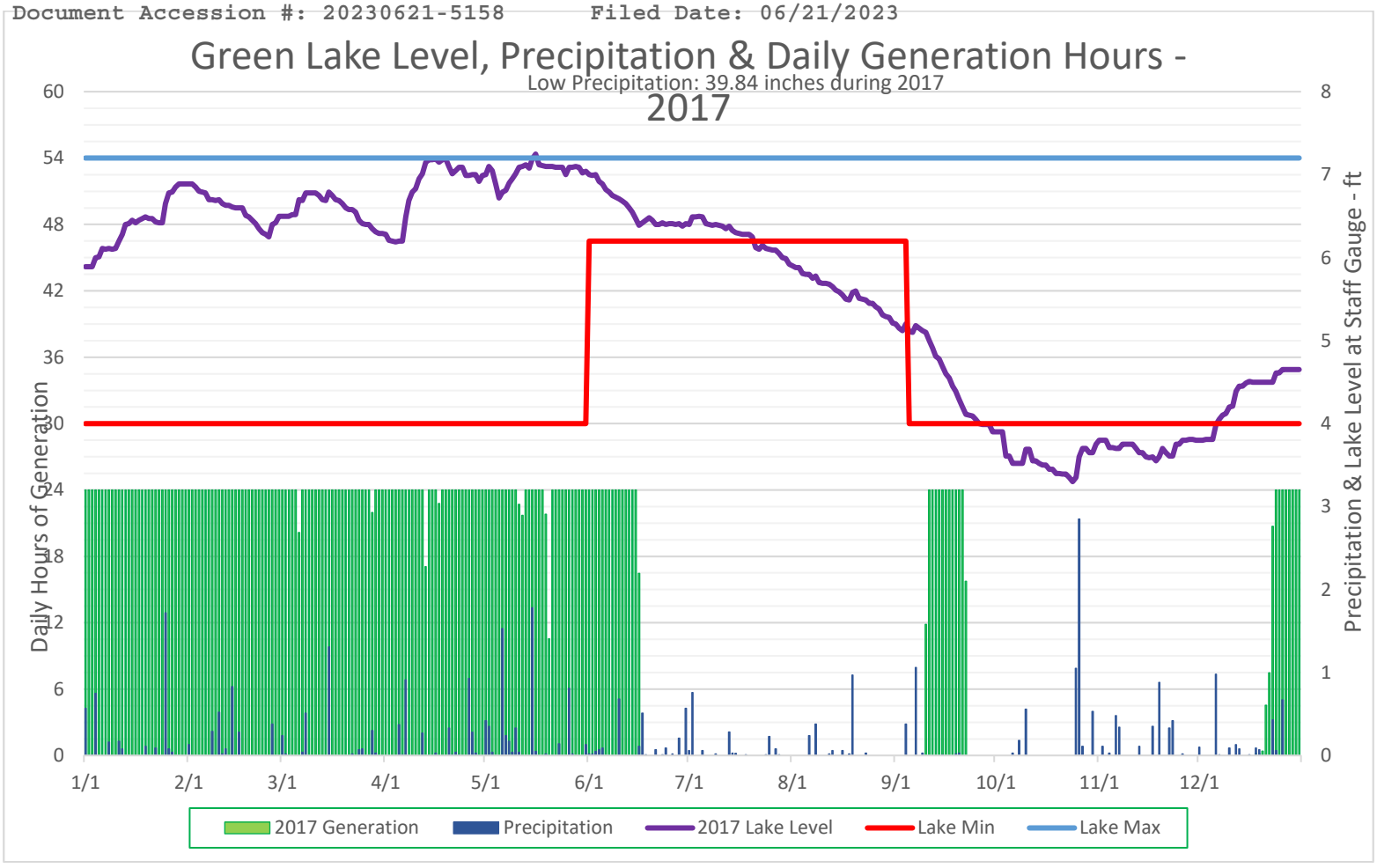

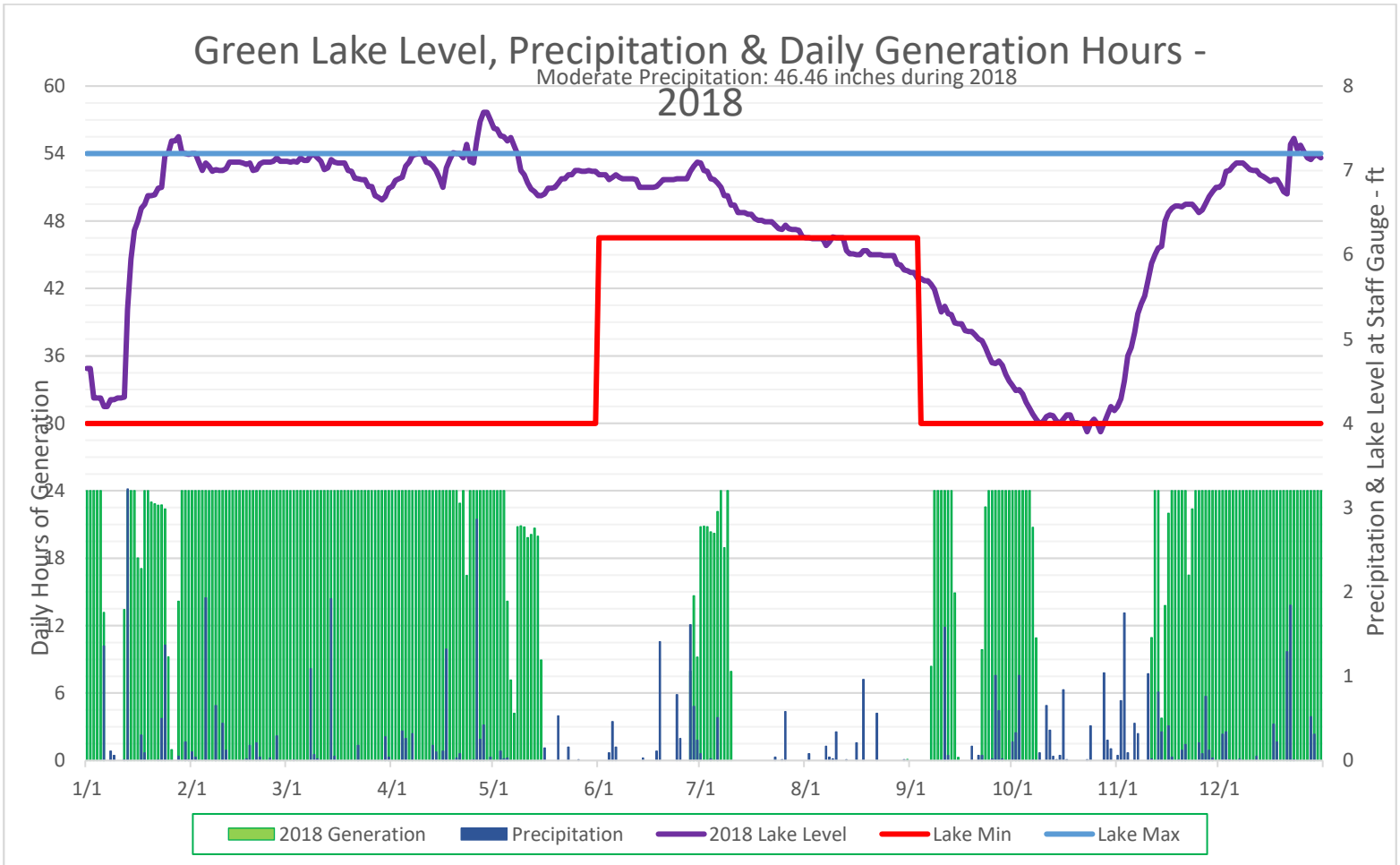

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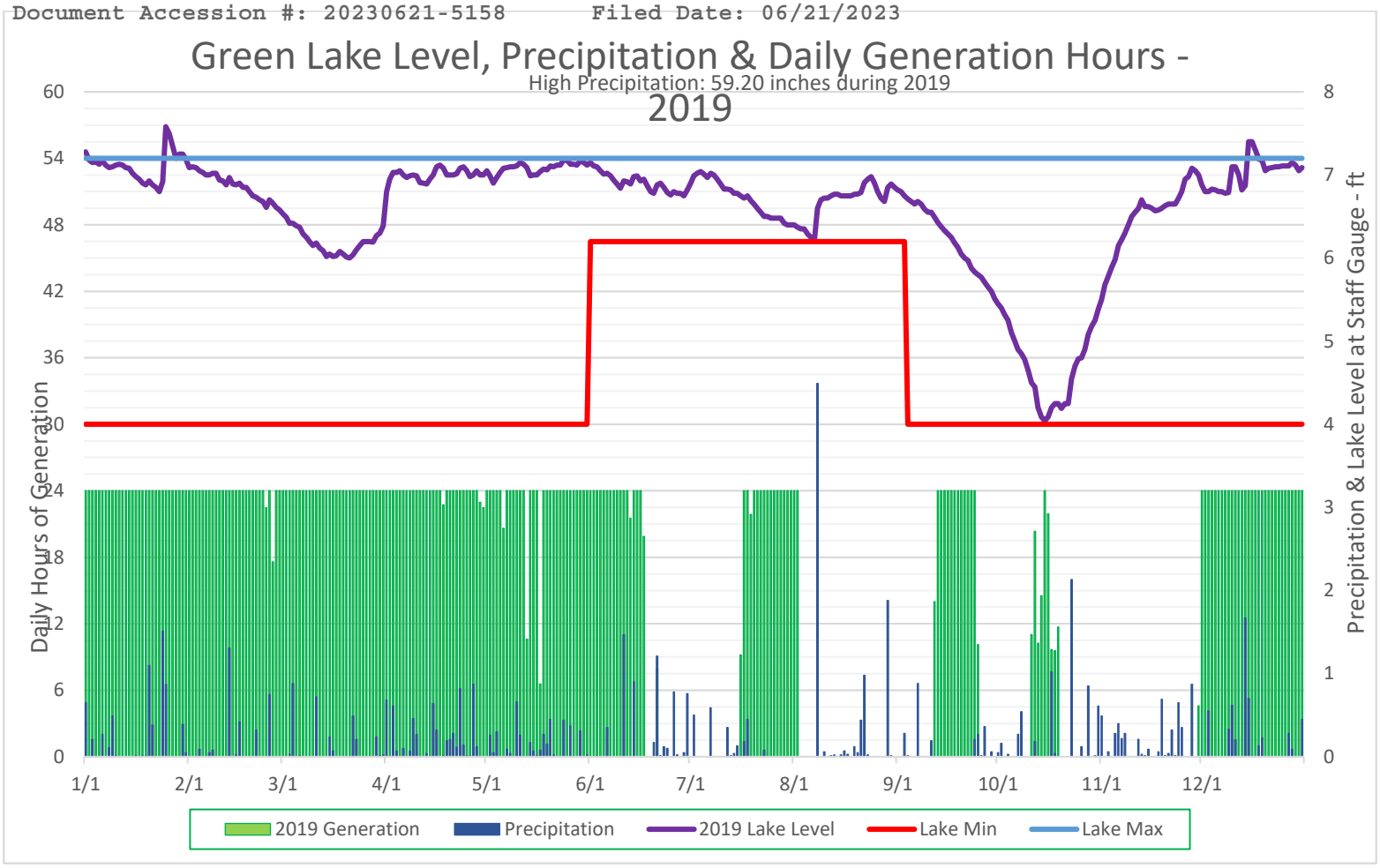
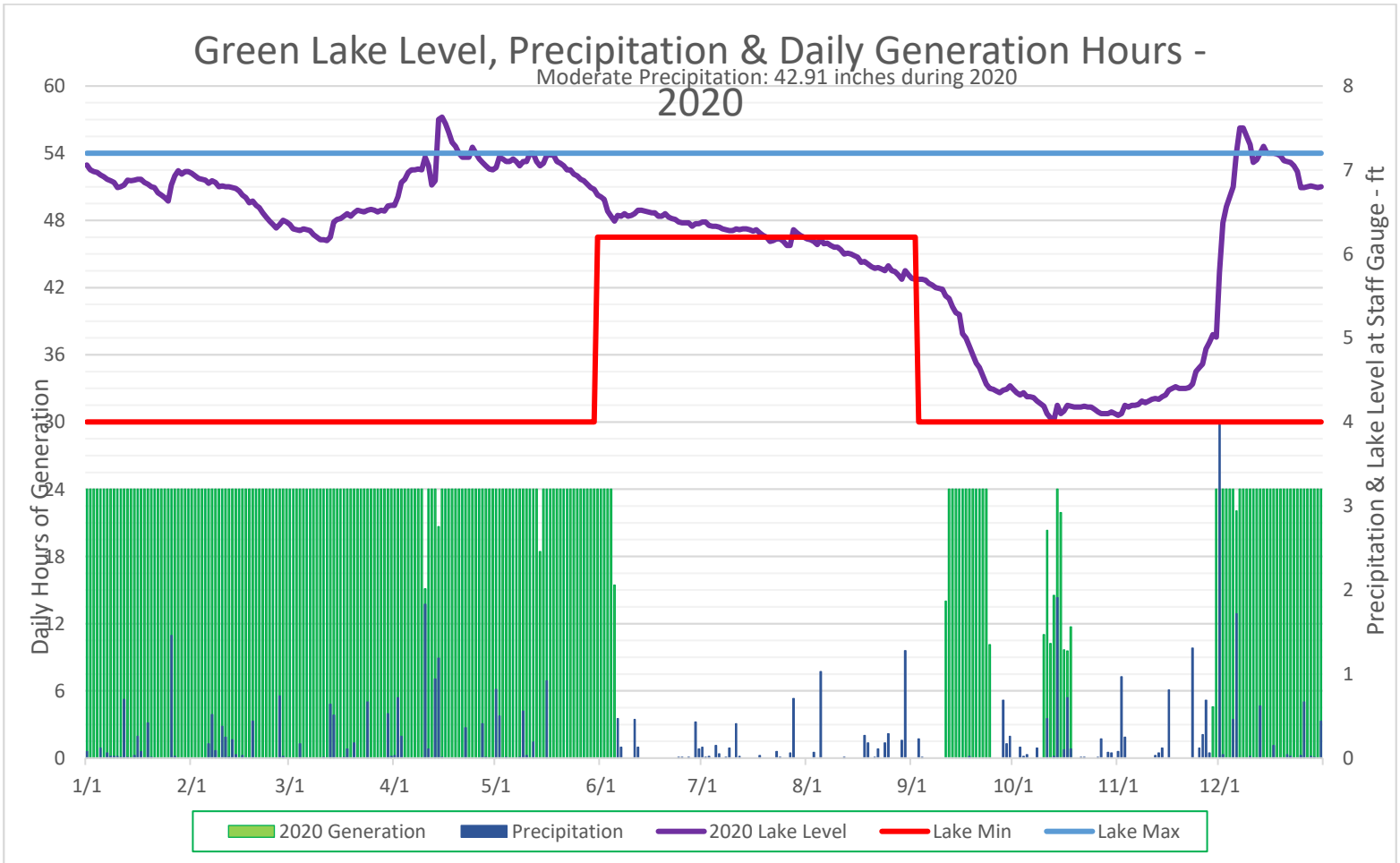




Document Accession #: 20230621-5158 Filed Date: 06/21/2023

EASEMENT

FOR The granting of an easement to construct a penstock, electric generating powerhouse, electric transmission and sewer line on land of the United States of America

THE SECRETARY OF THE INTERIOR, by his authorized representative, the Regional Director, U.S. Fish and Wildlife Service, 1 Gateway Center, Newton Corner, MA. in accordance with applicable authorities, and regulations published December 19, 1969, 50 CFR Part 29.21, for and in consideration of

One Dollar ($1.00) and other valuable consideration as set forth in a Licensed Project Development Agreement appearing as Appendix A hereto,

hereby grants to Green Lake Water Power Company, c/o Kleinschmidt & Dutting, 75 Main Street, Pittsfield, Maine 04976 - 0076
herein designated as the grantee, an easement for a right-of-way for a period of fifty years (50) for a penstock, powerplant, electric transmission line and sewer lines over, across, in, and upon land of the United States described as follows:

Beginning at a point of land of the United States of America, which point is S 35°19'W, 185 feet from corner 1 of Bangor Hydro Electric Co. et al Tract (12P), Green Lake NFH.

Thence: follows a centerline as:

P1	S 89°	0'E	320';
P2	S 69°	0'E	105';
P3	S 42°	30'E	134';
P4	S 57°	40'E	120';
P5	S 72°	15'E	128';
P6	S 82°	25'E	436';
P7	S 67°	50'E	332';
P8	S 85°	30'E	60'

Said right-of-way being twenty feet (20') wide on either side of the centerline as shown on Exhibit entitled "Green Lake Water Power Company, Plot Plan, Proposed Rights-of-Way, Easement," Kleinschmidt and Dutting Consulting Engineers, Pittsfield, Maine, November 7, 1983, revised January 5, 1984, Scale 1" = 100' attached hereto and made a part thereof.

An easement to construct a powerhouse on land of Fish and Wildlife Service which has the following description:

Beginning at a point of land of the United States of America, which point is N 71° 30'E, 151 feet from the northeast corner of the Hatchery building. Thence following the various courses.

G 1	N 19°	45' W	106';
G 2	N 4°	0' E	45';
G 3	S 85°	30' E	105';
G 4	S 4°	30' W	149';
G 5	S 30°	0' W	49';
G 6	N 50°	15' W	58';
G 7	N 30°	0' E	20'

An easement to construct and maintain a sewerline, which has the following centerline:

Beginning at a point on line G1 as described above approximately 95' from the start. Thence following the various courses as:

S 1	N 86°	0' W	84';
S 2	S 83°	0' W	82';
S 3	S 24°	0' W	84';
S 4	S 17°	0' W	480';
S 5	S 32°	0' E	100';
S 6	S 5°	0' E	150'

Said right-of-way being five feet (5') wide on either side of the centerline as described above.

An easement to construct and maintain an electric power line, which has the following centerline:

Beginning at a point on line G5 as described above approximately 40' from the start. Thence following the various courses:

E 6	S 55°	0' E	176';
E 5	S 33°	30'E	80';
E 4	S 73°	10'E	184';
E 3	N 70°	0'E	90';
E 2	N 59°	0'E	85';
E 1	N 81°	0'E	70'.

Said right-of-way being five feet (5') wide on either side of the centerline.

By accepting this easement the grantee agrees to the following terms and conditions:

(1) To comply with State and Federal laws applicable to the project within which the easement or permit is granted and to the lands which are included in the right-of way, and lawful existing regulations thereunder.

(2) To clear and keep clear the lands within the easement or permit area to the extent and in the manner directed by the project manager in charge; and to dispose of all vegetative and other material cut, uprooted, or otherwise accumulated during the construction and maintenance of the project in such a manner as to decrease the fire hazard and also in accordance with such instructions as the project manager may specify.

(3) To prevent the disturbance or removal of any public land survey monument or project boundary monument unless and until the applicant has requested and received from the Regional Director approval of measures the applicant will take to perpetuate the location of aforesaid monument.

(4) To take such soil and resource conservation and protection measures, including weed control on the land covered by the easement or permit as the project manager in charge may request.

(5) To do everything reasonably within his power, both independently and on request of any duly authorized representative of the United States, to prevent and suppress fires on or near, lands to be occupied under the easement or permit area, including making available such construction and maintenance forces as may be reasonably obtainable for the suppression of such fires.

(6) To rebuild and repair such roads, fences, structures, and trails as may be destroyed or injured by construction work and upon request by the Regional Director to build and maintain necessary and suitable crossings for all roads and trails that intersect the works constructed, maintained, or operated under the right-of-way.

(7) To pay the United States the full value for all damages to the lands or other property of the United States caused by him or by his employees, contractors, or employees of the contractors, and to idemnify the United States against any liability for damages to life, person or property arising from the occupancy or use of the lands under the easement or permit, except where the easement or permit is granted hereunder to a State or other governmental agency which has no legal power to assume such a liability with respect to damages caused by it to lands or property, such agency in lieu therof agrees to rapair all such damages. Grants of easements or permits involving special hazards impose liability without fault for injury and damage to the land and property of the United States up to a specified maximum limit commensurate with the foreseeable risks or hazards presented.

(8) To notify promptly the project manager in charge of the amount of merchantable timber, if any, which will be cut, removed, or destroyed in the construction and maintenance of the project, and to pay the United States in advance of construction such sum of money as the project manager may determine to be the full stumpage value of the timber to be so cut, removed, or destroyed.

(9) That all or any part of the easement or permit granted may be terminated by the Regional Director, for failure to comply with any or all of the terms or conditions of the grant, or for abandonment. A rebuttable presumption of abandonment is raised by deliberate failure of the holder to use for any continuous 2-year period the easement or permit for the purpose for which it was granted or renewed. In the event of noncompliance of abandonment, the Regional Director will notify in writing the holder of the easement or permit of his intention to suspend or terminate such grant 60 days from the date of the notice, stating the reasons therefor, unless prior to that time the holder completes such corrective actions as are specified in the notice. The Regional Director may grant an extension of time within which to complete corrective actions when in his judgment, extenuating circumstances not within the holder's control such as adverse weather conditions, disturbance to wildlife during breeding periods or periods of peak concentration, or other compelling reasons warrant. In the case of all other right-of-way holders, failure to take corrective action within the 60-day period will result in a determination by the Regional Director to suspend or terminate the easement or permit. No administrative proceeding shall be required where the easement or permit terminates under its terms.

(10) To restore the land to its original condition to the satisfaction of the Regional Director so far as it is reasonably possible to do so upon revocation and/or termination of the easement or permit, unless this requirement is waived in writing by the Regional Director. Termination also includes permits or easements that terminate under the terms of the grant.

(11) To keep the project manager informed at all times of his address, and, in case of corporations, of the address of it's principal place of business and the names and addresses of it's principal officers.

(12) That in the construction, operation, and maintenance of the project, he shall not discriminate against any employee or applicant for employment because of race, creed, color, or national origin and shall require an identical provision to be included in all subcontracts.

(13) That the grant of the easement or permit shall be subject to the express condition that the exercise thereof will not unduly interfere with the management, administration; or disposal by the United States of the land affected thereby. The applicant agrees and consents to the occupancy and use by the United States, it's grantees, permittees, or lessees of any part of the easement of permit area not actually occupied for the purpose of the granted rights or the full and safe utilization thereof by the holder. The holder of an easement or permit also agrees that authorized representatives of the United States shall have the right of access to the easement or permit area for the purpose of making inspections and monitoring the construction operation and maintenance of facilities.

(14) That the easement or permit herein granted shall be subject to the Licensed Project Development Agreement, appearing as Appendix A hereto, and subect to the express covenent that any facility constructed thereon will be modified or adapted if such is found by the Regional Director to be necessary, without liability or expense to the United States, so that such facility will not conflict with the use and occupancy of the land for any authorized works which may hereafter be constructed thereon under the authority of the United States. Any such modification will be planned and scheduled so as not to interfere unduly with or to have minimal effect upon continuity of energy and delivery requirements.

(15) That the easement or permit herein granted shall be for the specific use described and may not be construed to include the further right to authorize any other use within the easement or permit area unless approved in writing by the Regional Director.

(16) Notwithstanding any other provision hereof, to comply with each and every condition and provision of a licensed Project Development Agreement appearing as Appendix A hereto.

Document Accession #: 20230621-5158 Filed Date: 06/21/2023

IN WITNESS WHEREOF, I have hereunto set my hand this 4th day of June, 1984.

THE UNITED STATES OF AMERICA

WITNESS

William E. Knapp

BY: [signature] (L.S.)
Regional Director
U.S. Fish and Wildlife Service
Newton Corner, Massachusetts

The above instrument, together with all conditions thereof, is hereby accepted by the Green Lake Water Power Company.

IN WITNESS WHEREOF, I, R. Stevens Kleinschmidt, have executed this instrument in behalf of the grantee herein on this 4th day of June, 1984.

GREEN LAKE WATER POWER COMPANY

BY: R. St Kleinschmidt (L.S.)

TITLE: President

ACKNOWLEDGEMENT

State of Massachusetts)
)ss
County of Middlesex)

Date June 1984

On this 4th day of June 1984, before me personally appeared William to me known to be the person described in and who executed the foregoing instrument and acknowledged that he executed the same as his free act and deed.

Barbara C Boyer
Notary Public

My commission expires: March 1984

ACKNOWLEDGEMENT

State of Massachusetts)
)ss
County of Middlesex)

Date June 1984

On this 4th day of June 1984, before me appeared R. Steven Kleinschmidt, to me personally known, who, being by me duly sworn, did say that he is the Kleinschmidt of the Green Lake Water Power Company and that the seal affixed to said instrument is the corporate seal of said corporation and that said instrument was signed and sealed in behalf of said corporation by authority of its board of directors, and said R. Steven Kleinschmidt acknowledged said instrument to be the free act and deed of said corporation.

Barbara C Boyer
Notary Public

My commission expires:
March 1988

Document Accession #: 20230621-5158 Filed Date: 06/21/2023

CORRECTION EASEMENT

For the granting of an easement to construct an electric transmission line on land of the United States of America.

THE SECRETARY OF THE INTERIOR, by his authorized representative, the Regional Director, U.S. Fish and Wildlife Service, One Gateway Center, Newton Corner, Massachusetts, in accordance with applicable authorities, and regulations published December 19, 1969, 50 CFR Part 29, 21, for and in consideration of

One Dollar ($1,00) and other valuable consideration as set forth in a Licensed Project Development Agreement appearing as Appendix A to an Easement dated June 4, 1984, hereby grants to Green Lake Water Power Company c/o Kleinschmidt and Dutting, 75 Main Street, Pittsfield, Maine 04976 - 0076 herein designated the grantee, an Easement for a right-of-way for a period of fifty (50) years for an electric transmission line across, in, and upon land of the United States described as follows:

Beginning on line G4 as shown on Exhibit entitled "Green Lake Water Power Project, Plat Plan, Proposed Rights-of-Way, Easement", Kleinschmidt and Dutting Consulting Engineers, Pittsfield, Maine, November 7, 1983, revised June 27, 1984, scale 1" = 100'. Thence following the two courses: N 67° 00' E, 660'; thence N 85° 30' E, 150' to an electric pole along State Route 180.

Said right-of-way being five feet (5') wide on either side of the center line.

This easement is given to correct the description in an easement given on the fourth day of June 1984. By giving this easement, that portion of the description in the said previous easement for an electric transmission line having courses running from E1 to E6 on the above mentioned easement is hereby revoked and is void. All terms and conditions of the said easement given on June 4, 1984 as listed therein are binding for this easement.

IN WITNESS WHEREOF, I have hereunto set my hand this 5th day of October, 1984.

THE UNITED STATES OF AMERICA

WITNESS

Adel R. Larson Jr.

BY: _____ (L.S.)
Regional Director
U.S. Fish and Wildlife Service
Newton Corner, Massachusetts

The above instrument, together with all conditions thereof, is hereby accepted by the Green Lake Water Power Company.

IN WITNESS WHEREOF, I, R. Stevens Kleinschmidt, have executed this instrument in behalf of the grantee herein on this 1'st day of November, 1984.

GREEN LAKE WATER POWER COMPANY

BY: R St Kleinschmidt (L.S.)

TITLE: President

ACKNOWLEDGEMENT

State of Massachusetts)
) ss
County of Middlesex)

On this 16 day of October, 1984, before me personally appeared Wilbur C. Ake, to me known to be the person described in and who executed the foregoing instrument and acknowledged that he executed the same as his free act and deed.

Barclay C. Hayes
Notary Public
BARCLAY E. HAYES

My commission expires: March 18 1988

ACKNOWLEDGEMENT

State of Maine)
) ss
County of Somerset)

Date: November 1, 1984

On this 1st day of November, 1984, before me appeared R. Stevens Kleinschmidt to me personally known, who, being by me duly sworn, did say that he is the President of the Green Lake Water Power Company and that the seal affixed to said instrument is the corporate seal of said corporation and that said instrument was signed and sealed in behalf of said corporation by authority of its board of directors, and said R. Stevens Kleinschmidt acknowledged said instrument to be the free act and deed of said corporation.

Claire A. Heffren
Notary Public

My commission expires:

CLAIRE A. HEFFREN
NOTARY PUBLIC, MAINE
MY COMMISSION EXPIRES MARCH 31, 1990

Document Accession #: 20230621-5158 Filed Date: 06/21/2023

REVISION EASEMENT

For the granting of an easement to construct an onsite sewage disposal system on land of the United States of America.

THE SECRETARY OF THE INTERIOR, by his authorized representative, the Regional Director, U. S. Fish and Wildlife Service, One Gateway Center, Newton Corner, Massachusetts, in accordance with applicable authorities, and regulations published December 19, 1969, 50 CFR Part 29.21, for and in consideration of

One Dollar ($1.00) and other valuable consideration as set forth in a Licensed Project Development Agreement appearing as Appendix A to an Easement dated June 4, 1984, hereby grants to Green Lake Water Power Company c/o Kleinschmidt and Dutting, 75 Main Street, Pittsfield, Maine 04976 - 0076 herein designated the grantee, an Easement for a right-of-way for a period of fifty (50) years for an onsite sewage disposal system across, in, and upon land of the United States described as follows:

Beginning at a point on line G2 as described in the above mentioned easement approximately 40' from the start. Thence following the various courses as:

S 1	N 67°	40'	W	147';
S 2	S 89°	30'	W	84';
S 3	S 62°	45'	W	35';
S 4	N 27°	15'	W	60';
S 5	N 62°	45'	E	35';
S 6	S 27°	15'	E	60'

This easement is given to revise the description in an easement given on the fourth day of June, 1984. By giving this easement, both parties hereto deem that the portion of the description in the said previous easement for a sewer line having courses running from S1 to S6 on the above mentioned easement is hereby revoked and is void. All terms and conditions of the said easement given on June 4, 1986 as listed therein are binding for this easement.

IN WITNESS WHEREOF, I have hereunto set my hand this 27th day of October, 1986.

THE UNITED STATES OF AMERICA

WITNESS

Opel R Lawson Jr

BY: [signature] (L.S.)
ACTING Regional Director
U. S. Fish and Wildlife Service
Newton Corner, Massachusetts

The above instrument, together with all conditions thereof, is hereby accepted by the Green Lake Water Power Company.

IN WITNESS WHEREOF, I, _____, have executed this instrument in behalf of the grantee herein on this _____ day of _____, 1986.

GREEN LAKE WATER POWER COMPANY

BY:_____(L.S.)

TITLE:_____

ACKNOWLEDGEMENT

State of Massachusetts)
) ss
County of Middlesex)

On this 27th day of October, 1986, before me personally appeared Walter C. Ashe to me known to be the person described in and who executed the foregoing instrument and acknowledged that he executed the same as his free act and deed.

Barbara Hayes
Notary Public

My commission expires: March 15 1988

ACKNOWLEDGEMENT

State of)
) ss
County of)

Date:_____

On this _____ day of _____, 1986, before me appeared _____ to me personally known, who, being by me duly sworn, did say that he is the _____ of the Green Lake Water Power Company and that the seal affixed to said instrument is the corporate seal of said corporation and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors, and said _____ acknowledged said instrument to be the free act and deed of said corporation.

_____
Notary Public

My commission expires:

1889

Ellsworth, Maine, the Picturesque City of the East, and Green Lake, the Tourists', Anglers', and Hunters' Paradise

George H. Haynes

Willia S. Frost.

Pamp 1531
Vickery

Ellsworth Maine:

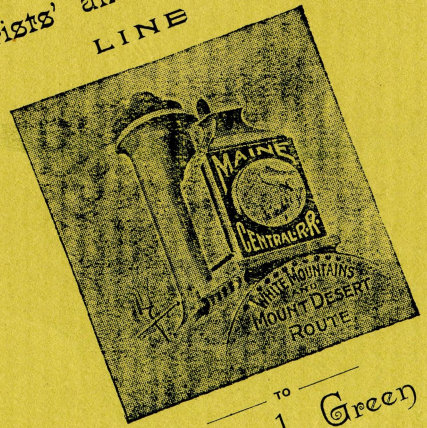
its Picturesque Surroundings and Superior Game Region at GREEN LAKE

generally known as Reeds Pond.

"O'er no sweeter lake
Shall morning break or noon cloud sail
No fairer face than thine shall take
The sunset's golden veil."

Tourists' and Sportsmen's

LINE



—— TO ——

Ellsworth · and · Green · Lake.

ELLSWORTH, MAINE,

THE PICTURESQUE CITY OF THE EAST,

AND

GREEN LAKE

THE

Tourists', Anglers', & Hunters'

PARADISE.

ILLUSTRATED BY
HARRIE B. COE, Portland, Me.

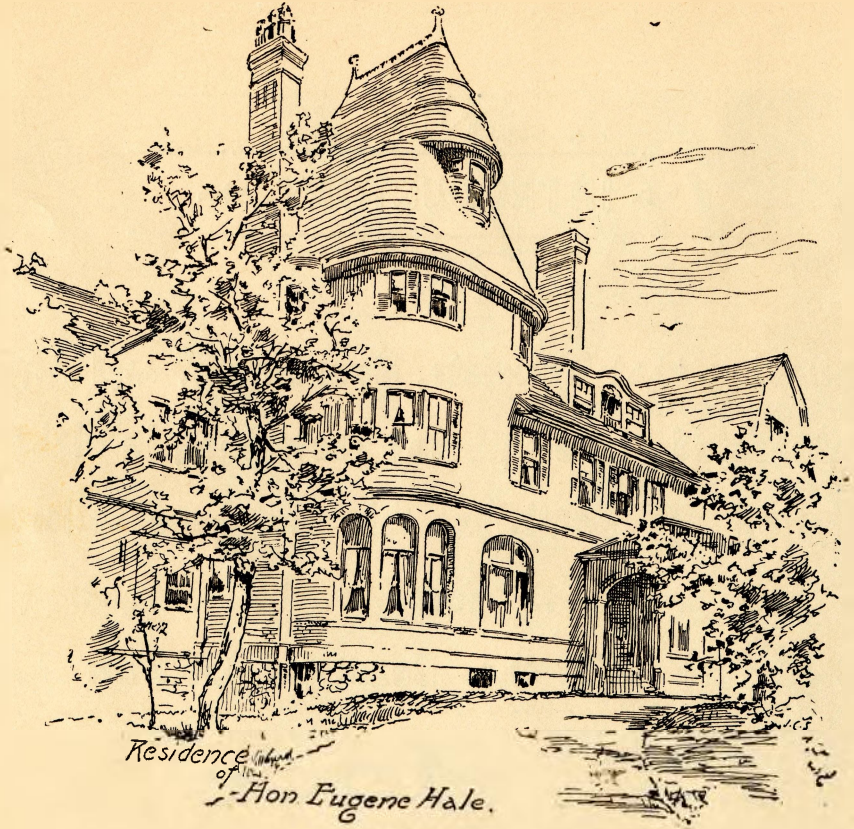
BY GEORGE H. HAYNES,
CAMDEN, ME.

1889.

YACHTING ON UNION RIVER BAY, ELLSWORTH.

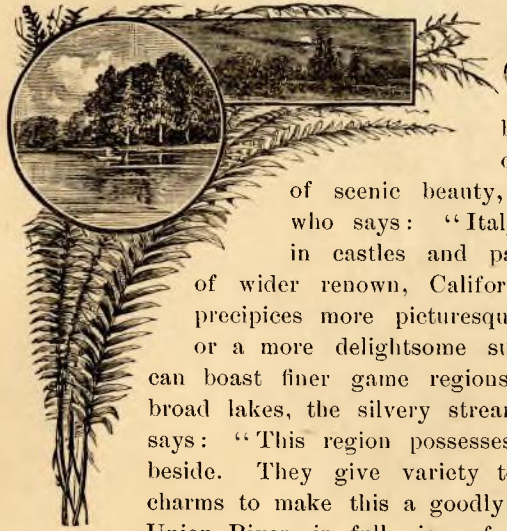
INTRODUCTORY.

Believing that Tourists, Sportsmen, and Anglers are interested more in brief facts than in elaborate description of localities, this brochure tells them in as few words as possible the attractions of ELLSWORTH and the Beautiful GREEN LAKE.

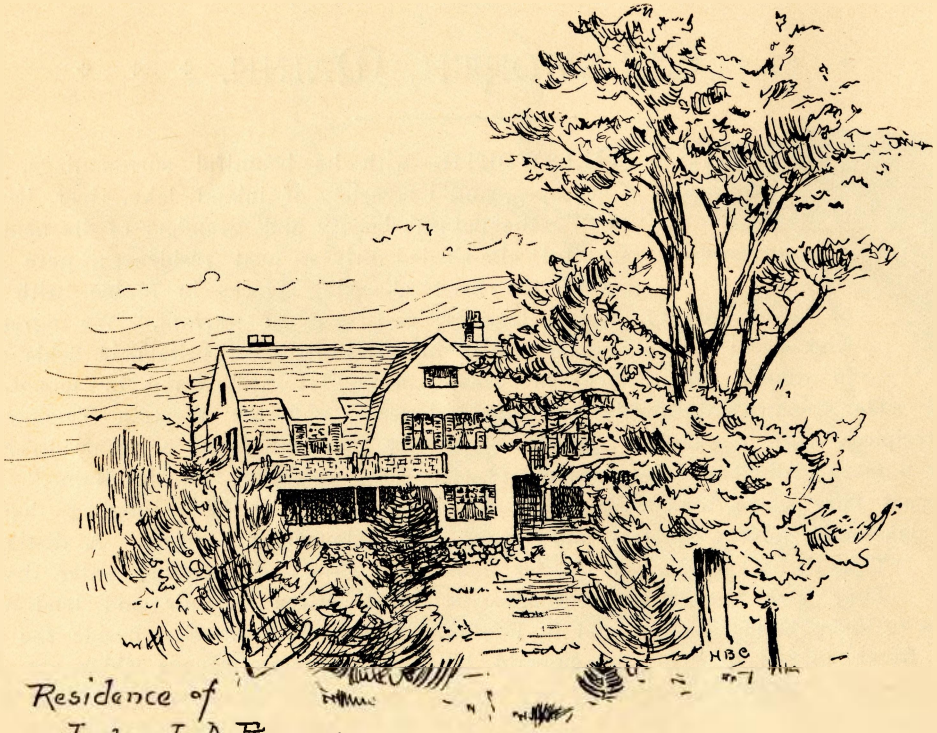


..... "THE PINES." .....

ELLSWORTH, MAINE.



ELLSWORTH, with its beautiful surroundings, picturesque landscapes, and its variety of inland, lake, river, bay, and sea views, the natural beauty and grandeur of its mountain scenery, its beautiful elm-shaded drives, neat residences, pure air and water, is one of the most charming places in Maine, with its rich heritage of scenic beauty, Indian legends, and tales of warfare. We agree with the writer who says: "Italy may rejoice in skies as blue, Britain in fields as fair, Germany in castles and palaces of greater antiquity, Switzerland in mountains and glaciers of wider renown, California in balmier breezes, and the Western Territories in crags and precipices more picturesque; but nowhere can there be found a richer diversity of landscape or a more delightsome succession of panoramic surprises than in Maine." And no country can boast finer game regions than the wooded heights, nor better angling than there is in the broad lakes, the silvery streams and creeks, and shimmering lakelets. A distinguished Professor says: "This region possesses a greater number of sheets of laughing water than all the country beside. They give variety to the landscape; they soften the air and lend all their thousand charms to make this a goodly land to live in." The city is nestled beside the beautiful winding Union River, in full view of the emerald hills and mountain ranges which are grand and lovely to behold; and although we cannot say with Byron, "Truly there is no scene on earth that equals this," yet a feeling akin to it arises as we view the lovely fertile valley and its amphitheatre-like situation, with the beautiful

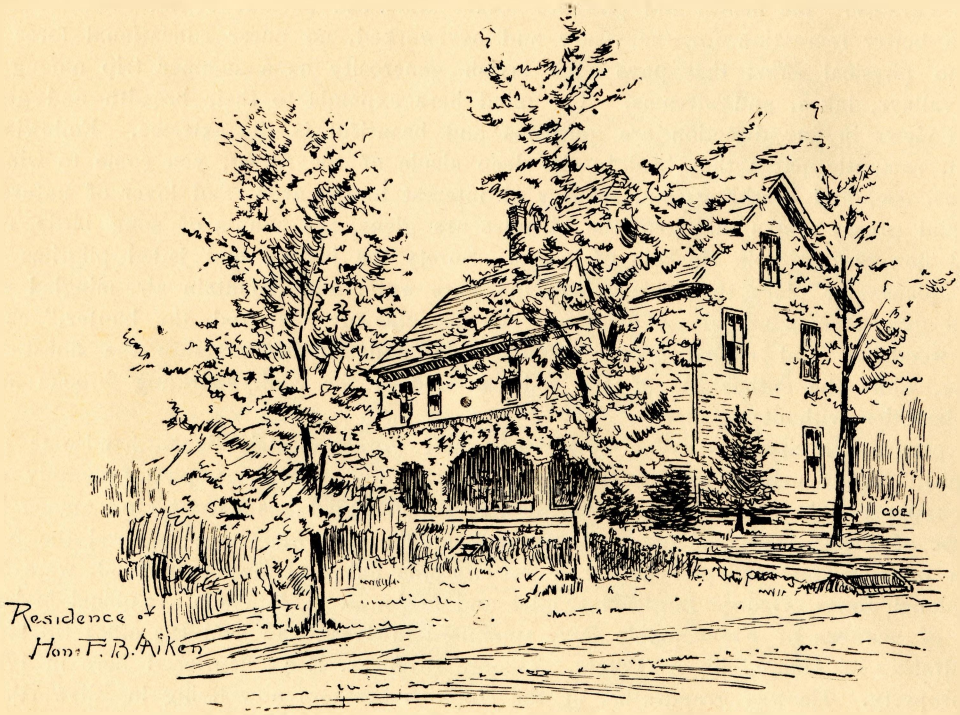


Residence of
Judge L. A. Emery

. . . . . "FIRLANDS." . . . . .

ranges of hills and mountains, interspersed with dashing and sparkling mountain streams and broad river. Here at this "Nature's Paradise" the health and pleasure seeker alike can partake of its comforts and beauties, and "We know of no better recreation for the weary and overworked, no purer educational force for the serious and thoughtful, no physical effort that pays such lavish generosity as a summer trip among these beautiful mountains, hills, valleys, lakes, and streams. The mind here expands to their breadth and grows up to their exaltation." The views in any direction are gorgeous and beautiful in the extreme. Following the delightful drives or the cool, romantic paths that lead to the deep shade of the forest, you come to winding trout-laden brooks and streams, cool and sparkling, and scenery of interest to the artist and lover of nature's wilds. Here beside the lakes and grassy nooks that gem the hillsides are glens, the haunts of song birds, redolent with the fragrance of wild flowers, veritable thickets of roses. Surely the invalid and jaded pilgrims from the stifled cities can find no pleasanter place than this, where the pure water and mountain air, mingled with the balsam, fir, and pine, will give them a new lease of life. The disciples of "Nimrod, the hunter," can find here deer without number, woodcock and ruffled grouse innumerable, and on the marshes the finest duck and snipe shooting in Maine, while the enthusiasts of the rod can find in the cool, sparkling brooks and lakes in the vicinity speckled beauties without number.

Ellsworth is a progressive city, has a fine system of water works, electric lights, handsome public buildings, fine business blocks, elegant private residences, and its church edifices will compare favorably with any city in the State. Its newspaper, *The Ellsworth American*, is ably edited, and takes a front rank among leading journals. The city can boast of being the home of many eminent public men who have honored the State and nation. Among the earlier ones, in fact the pioneers when the city was but a plantation in 1763, were Melatiah Jordan, Benjamin Joy, Colonel Jones, George Lord, Nathaniel and Major John Jellerson. Colonel Melatiah Jordan was the first collector of customs of Frenchman's Bay, appointed in 1789, and held the office till his death in 1818. He was the grandfather of Hon. John A. Peters. George Brimmer, Esq., flourished here in 1790 as agent for the Jarvis land property. He was grandfather of the Hopkins brothers now living in Ellsworth. The Hopkins

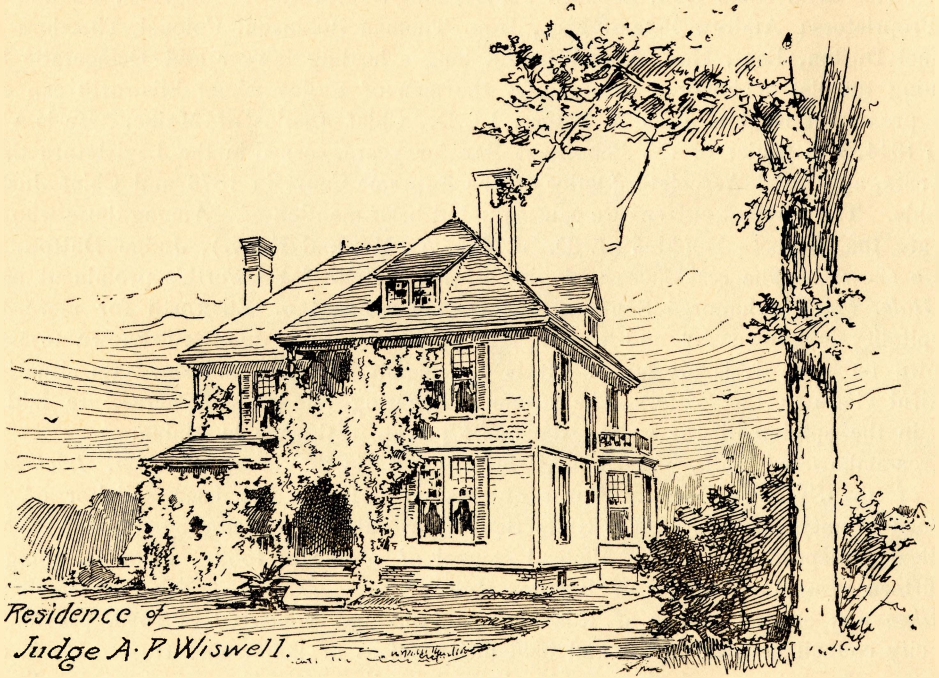


family, prominent in early days as well as now, were descendants from Bishop Hopkins, a High Church dignitary of Londonderry. After them came Hon. Leonard Jarvis, long a member of Congress; Colonel John Black, agent of the Bingham Proprietors; Andrew Peters, Esq., Hon. Thomas Robinson, Colonel Theodore Jones, George N. Black, Esq., Samuel Dutton, Esq., Hon. Arno Wiswell, long a leading lawyer and Democratic leader. But space forbids us continuing the list of honored names. Of the men of to-day whom Ellsworth can claim, we can give but a few. Most prominent is Hon. John A. Peters, LL.D., Chief Justice of Maine. He is a graduate of Yale, went to Bangor in 1844, was leader of the Penobscot Bar for years, served in the Legislature three years, member of Congress six years, appointed Associate Justice of the Supreme Court in 1873 and Chief Justice in 1883, which position he now holds. The resident citizens we can make but brief mention of. Among those who have an active and honorable record are the brothers Hopkins (J. D., J. H., A. M., and E. K.), Judge Dutton, and many others. In this *brochure* we show the fine residences and give a brief sketch of Ellsworth's prominent men of to-day.

Hon. Eugene Hale, Maine's honored Senator, has been a resident of Ellsworth for more than thirty years, and his open hospitality is known far and wide. His public record is too well known to need mention here. "*The Pines*," shown on page 4, is his home. It is an elegant baronial mansion. Its situation commands one of the most beautiful views in the State. The grounds, covering hundreds of acres, are laid out in an artistic manner, and it is, in the opinion of the writer, the finest private residence in Maine.

The modern tree-embowered villa, "*Firlands*," on page 6, is the home of *Hon. Lucilius A. Emery*, now Associate Justice of the Supreme Judicial Court of Maine. Mr. E. has been solicitor of Ellsworth, County Attorney of Hancock County, member of the State Senate several years, Attorney-General of Maine, was elected Professor of Medical Jurisprudence in the Medical School of Maine in 1889. Prior to going on the bench in 1883 he was for fifteen years law partner of Senator Hale.

Hon. F. B. Aiken was elected Mayor of Ellsworth in 1888 and re-elected in 1889, previous to which he was a member of the city council several years, and held many offices of honor and trust. He is one of Ellsworth's successful merchants. The cut on page 8 shows his home with its pretty lawns and surroundings.



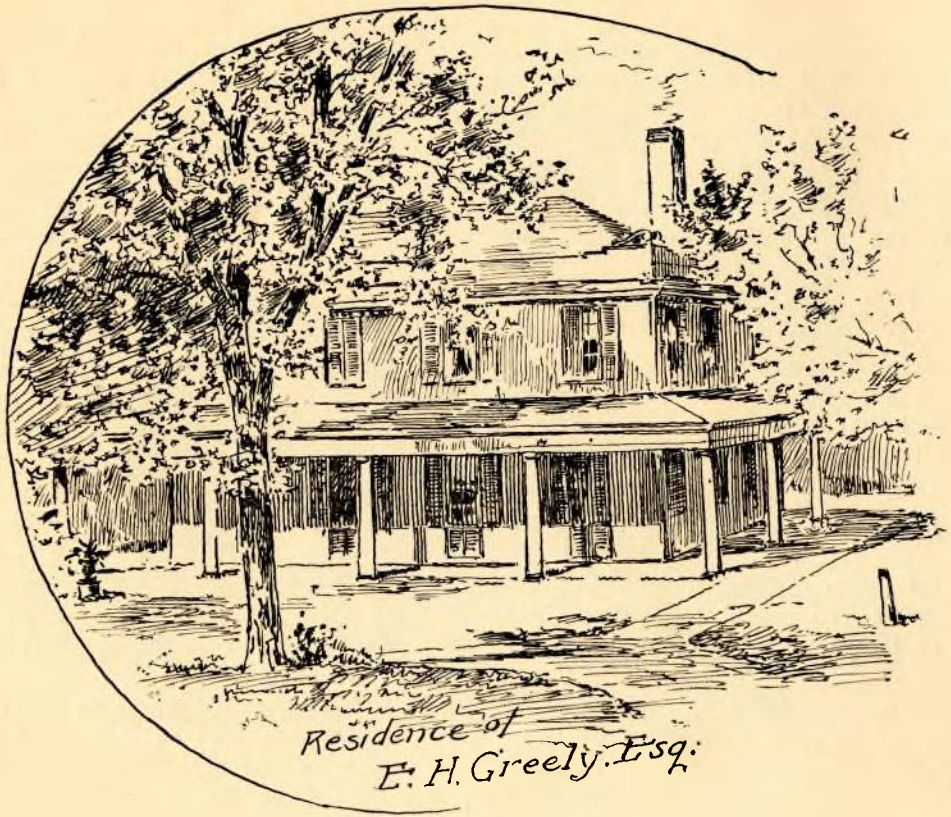
On page 12 is the home-like mansion of *E. H. Greeley, Esq.*, the well-known real estate dealer at Bar Harbor and around Frenchman's Bay, where he now holds eligible sites. Mr. G. is also an admirer of fine horses, and always has some good ones which he is pleased to show his friends.

Judge A. P. Wiswell is the son of Hon. Arno Wiswell, a former prominent lawyer of Ellsworth. Hon. A. P. Wiswell was Judge of the Municipal Court for several years, and has represented his city in the Legislature. He resigned the position of Judge to accept that of National Bank Examiner under President Garfield, which position he held till the change of administration. Mr. W. is one of the ablest lawyers in Hancock County. The cut on page 10 shows his beautiful home.

Col. C. C. Burrill is one of the prominent citizens. He was the founder of the Burrill National Bank of Ellsworth and the First National Bank of Bar Harbor, and has been president of both institutions ever since their organization. He also was the founder of the Hancock County Savings Bank, and has held the office of Treasurer since it was organized. He has been an active member of the city government, has served as member of the Legislature in the House one term, in the Senate two terms, and on Governor Robie's staff. He is largely engaged in real estate transactions. His attractive home is shown on page 14.

The elegant mansion on page 16 is the former home of *Colonel John Black*, which was built about 1824, and at that time was the finest private residence in Maine. Colonel Black came to Ellsworth about 1810 as manager of the Bingham Purchase, which office he held until 1850, when he resigned and his son, George N., was appointed to fill the place. Colonel Black was a gentleman of fine personal appearance and sterling integrity. In his leisure moments he indulged in painting, being quite an artist, and several fine paintings he executed adorn the walls of the mansion to-day. He was for many years a leading lumberman and ship-builder. He died in 1856.

George N. Black was prominent as manager of the Bingham Estate, and was one of the foremost business men of his day, amassing a large fortune. He lived in the old mansion until he died about 1880. After his death it was occupied by his son, George N. Black, Jr., Esq., until he moved to Boston, but he keeps the old



mansion the same as it was in the days of his grandfather and father, and with its commanding situation, the elegance of the grounds, grand old trees and hedges, it is the most picturesque spot in town.

The drives in the vicinity of Ellsworth are delightful. The *Bucksport Road* is much frequented by the pleasure-loving people who enjoy the ride through the cool, green aisles of the forest, past the West Ellsworth hills, which afford beautiful mountain and lake views. It is eighteen miles to Bucksport, through a fine game region, many deer being killed yearly in this vicinity. Parties wishing to take an extended drive can branch from the *Bucksport Road* at *West Ellsworth*, taking the Dedham Road, through a fine picturesque country around Branch Pond, returning to *Ellsworth* via old *Bangor Road*, a drive of about twenty-five miles, one of the prettiest in Maine. Another is the *Lamoine Road*. Leaving the city by the elm-shaded Mt. Desert Street, for two miles you ride through pretty rural scenery. Here branch to road leading to the prosperous town of *Lamoine*. (It is three miles from the city to the head of *Jordan's River*, an arm of the sea.) From here it is four miles to head of *Lamoine Bay*. This bay is from one to three miles wide and divides *Lamoine* from Mt. Desert, and affords as picturesque mountain, island, and sea views as the coast of Maine affords. From the head of the bay to East Lamoine it is three miles to *Lamoine Point*, a coming summer resort. There is a café there now that would do credit to any city. There is a steam ferry across from here to Mt. Desert Island, making a drive in all from Ellsworth to Bar Harbor of only fifteen miles. The first part of the drive gives a charming diversified landscape, the last a view of Frenchman's Bay, the most beautiful sheet of water on the Atlantic coast. On the western shore tower the lofty peaks of Mount Desert, to the north and east lie the wooded shores of Lamoine, Hancock, Sullivan, and Gouldsboro, while the entrance is guarded by a chain of rock-bound, foliage-covered islands—a natural breakwater opposed to the advance of the mighty ocean. Dotted along the shores of this bay are numerous budding summer resorts, all off-shoots from the parent stem—Bar Harbor. As she flourishes, so will they flourish; and their prosperity is a sure token of the growing popularity of this region and a prestage of its glory.

In sailing on Frenchman's Bay, numerous spots of picturesque beauty present themselves. The first point which awakens the interest of the spectator is the beautiful peninsula formerly known as Waukeag Point. Off this point

Residence of Col. C.C. Brumm II.

lies a chain of beautiful islands, not too high to obscure the view of the mainland, but forming a lovely harbor, or rather strait, running along the entire water front of the peninsula. As you approach the shore, occasional glimpses of a pretty sand beach with a wooded shore sloping upwards appear between these islands, until at last, through an opening between Dram and Preble Islands, is seen a lovely stretch of shore, dotted with picturesque cottages, with a magnificent wharf jutting out into the harbor, and every sign of a prosperous summer resort. Behind, the land rises in gentle slopes crowned with oak and fir, and in the distance is the lofty peak of Schoodic Mountain. This is Sorrento; for the Indian name has been changed to the Italian. The beautiful Bay of Naples has its rival in this bay of the Pine Tree State; and Sorrento, in Italy, is famed for the salubrity of its climate; hence the name.

Nature has done much for Sorrento, but without the helping hands of enterprise and capital it would still be the same wildly beautiful but desolate spot that it was a few years ago. Waukeag would have been Waukeag still—the home of a few scattered cottagers who made their living, from hand to mouth, by farming a little and fishing a little.

The Lamoine drive is one of the most magnificent in the vicinity. Parties can view all the improvements of the noted watering places, see the fine villas, and return to the quiet of charming Ellsworth in a few hours.

The *Surry Road*, which runs along the winding Union River, is a favorite drive of pleasure seekers. To Surry is six miles; to Newbury Neck, South Surry, ten miles; and to Bluehill fourteen. This road commences on Bridge Hill and runs past the *Black* estate with its extensive grounds and elegant old mansion. From here for miles there is a fine view of Union River, and residences on its eastern slope. Two miles from town we come in view of *Union River Bay*, with its picturesque islands, and in the distance Mt. Desert Mountains. One mile from here, or three from town, is Weymouth's Point, a celebrated place for fishing, clam bakes, picnics, yachting, and boating. The *Trenton Road* is a pretty shady drive which skirts the shore eight miles to the toll bridge, which connects the main land with *Mt. Desert Island*. *Hancock Point Road*, a pretty drive, taking eastern road it is six miles past several arms of the sea to a point where the road

The Col. John Black Mansion

turns direct to Hancock Point, and runs six miles to the point, a beautiful drive. The extent of country between all these roads is a veritable wilderness full of deer, woodcock, and grouse.

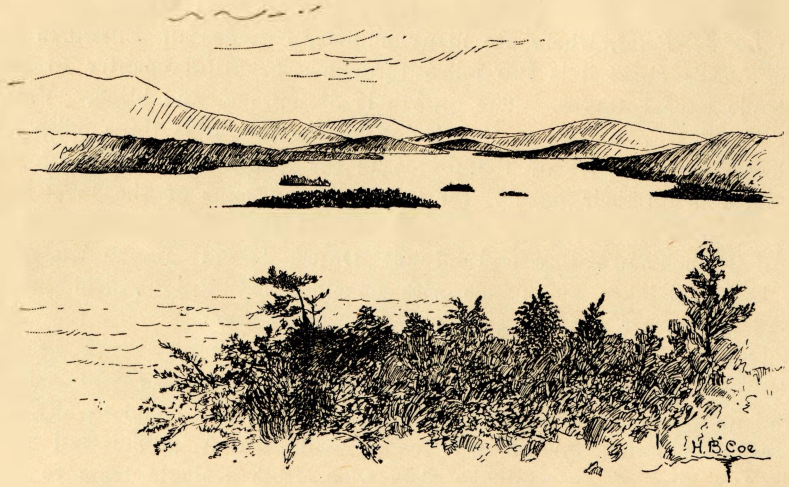
A drive much taken by sportsmen is to *Waltham*, twelve miles through the primeval forest, over a good turnpike, and in a fine game region. A branch of this road crosses Union River four miles above Ellsworth, and extends along the river to the prosperous towns of Mariaville and Otis.

The *Bay Side Road* is one that shows many points of interest. It is two miles to the mouth of Union River, and five miles to *Lord's Point*, where are many summer cottages of Ellsworth people. Here is a fine beach for bathing. From *Lord's Point* it is two miles through a beautiful country to *Shady Nook*. Here quite a colony of Ellsworth people have cottages. The growth is fir, spruce, and birch. From the cottages there are elegant inland and marine views. From here to Oak Point, on the bay, it is three miles. This is a lovely spot.

This closes a brief description of part of the drives in the immediate vicinity of the city. But one must see them to appreciate them in all their beauty, for they open up some of the most lovely scenery imaginable, and lead to cosy nooks for fishing and clam bakes, and rest for the weary mortal. From the river, bay, or coast line the view of Frenchman's Bay and Mount Desert Island is magnificent and unsurpassed, while the interior abounds in beautiful lakes and ponds with excellent facilities for fishing and boating. The woods also are full of game, and the hunter can find plenty of recreation there.

We have confined ourselves thus far to a brief description of the city as a summer home and place for the busy citizens to live and enjoy its beauties and comforts. We now will show its attractions for the enthusiasts of the rod and gun, which are superior to many localities and equal to any in Maine.

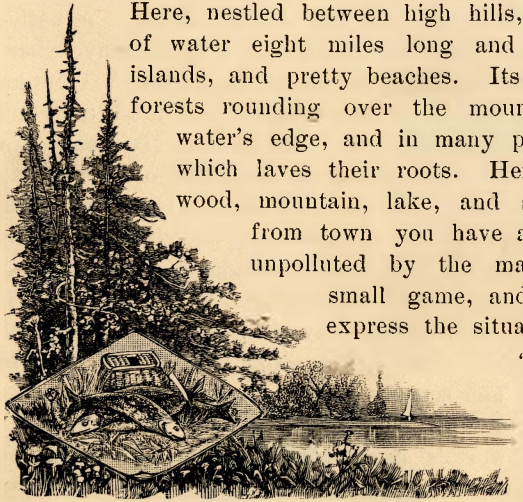
It has ample hotel accommodation for all who come, and elegant public and private turnouts. Parties can obtain at the hotels any kind of an equipage they wish, from a single team to a coach and four for the beautiful drives in the vicinity, which we give a partial description of in these pages; also outfits, teams, and guides for the celebrated hunting and fishing grounds. The Maine Central Railroad, with its fine road-bed, steel rails, elegant appointments and service, furnishes elegant coaches *four times a day* to and from Boston and New York, also Bar Harbor.



* * * GREEN LAKE * * *

(FORMERLY KNOWN AS REED'S POND.)

THE Lake George of eastern Maine is situated only six miles from the city. The drive to the lake is delightful. When we come in sight of the charming lake a panorama of rare beauty greets the vision. Here, nestled between high hills, set like a gem in its beautiful emerald colorings, is a lovely sheet of water eight miles long and three miles wide, noted for its translucent waters, its picturesque islands, and pretty beaches. Its clear waters are teeming with land-locked salmon and bass. The forests rounding over the mountains and hills in undulating billows of green, grow down to the water's edge, and in many places, gracefully bending, kiss the very bosom of the tranquil lake which laves their roots. Here, only one-half hour from the city of Ellsworth, is scenery of wood, mountain, lake, and stream unsurpassed in New England, and at this short distance from town you have a true poetical conception of the wilderness in all its wild beauty, unpolluted by the march of modern progress. The virgin forest is full of deer and small game, and as you view the lake for the first time the following lines will express the situation:



"O beautiful hills across the lake,
Asleep in moonlight or awake
To catch the color of the sky
That sifts through every cloud swept by,
How beautiful ye are in change
Of sultry haze and storm-light strange,
How dream-like rest ye on the bar
That parts the billow from the star!"

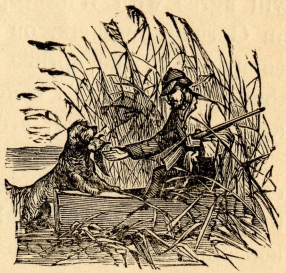
On a point called Scott's Neck, two miles across, via the petite steamer "Boss Hale," is Camp Comfort, situated in a spot of scenic

beauty; in fact, "Adam in Paradise never saw a more beautiful spot to weave a cabin." Here is fine accommodations for a party of twenty, and any one who has partaken of its hospitality agrees that it is rightly named. Dr. Haines has been interested here for several years. He first purchased the twenty acres of land on Scott's Neck, which is a beautiful spot. He rapidly extended his purchases until now, in connection with Senator Hale, he owns more than 7,000 acres bordering on, or adjacent to, the shores of this lake.

Scott's Neck, which is a beautiful peninsula of several acres, has something of a history. For many years it was the home of one W. S. Scott, a mysterious character of Revolutionary fame, who built him a log house there and lived by cultivating a piece of land and by hunting and fishing. This Scott, according to the historian, John L. Moor, Esq., came to America in 1775 as the private secretary of General Howe. A native of Scotland, liberally educated, and a surgeon by profession, he served as a surgeon in the British army, where in the Revolutionary war, together with a thousand British troops, he was taken prisoner at the battle of Trenton, but he was soon after paroled. When the war closed he decided to remain in this country, and after traveling for some time in various parts of New England, he finally came to Ellsworth, with one Samuel Dexter. For considerable length of time he served as doctor, lawyer, and pedagogue to the people of the town, often refusing all compensation and never taking more than the most meagre pay for his services. He was very reticent as to his former life, which was regarded by the citizens as a great mystery. Finally he settled at Scott's Neck, as we have said, and continued to reside there a hermit until the infirmities of age obliged him to abandon his hermitage.

Green Lake has what are called the upper and lower lake, connected by "the narrows." Altogether it is about eight miles long and will average from one to three miles in width. It has several islands, among which may be named Moose Island, Black Island, the Old Man, and the Old Woman. The water is bold and easy of navigation, in some places reaching a depth of two hundred feet. The scenery around the shores of the lake and all the environments as far as you can see are very fine and attractive.

Camp Comfort, which was built by Dr. W. M. Haines, one of Ellsworth's enterprising citizens, is a capacious log cabin fitted up with every convenience for "comfort," and any one who wishes for rest will find it here, and



will agree with Winthrop, who says: "I have slept on the various beds of the world—in a hammock, in a pew, on German feathers, on a bear-skin, on a mat, on a hide; all, all give but a feeble, restless, unrecreating slumber, compared to the spruce or hemlock bed in a forest of Maine. This is fragrant, springy, soft, well-fitting, better than any Sybarite's couch of uncrumpled rose leaves. . . . Rheumatism never, after nights on such a bed; agues, never; vigor, ardor, fervor, always."

Dr. R. C. M. Page, Professor of Diseases of the Chest, of the New York Polyclinic, says: "Among the causes of consumption are over-work, mental anxiety, insufficient nourishment, and in general anything calculated to produce lowered vitality. The climatic treatment is our one chief hope. If change of air will not cure the consumptives, doctors can do little. I have made a special study of this portion of the subject and consider it of utmost importance. Do not send the patient to Florida, where dampness and fog are pretty sure to do serious harm. Choose, rather, dry altitudes in a pine wood region." This you find at *Camp Comfort*, which, as before stated, is fitted up with all home comforts. *Crescent Beach*, right at the door, affords an excellent place for bathing in the lake's translucent waters. An elegant little steamer, yachts, boats, and guides are always at the disposal of guests.

In addition to the beauties of this charming resort for the pleasure seeker, invalid, and jaded pilgrim, we propose to show its superior attractions for the hunter and angler, for it has been a famous hunting ground for more than one hundred years, and right on the spot now occupied by Camp Comfort, tradition says, was in ye olden time the home of the red man, and here amid its seclusion and beauties he hunted the wild game, "and wooed and won his dusky mate." Then it was that the Manitou, or great spirit, told his Indian people:

"I have given you lands to hunt in,
I have given you streams to fish in,
I have given you brant and beaver,
Filled the marshes full of wild fowl,
Filled the rivers full of fishes,
Why then are you not contented?
Why then do you hunt each other?"

Just back of Camp Comfort is a mound, supposed to be "*The Happy Hunting-Ground*" of these sons of the forest. The Indian tradition says the lake was known in their parlance as Mar-las-sic—"good place for moose and deer." *Mollie Molasses*, an old Indian woman who died several years since, said she was born in a birch canoe while crossing the lake.

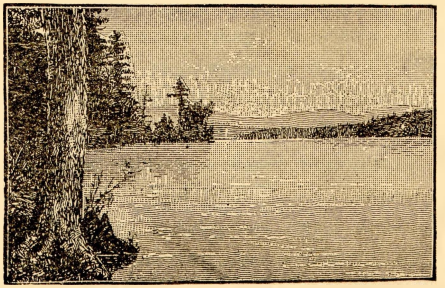
This pretty sheet of water abounds with a great variety of fish, land-locked salmon, trout, and bass, while the tributary brooks are full of speckled beauties. The principal brooks are *Great Brook*, which empties in on the northern shore of the lake, two miles from *Camp Comfort*, *Boggy Brook*, another large stream on the western shore of the lake, one mile from Camp Comfort.

Mann's Brook is at the head of the lake and several other streams within a radius of two miles of the camp. The weir and hatching works, the latter with a capacity for hatching five hundred thousand land-locked salmon, is now being built, and it is the intention of the proprietors to hatch and put into this lake all that are produced at this place. With its pure water and pebbly brooks, it must be the *Anglers' Paradise* in a very short time, and the hunters also, for to the north and east for hundreds of miles is the forest primeval full of deer, bears, large and small game.

The outlet of Green Lake is Reed's Brook. It is only two miles from Camp Comfort across the lake and from the lake to Union River it is one-half mile. At this point are the celebrated marshes so noted for black duck, wood-duck and snipe. These marshes are two miles wide, and they extend up the river more than twenty miles. There is excellent boating the entire distance, and as it runs through the wilderness it is one of the greatest game preserves in Eastern Maine, for it is the home of the deer, and other large game, which are so plenty that it is a common sight to see them grazing on the meadows, and sportsmen are always sure of securing all they wish. So plenty are the ducks here that flocks of hundreds are frequently seen. Why they come here in such large numbers is because it is a stopping place or feeding grounds of the migratory ducks, beside the vast numbers that breed in the vicinity. The writer who has been on the famed duck marshes in New Brunswick and Canada, and to the celebrated duck and goose shooting at

Miscoe Island, awards the palm to the Union River marshes. The duck grass, they love so well, grows here in profusion. In the fall the wild geese stop for weeks to feed, and could be killed in large numbers, and sportsmen should remember this unrivaled region is only a few minutes' sail across the lake from Camp Comfort, and twenty minutes' walk brings you to the marshes. In the fall the water is low and snipe pitch in here in large numbers, and as it is firm footing and good surface for working dogs it is rare sport. Any well trained dog can be used to advantage on the borders of the marshes, and the high ground adjoining where woodcock and partridge abound.

Another attractive place for the disciples of Nimrod and Isaak Walton is *Branch Pond*, four miles northwest from Ellsworth, on a good turnpike. This pond is eight miles long and two miles wide, and is stocked with bass and pickerel. Running into the pond are many fine trout streams where trout can be caught by the hundreds. Four miles from town, on the Bucksport Road, are the *Patten Ponds*, the lower two miles long by one mile wide, and a stream one-half mile long connects this with the upper pond, one mile long. Here and in tributary brooks is good trout fishing at any season. Guides and boats can always be obtained here.



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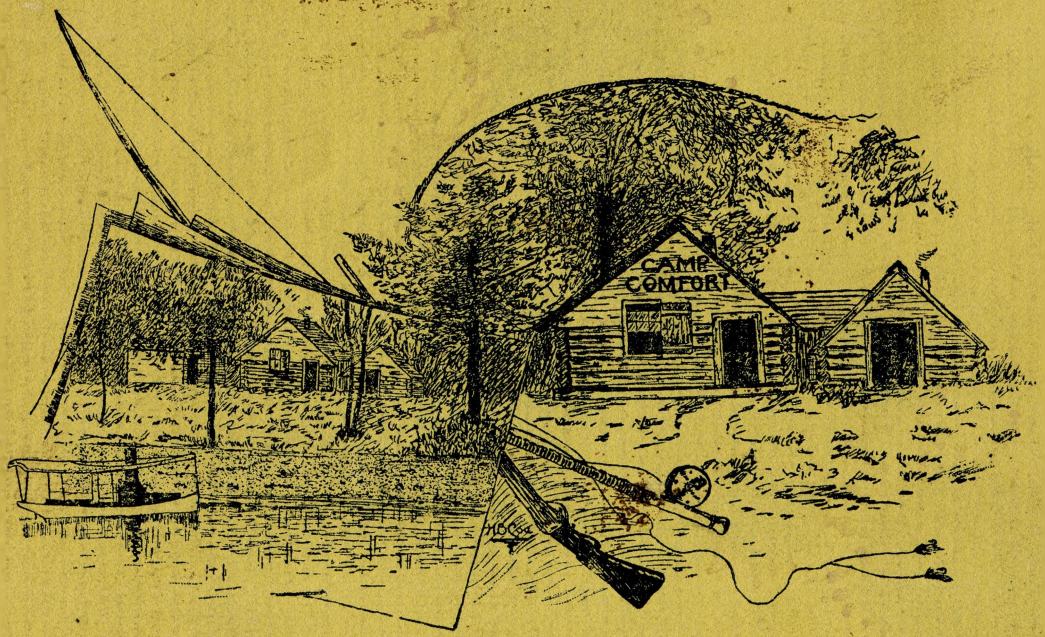
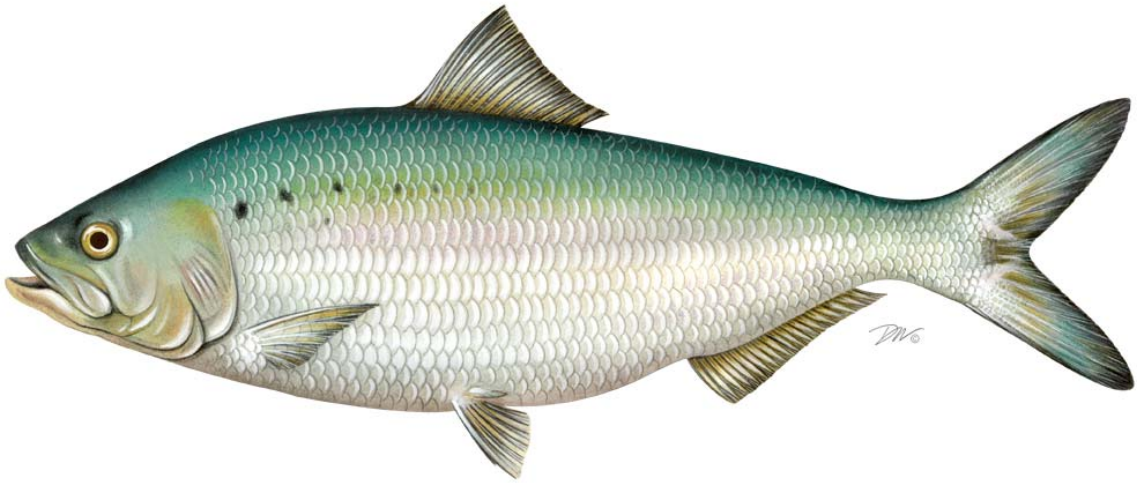


Maine Department of Marine Resources

American Shad Habitat Plan



Prepared by:

Maine Department of Marine Resources
Sea-Run Fisheries Division

With contributions by:

Matthew LeBlanc, Brookfield Renewable Energy
Justin Stevens, National Oceanic and Atmospheric Administration
John Lichter, Bowdoin College

Submitted to the Atlantic States Marine Fisheries Commission as a requirement of Amendment 3 to the Interstate Management Plan for Shad and River Herring

Approved February 6, 2014

Maine Department of Marine Resources

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September 16, 2013

Submitted to the Atlantic States Marine Fisheries Commission as a requirement of the Amendment 3 to the Interstate Management Plan for Shad and River Herring

Report Overview

This report will provide river-specific information for the major known American shad spawning and young-of-year rivers: the Saco, Androscoggin, Kennebec (and Sebasticook), and Penobscot rivers. Information about general threats, data availability, current work and recommended actions are summarized in the first section.

State-Wide Information

Amount of Habitat

State-wide, there are twenty-three identified American shad rivers with over 2545 river kilometers of potential habitat. Currently only 1611 river kilometers are known to be open to American shad passage, while over 810 river kilometers of historical habitat are currently inaccessible (Figure 1, Table 1). Of the habitat that is accessible, a large portion on many rivers is above dams with fishways that may provide only limited accessibility. It is assumed that the mapped habitat represents both adult and juvenile use. American shad are documented as regular catches in recreational fishing reports from the Sheepscot, Mousam, Presumpscot, Saco and Kennebec rivers and Scarborough Marsh, but there are few reports from other rivers. The population sizes are unknown.

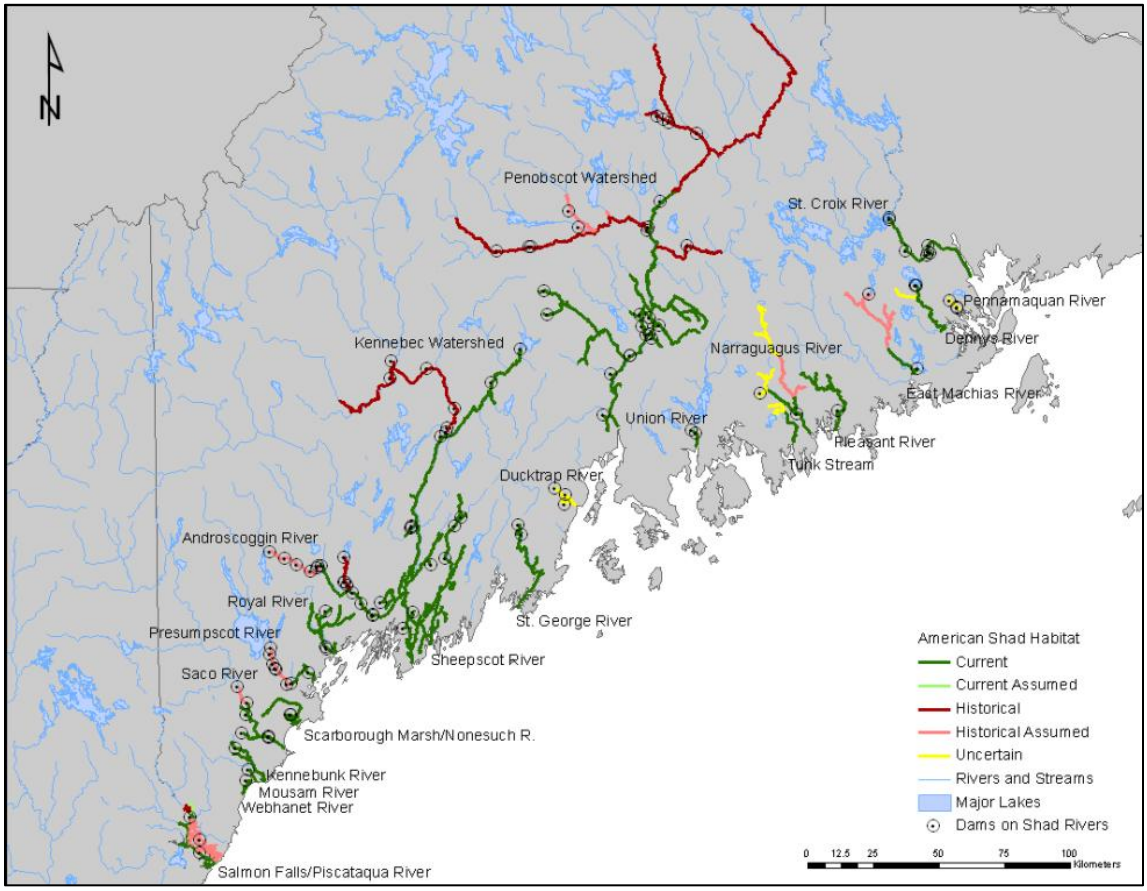

Figure 1. American shad habitat in Maine waters as identified by a USFWS mapping effort (USFWS 1983). Dams and impoundments on shad rivers are also shown.

Major Threats

Barriers to migration are the primary impediments to American shad habitat and successful spawning within Maine state waters. Out of 24 shad rivers in Maine, 18 have a mainstem dam that likely limits shad passage upstream. Of these, five have no capacity for fish passage (Table 2).

Even when fish passage is installed at these dams, the use of habitat upstream of dams is thought to be much lower than the use of areas below the dam. In 2011, video monitoring below Brunswick Fishway on the Androscoggin River documented over 16,000 American shad below the dam, while no shad were passed at the top of vertical slot fishway (J. Lichter, Bowdoin College, pers. comm). Fish passage efficiency for American shad has not been documented at the other sites in Maine, however other studies have described the potential for shad passage.

Table 1. Amount of American shad habitat (river kilometers) in Maine waters (USFWS 1983). Rivers are listed in order of descending habitat kilometers.

River/Watershed	Current (though may be limited)	Current Assumed	Historical	Historical Assumed	Uncertain	Total
Penobscot Watershed	399.6		354.0	32.7		786.3
Kennebec Watershed	300.4		107.2			407.6
Salmon Falls/Piscataqua River	59.8	8.1	8.9	108.1		184.9
Sheepscot River	178.8					178.8
Narraguagus River	38.9			35.6	60.4	134.9
Royal River	106.2					106.2
Androscoggin River	48.3		17.4	34.8		100.5
Saco River	49.1			50.6		99.7
East Machias River	18.8			67.0		85.7
Pleasant River	72.1					72.1
Scarborough Marsh/Nonesuch R.	70.4					70.4
St. George River	65.5					65.5
St. Croix River	61.8					61.8
Kennebunk River	47.0					47.0
Dennys River	34.8				10.7	45.5
Presumpscot River	22.0			22.2		44.2
Tunk Stream	20.2				16.8	37.1
Ducktrap River					22.8	22.8
Webhanet River	8.9					8.9
Union River	7.9					7.9
Pennamaquan River					7.6	7.6
Mousam River	6.3					6.3
Little River	5.5					5.5
Grand Total	**1622.3**	**8.1**	**487.5**	**351.0**	**118.2**	**2587.2**

The majority of the dams with fish passage on shad rivers in Maine have Denil fishways. Denil fishways seem to have high potential for passage (Slatick and Basham 1985, Haro *et al.* 1999), however, the ability of shad to locate the fishway opening in a large mainstem dam may be low, especially when there is a large spillway. Thus, the potential for shad passage above a mainstem dam with a Denil fishway is generally moderate.

Other mainstem dams in Maine have fishlifts. The potential for these locations to pass American shad is thought to be low to moderate. As discussed above, the ability of shad to locate the fishlift entrance is likely hindered by attraction flows from large spillways. Further, in all Maine dams with fishlifts there is evidence that shad remain in holding areas above the fishlift but do not exit the headpond, as evidenced by a large proportion of "passed" shad found only when the facilities are periodically de-watered, and only few shad passed during normal operations (Maine DMR ASMFC Compliance 2011 Report).

Table 2. The first mainstem dams on American shad rivers in Maine with fish passage and dam ownership information listed.

River/Watershed	Distance to first mainstem dam (km)	First Mainstem Dam Name	Fish Passage Type	Shad Passage Potential	Dam Ownership	FERC License	FERC License Renewal
Salmon Falls/ Piscataqua River	26.8	South Berwick Dam	Denil	Moderate	Consolidated Hydro New Hampshire, Inc	Yes	11/30/2037
Salmon Falls/ Piscataqua River	26.6	Great Works Pond Dam	None	None	Great Works Hyrdo Co.	No	
Webhanet River	None						
Little River	3.3	Skinners Mill Dam	None	None	Not listed	No	
Mousam River	6.8	Kessler Dam	None	None	Kennebunk Light and Power District	Yes (3 dams)	3/31/22
Kennebunk River	27.9	Days Mill	None	None	Private	No	
Saco River	9.3	Cataract Project	Fish Lift, Denil, 2 fish locks	Low to Moderate	Brookfield Renewable Energy	Yes (4 dams)	11/30/29
Scarborough Marsh/ Nonesuch R.	None						
Presumpscot River	12.6	Cumberland Mills	Denil Fishway	Moderate	S. D. Warren	No	
Royal River	4.9	Bridge Street Dam	Denil Fishway	Low	Town of Falmouth	No	
Androscoggin River	48.2	Brunswick Project	Vertical slot	Low (Documented)	Brookfield Renewable Energy	Yes	2/28/29
Kennebec River	140.8	Lockwood Project	Fish Lift	Low	Brookfield Renewable Energy	Yes	10/31/36
Sebasticook River	173.6	Benton Falls	Fish Lift	Moderate	Essex Hydro Associates	Yes	2/28/34
Sheepscot River	44.0	Head Tide Dam	Slots	Moderate	Town of Alna	No	
St. George River	48.3	Sennebec Pond Dam	Rock Ramp	High	Sennebec Lake Assoc.	No	
Ducktrap River	17.9	Dickey Mill Dam	None	None	Not listed	No	
Penobscot Watershed	68.5	Milford Dam	Fish Lift	Low to Moderate	Bangor Hydro Electric Co.	Yes	4/1/38
Union River	7.3	Ellsworth Dam	Denil,Trap and Truck	Not Passed Upstream	Black Bear Hydro	Yes	12/31/18 (consulting)
Tunk Stream	None						
Narraguagus River	10.6	Cherryfield Dam	Denil Fishway	Moderate	Town of Cherryfield	No	
Pleasant River	None						
East Machias River	None						
Dennys River	None						
Pennamaquan River	2.9	Pembroke Cottage Dam	Denil Fishway	Moderate	Private	No	
St. Croix River	30.8	Milltown Power Station Dam	Denil Fishway	Moderate	New Brunswick Electric Co.	No	

Water quality. While poor water quality due to point source pollution from tanneries, paper mill companies, and other manufacturing may have negatively impacted adult spawners, developing embryos, and young-of-year in the early to mid-twentieth century, improvements were made as a result of the Clean Water Act after 1970. As a result, it is not thought that poor water quality remains a threat in most known spawning/rearing locations. Basic water quality parameters (temperature, dissolved oxygen, turbidity, pH) are well above the tolerances for American shad, *when they are taken*. It should be noted that only temperature is taken on a daily basis at most fishways in Maine whether DMR or power-company operated,. Moreover, there are no current studies in Maine to determine whether existing levels of toxic contaminants (heavy metals, PCBs) may be negatively affecting shad populations.

The Maine Department of Environmental Protection (DEP) administers regular water quality testing of Maine's waters. The State has four classes for freshwater rivers, three classes for marine and estuarine waters, and one class for lakes and ponds. A close comparison of the standards will show that there are few differences between the uses or the qualities of the various classes. All classifications attain the minimum fishable-swimmable standards established in the federal Clean Water Act, and most support the same set of designated uses with some modest variations in their description. More information about the classification schema can be found at: http://www.maine.gov/dep/water/monitoring/classification/

The Maine DEP determines the water quality classification of freshwater areas through the Biological Monitoring Program. This program assesses the health of rivers, streams, and wetlands by evaluating the composition of resident aquatic benthic macroinvertebrate and algal communities. The DEP develops standards for each river, stream and wetland using these methods, testing important sites on a rotating basis. Smaller waterways may be tested infrequently. More information can be found at: http://www.maine.gov/dep/water/monitoring/biomonitoring/index.html

Marine water quality is assessed by multiple organizations and the information compiled by the Maine DEP for Clean Water Act reports that are due every other year to the EPA. The DEP utilizes data for assessments in marine waters from its own environmental and toxics monitoring programs including the Surface Water Ambient Toxics and the Gulf of Maine Council on the Marine Environment's Gulfwatch project, and to a large extent from a variety of governmental agencies, academic institutions, non-profit organizations and municipalities, such as the Maine Healthy Beaches program, Maine Department of Marine Resources, New Hampshire Department of Environmental Services, University of Maine, BioDiversity Research Institute, Casco Bay Estuary Partnership, Kennebec Estuary Land Trust, Marine Environmental Research Institute, Mount Desert Island Biological Laboratory, Town of Rockport Conservation Commission, and the Wells National Estuarine Research Reserve. Additionally, a number of volunteer monitoring groups monitor Maine's estuarine and coastal waters. The DEP currently accepts data from organizations with approved Quality Assurance Project Plans (QAPPs) whose monitoring programs and analytical labs enable collection and processing of quality data, and from selected organization with DEP-approved sampling plans. Biannual reports can be found at: http://www.maine.gov/dep/water/monitoring/305b/index.htm

Channelization and dredging occur in Maine waters, though are not thought to be a significant threat to American shad habitat. Channelization and dredging typically occur beyond the mouths of rivers in association with beach restoration (southern Maine) or shipping lanes (Kennebec River, Bath Iron Works). Before any channelization or dredging project commences, it must first be reviewed by all relevant agencies (including Maine DMR, Maine DEP, USFWS, and NOAA) which provide comments concerning species interaction.

Invasive species. Concerning the threat from competition and predation, a growing number of invasive white catfish, carp (*Cyprinus carpio*), and Northern pike have been documented in Maine. These species are found in American shad spawning areas, but the impact on shad populations has not been documented.

Statewide Available Data

In 1982, the US Fish and Wildlife Service (USFWS) compiled habitat information for many diadromous species to create a snapshot of the current and historic distribution in Maine that is available from the USFWS Northeast Regional Office's data website (USFWS 2013). The purpose of this project was to identify, based on the best available information, the current and historic geographic distribution of 12 diadromous (sea-run) fish species in Maine (alewife, American eel, American shad, Atlantic salmon, Atlantic sturgeon, Atlantic tomcod, blueback herring, rainbow smelt, sea lamprey, sea run brook trout, shortnose sturgeon, striped bass).

To begin this process, available digital data depicting current and historic extent of each species was presented on a series of paper maps. These maps were distributed throughout the state and reviewed by fisheries biologists, including representatives from government agencies, non-government organizations and private individuals. Reviewers edited the maps on the basis of their personal knowledge, institutional knowledge and review of existing data and documents, both published and unpublished. These maps were then collated and coded in a networked hydrography dataset (the most detailed available National Hydrography Dataset[NHD]) resulting in one GIS layer (a line Feature Class) for each fish species. Each Feature Class shows the user the current and historic extent of the species and the sources used to delineate that extent. The Feature Class can be used alone but is most useful when joined back to the NHD as an event table, thus making additional data available (e.g. feature names, flow, etc.). The 'AmericanShad' feature class specifically identifies the current and historic distribution of American shad in Maine (USFWS 1982).

Agencies with Regulatory Authority

Maine DMR, USFWS, NOAA, Maine DEP, FERC

Other Organizations

Dam ownership for first mainstem dams is listed in Table 2.

Current Action and Progress

During all Federal Energy Regulatory Commission (FERC) relicensing processes, the Maine DMR in collaboration with federal agencies advocates for fish passage that will allow the best accommodation for all diadromous fish passage, including American shad passage. In addition to FERC processes, the Maine DMR also provides comments on most fish passage projects in

the state – where there is a project on identified shad river, we provide comments and work with public and private landowners to install fish passage, or upgrade existing passage, to allow for all maximum passage potential for all diadromous species, including American shad.

Regarding monitoring projects, other than three on-going activities (fishway monitoring on the major rivers, juvenile beach seine and in-river trawl surveys, recreational fishing surveys), there are few efforts focused on American shad in Maine waters. There are a few river-specific projects that are discussed in the sections below, including video monitoring at Brunswick fishway. There are, however, no efforts to ground-truth the assumed current spawning habitat, and currently no fishway efficiency studies that focus on shad passage.

Larval stocking. American shad fry were raised at the Waldoboro hatchery from 1992 to 2008 using eggs collected from adults from the Kennebec, Connecticut, Androscoggin, Merrimack, Saco, and Sebasticook Rivers. The program ended in 2008 due to a lack of funding. Larval American shad that were reared in the hatchery were 'marked' by immersion in an oxytetracycline (OTC) bath before being released. Receiving locations included multiple sites on the Androscoggin, Kennebec, and Sebasticook Rivers (both below and above dams), as well as at the presumed spawning locations on the Medomak River and on the Saco River in tidal water. The hatchery closed in 2009 with no plans to reopen the hatchery due to funding and current management of American shad along the East Coast.

Adult American shad otoliths are collected from mortalities at fish passage facilities, from juveniles collected during the beach seine surveys, and from some anglers who voluntarily submitted samples. The Maine DMR inshore trawl survey also began collecting otoliths from a sub-sample of American shad in fall 2012. We are currently fine-tuning our instrumentation and methods to correctly identify OTC marked otoliths. While we have not directly measured the success of the stocking program, juvenile abundance in the Kennebec/Androscoggin complex does seem to have increased concurrent to larval stocking (Figure 2).

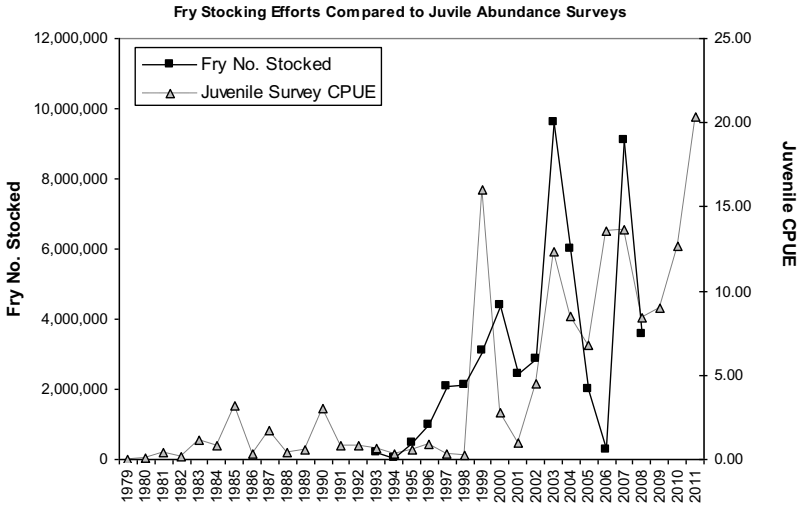

Figure 2. Juvenile abundance compared to fry stocking efforts.

Juvenile Abundance Surveys. In 1979, MDMR established the Juvenile Alosine Survey for the Kennebec/Androscoggin estuary to monitor the abundance of juvenile alosines at 14 permanent sampling sites. Four sites are on the upper Kennebec River, three on the Androscoggin River, four on Merrymeeting Bay, one each on the Cathance, Abagadasset, and Eastern rivers. These sites are in the tidal freshwater portion of the estuary. Since 1994, Maine DMR added six additional sites in the lower salinity-stratified portion of the Kennebec River.

Over the entire sampling period (1979-2012), the overall highest average catch per unit effort (CPUE) for juvenile American shad was found in the Abagadasset River (11.46 shad per haul), followed by the upper Kennebec River (9.02). Merrymeeting Bay (4.99), the Cathance (3.83), Eastern (2.87), and the lower Kennebec rivers (2.09) all have lower but consistent CPUE values. The Androscoggin River consistently has low catches of shad or years where no shad are caught (0.51 shad per haul; Table 3). The strength of these data in identifying successful spawning areas is limited because sampling in performed after the spawning event, and juvenile shad may have become dispersed from their natal location by passive larval drift. These data may provide some insight into juvenile shad habitat.

Recommended Action(s)

- Remove mainstem hydropower dams or install effective fish passage
- Ground-truth assumed current spawning habitat state-wide
- Conduct population estimates for Saco, Androscoggin, Kennebec/Sebasticook, and Penobscot rivers
- Map young-of-year habitat based on existing beach seine and in-river trawl surveys in the Kennebec River/Merrymeeting Bay estuary complex and Penobscot River
- Conduct fishway efficiency studies that focus on shad passage at existing fishways
- Determine locations beyond those regularly monitored where American shad passage may be limited by human-made obstructions
- Monitor water chemistry (DO, turbidity, pH, temperature, conductivity) at known spawning grounds during May-July

Table 3. American shad catch per unit effort in eight survey locations in the Kennebec River/Merrymeeting Bay estuary complex. Survey design was altered in 1994 when 6 stations were added to the survey sites.

Juvenile American Shad Catch per Unit Effort by River Segment								
Year	Upper Kennebec River	Merrymeeting Bay	Androscoggin River	Cathance River	Abagadasset River	Eastern River	Mid Kennebec River	Lower Kennebec River
1979	0.16	0.00	0.00	0.00		0.00		0.00
1980	0.00	0.36	0.29	0.00		0.00		0.00
1981	1.08	0.85	0.29	0.50		0.00	0.17	0.00
1982	0.00	0.33	0.17	0.00		0.00	0.63	0.00
1983	0.15	0.20	2.18	3.00		0.00		
1984	0.90	0.46	0.00	2.00		0.67		
1985	0.69	1.53	0.40	6.50		7.00		
1986	0.10	0.15	0.08	1.00		0.50		
1987	0.15	8.05	0.17	1.25	0.50	0.00		
1988	0.11	1.36	0.00	0.00	0.33	0.51		
1989	1.25	0.29	1.29	0.48	0.00	0.00		
1990	3.50	2.46	0.83	6.83	0.33	4.20		
1991	1.21	0.00	0.00	0.67	1.67	1.17		
1992	0.10	0.67	0.67	3.67	0.00	0.00		
1993	0.00	0.29	3.63	0.00	0.00	0.00		
1994	0.00	0.35	1.00	0.00	0.17	0.50		
1995	0.21	0.39	1.89	0.17	0.60	0.33		
1996	4.15	0.25	0.00	0.20	0.33	0.50		
1997	0.00	0.88	0.80	0.00	0.40	0.00		
1998	0.00	1.67	0.00	0.00	0.00	0.00		
1999	0.00	20.46	0.00	42.67	33.00	0.00		
2000	15.14	0.33	0.14	0.33	0.33	1.33		1.58
2001	0.57	3.14	2.57	0.43	0.00	0.20		0.05
2002	1.96	2.18	0.18	1.86	22.86	2.43		0.19
2003	74.13	3.63	0.00	2.17	0.67	5.33		0.42
2004	48.21	6.67	0.00	0.67	3.00	0.50		0.39
2005	24.96	3.42	0.06	2.83	10.00	2.40		3.72
2006	38.79	25.30	0.00	0.67	16.50	8.33		5.44
2007	33.38	24.13	0.00	0.67	19.00	16.83		1.40
2008	3.95	12.88	0.00	3.00	34.17	3.67		1.38
2009	4.29	16.38	0.20	4.17	31.67	5.17		1.27
2010	45.63	8.25	0.39	11.00	15.33	7.17		1.03
2011	0.63	11.25	0.00	25.33	94.17	9.17		1.73
2012	1.30	11.17	0.06	8.00	13.00	19.67		16.86
Average	9.02	4.99	0.51	3.83	11.46	2.87	0.40	2.09

Saco River

Amount of Habitat

There are currently 49.1 river kilometers of accessible shad habitat in the Saco River (though accessibility to habitat above dams with fish passage is limited), with another 50.6 river kilometers of assumed historical habitat (Table 1). Spawning and juvenile habitat have not been identified. Although no studies have documented shad spawning areas in the Saco River, it is thought that the majority of spawning occurs below the Cataract Project mainstem dams. Habitat above this area is mapped as accessible habitat because shad passage is possible at the Skelton Dam fishlift and interim trap and truck operations to move shad past the project's fish locks (see discussion below). The river portion listed as inaccessible (historical assumed) is above the Bar Mills, which currently has no fish passage facility (Figure 3).

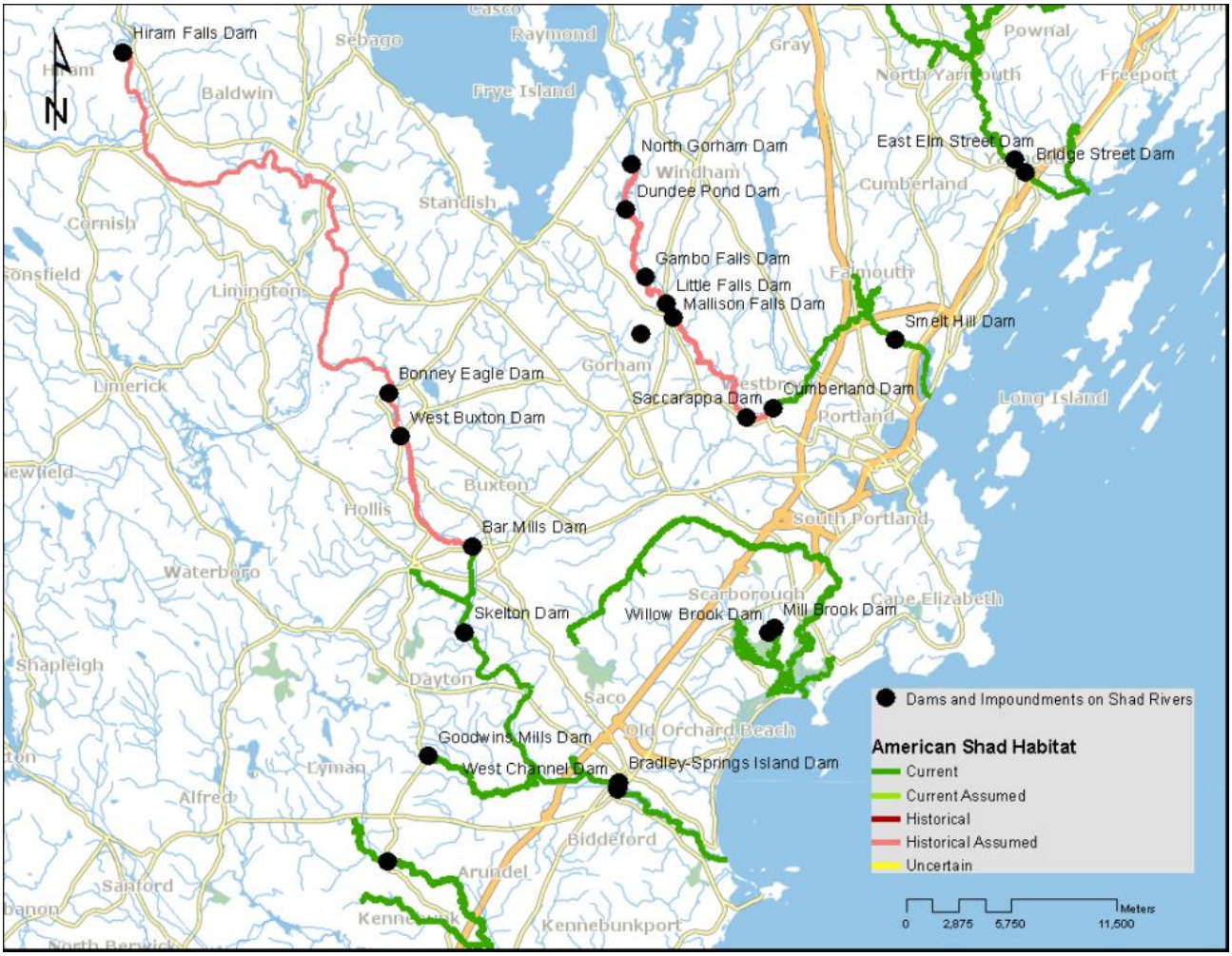

Figure 3. Saco River American shad habitat. Historical habitat is above dams with no fish passage. The Scarborough Marsh and Nonesuch River shad habitat is also shown in full in the middle-right of the figure.

Available Data

- Adult American shad counts, Brookfield Renewable Energy
- Video monitoring of shad behavior downstream on the Cataract Project, Brookfield Renewable Energy
- Maine DEP water quality reports
- USFWS. 1983. American Shad Habitat in the Gulf of Maine. http://www.fws.gov/r5gomp/gom/habitatstudy/metadata/shadhab83.htm
- USFWS. 2013. GIS Data at the Gulf of Maine Coastal Program. http://www.fws.gov/r5gomp/gisindex.htm

Threat(s)

- Barriers to migration

The majority of shad passage on the Saco River occurs at the East Channel fishlift of the Cataract Project. The project is licensed by the Federal Energy Regulatory Commission (FERC No. 2528) and is owned by Brookfield Renewable Energy (formerly NextEra, formerly Florida Power and Light). The project includes the Cataract (East Channel) Dam and East Channel fishlift and an integral intake powerhouse containing a single turbine generator on the northeastern side of Factory Island in the City of Saco; and the West Channel dam and Denil fishway in the cities of Saco and Biddeford (Figure 3).

The impoundment formed by these dams extends upriver in the cities of Biddeford and Saco about 0.3 mile to another set of dams at Spring Island referred to as Bradbury and Spring Island dams. The impoundment formed by these dams extends upriver approximately 9.3 miles through the cities of Biddeford and Saco and the towns of Dayton and Buxton to Brookfield Renewable Energy's Skelton Project (Figure 3). A 90-foot high fish lift was constructed at the Skelton Project and first became operational in the fall of 2001.

Agencies with Regulatory Authority

Maine DMR, USFWS, NOAA, Maine DEP, Brookfield Renewable Energy (formerly NextEra, formerly Florida Power and Light)

Other Organizations

Saco River Salmon Club

Current Action and Progress

Monitoring and Passage. In 2012, the Cataract fishways were operated by personnel from Nextera Energy Resources Hydro Operations division. These fishways were built to pass anadromous target species (Atlantic salmon, American shad, and river herring) as part of resource agency plans to restore these species to the Saco River, and have operated for 19 years. Although fishway construction was completed in the spring of 1993, the fishways were not completely operational until June 2, 1993 (East Channel) and June 25, 1993 (West Channel).

An underwater camera connected to a television monitor and VCR was first used in 1995 to gather information on fish behavior within the lower flume of the East Channel fishlift. The camera documented that shad exhibit a fallback behavior in and around the East Channel lower

flume V gate crowder. On occasion, shad would swim upstream through the V gate crowder into the hopper area, then within minutes (and sometimes seconds) swim back downstream through the V gates and out of the lower flume into the tailrace. Also, on many occasions, shad were reluctant to pass through the V gate crowder in the fishing position (see 1995 Cataract fishway study report Sections 3 and 4 for detailed information on camera study and results). Since 1996, the underwater video camera, combined with keeping the V gate crowder wide open, was a very important technique that increased East Channel fishway efficiency. Fishway personnel observed that by keeping the V gate crowder open, shad moved readily into the trapping area. Utilizing the underwater camera, fishway personnel could observe shad as they passed through the wide open V gate crowder, then close the crowder and trap before the shad had a chance to fall back. This technique will continue in 2013.

A 2007 settlement agreement provides a schedule for fish passage at the remaining dams owned by FPL Energy (Table 4), a schedule for effectiveness testing, and a schedule for improvements at the Spring Island or Bradbury dam so American shad can pass.

Table 4. Schedule for fish passage implementation at Saco River dams.

Dam Name	Upstream anadromous passage
Cataract - East Channel, West Channel	fishlift, Denil
Cataract - Springs Island, Bradbury	fishlocks
Skelton	fishlift
Bar Mills	5/1/2016
West Buxton	5/1/2019
Bonny Eagle	5/1/2022
Hiram	5/1/2025

In 2012, NextEra biologists counted a total of 6,404 American shad (6,221 passing the East Channel Dam, and 183 passing the West Channel Dam, Figure 4). In addition to the 6,221 American shad successfully passing through the Cataract East Channel fishway, a total of 68 shad mortalities were noted. This represents a total fishway mortality of 1.2 %, which is similar to past years: 1995 (3.5%), 1996 (4.8%), 1997 (2.7%), 1998 (3.5%), 1999 (2.6%), 2000 (2.7%), 2001 (2.4%), 2002 (2.8%), 2003 (2.5%), 2004 (3.0%), 2005 (2.6%), 2006 (2.8%), 2007 (3.0%), 2008 (2.9%), 2009 (4.8%), 2010(1.9%), 2011 (2.1%). The majority of the American shad captured at the East Channel fishlift were transported to the Diamond Riverside Boat Ramp stocking location (approximately half mile upstream of the fishway), while the remaining shad were allowed to freely swim through the fishway into the Cataract impoundment.

At the Skelton Project during the 2012 season, 47 shad were lifted. It is assumed that many of the American shad that were not lifted at the Skelton fishway spawned below the project, as post-spawned American shad and juvenile American shad are routinely observed at the downstream Cataract Project. Also, the 9.3 miles between the Skelton Project and the Cataract Project provides potential spawning habitat for approximately 25,000 adult American shad.

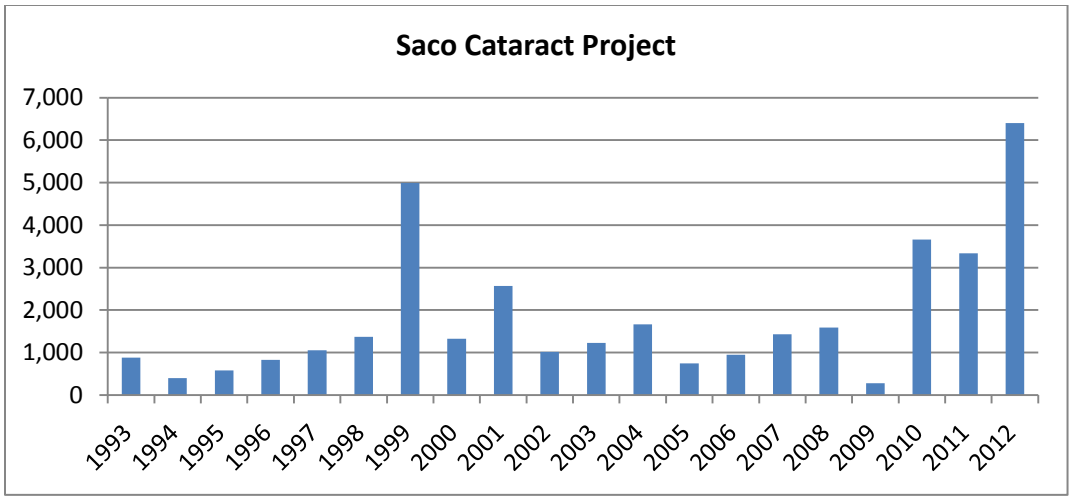

Figure 4. American shad passage at the Cataract Project from 1993 to 2012.

Goals and Recommended Actions

- Continue DMR consultations on proposed operational change to improve shad passage at fish locks
- Ground-truth spawning habitat both below Cataract Project and identify other spawning areas upstream
- Estimate mortality for adult shad passing the Cataract Project
- Conduct downstream efficiency and mortality studies
- In addition to video monitoring at the Cataract Project, document upstream efficiency at this location and at the Skelton Project
- Monitor water chemistry (DO, turbidity, pH, temperature, conductivity) during spawning season

The timeline and associated costs of these recommended actions has not been determined.

Androscoggin River

Amount of Habitat

The Androscoggin River contains 100.5 river kilometers of potential American shad habitat. Of this, 48.3 river kilometers are accessible (though accessibility to habitat above dams with fish passage is limited), while the remaining habitat is inaccessible due to obstructed fish passage (Figure 5, Table 1). While passage above the Brunswick Dam is considered possible because the vertical-slot fishway allows some shad passage, actual passage by American shad has been documented to be very low (Figure 6), and the majority of habitat use has been documented in the small portion of river below the dam.

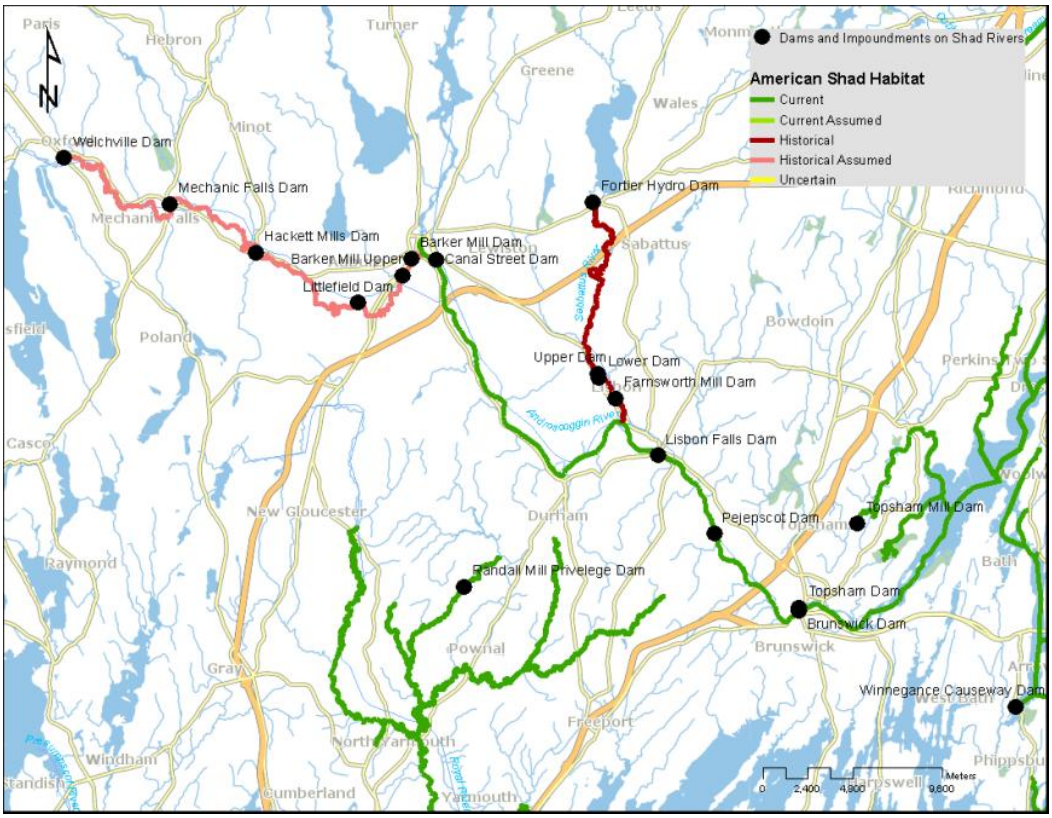

Figure 5. Androscoggin River American shad habitat. Historical habitat is above dams with no fish passage. The upper portion of the Royal River also is shown at the bottom of the figure.

Available Data

- Adult American shad counts, Maine DMR
- Juvenile Abundance, Maine DMR
- Video monitoring of shad behavior downstream of Brunswick Fishway, Bowdoin College
- Maine DEP water quality reports
- USFWS. 1983. American Shad Habitat in the Gulf of Maine. http://www.fws.gov/r5gomp/gom/habitatstudy/metadata/shadhab83.htm
- USFWS. 2013. GIS Data at the Gulf of Maine Coastal Program. http://www.fws.gov/r5gomp/gisindex.htm

Threat(s)

- Barriers to migration
- Past water quality (no longer considered to be a threat)
- Invasive species (possible, not studied)

American shad historically spawned in the Androscoggin River from Merrymeeting Bay to Lewiston Falls, and in the Little Androscoggin River from its confluence with the Androscoggin to Biscoe Falls. However, construction in 1807 a low-head dam at the head-of-tide on the Androscoggin River caused the abundant American shad run to decline sharply.

Barriers to migration. In 1980 the U.S. Fish and Wildlife Service developed conceptual drawings for a vertical slot fishway for the Brunswick Project, which is located at the head-of-tide on the Androscoggin River. The fishway was designed to pass 85,000 American shad and 1,000,000 alewives annually. The upstream passage facility was one of the first vertical slot fishways designed to pass American shad on the east coast, and was a scaled-down version of a fishway located on the Columbia River. Redevelopment of the Brunswick Project and construction of the fishway was completed in 1983. The completed fishway was 570 feet long, and consisted of 42 individual pools with a one-foot drop between each. Downstream passage consisted of a 12-inch pipe located between two turbine intakes. When the Federal Energy Regulatory Commission issued a license for the Brunswick Project in 1979, it did not require efficiency studies for the upstream and downstream passage facilities.

Maine DMR initiated an anadromous fish restoration program in the Androscoggin River after fish passage was installed the Brunswick Project dam, and just prior to the installation of passage in 1987 and 1988 at the next two upstream projects. Between 1985 and 2008, a total of 7,882 prespawn American shad from in-state (Cathance and Androscoggin rivers) and out-of-state (Merrimack and Connecticut rivers) sources were stocked into spawning habitat below Lewiston Falls. In addition, approximately 5.6 million shad fry were stocked into these waters between 1999 and 2008.

Currently the factor limiting successful American shad restoration to the Androscoggin is the lack of effective passage at the Brunswick Project. Neither the Brunswick vertical slot fishway nor a similar one at the Rainbow Dam on the Farmington River, CT, has proven to be successful at passing American shad. Visual observations, underwater videography, and radio telemetry studies conducted at the Brunswick Project by Maine DMR in cooperation with the U.S. Fish and Wildlife Service have shown that American shad swim past the fishway entrance repeatedly, but rarely enter it. The few shad that enter the fishway rarely ascend beyond the corner pool, and in 27 years of operation only 219 American shad have used the fishway.

In February 2011, NextEra Energy, owner of the Brunswick Project, agreed to conduct an experiment to determine whether upstream passage of American shad could be improved by increasing the amount of attraction water at the fishway (see Video Monitoring below).

Past water quality. After dams confined American shad to the tidal portion of the river, severe water pollution virtually eliminated the population. American shad that continued to reproduce in the six-mile stretch of river below Brunswick supported significant commercial fisheries until the

late 1920's. By the early 1930s, severe water pollution from upstream industries and municipalities had caused declines in many fish species. Water pollution abatement efforts that began in the early 1970s resulted in the dramatic improvement of water quality in the Androscoggin River.

Invasive species. White catfish, carp (*Cyprinus carpio*), and Northern pike populations are known to be increasing in the lower Androscoggin River, in the portion where American shad spawning occurs and where juvenile shad are found. The effect of these invasive species on shad populations is not known, however white catfish are known to eat fish eggs of native species.

Agencies with Regulatory Authority

Maine DMR, USFWS, NOAA, Maine DEP, Brookfield Renewable Energy (formerly NextEra, formerly Florida Power and Light)

Other Organizations

Bowdoin College, University of Maine, Bates College, University of Southern Maine, Androscoggin River Alliance, Friends of Merrymeeting Bay

Current Action and Progress

Juvenile Abundance Surveys. See description in State-Wide Information above.

Monitoring and Passage. Fisheries personnel monitor American shad during their spawning migration at the Brunswick Fishway on the Androscoggin River. Shad are counted and passed upstream as they are encountered at the top of the fishway, after the shad have volitionally passed the 42 pools of the fishway. Biological sampling (length, weight, sex, and scale sample) is not performed on live American shad because the run levels continue to be extremely low, and any handling may cause mortality. Sampling is performed on American shad that have experienced fish passage mortality. Passage of American shad has remained low – only 11 were passed in 2012, and only 289 total passed in all years of the data series (Figure 6).

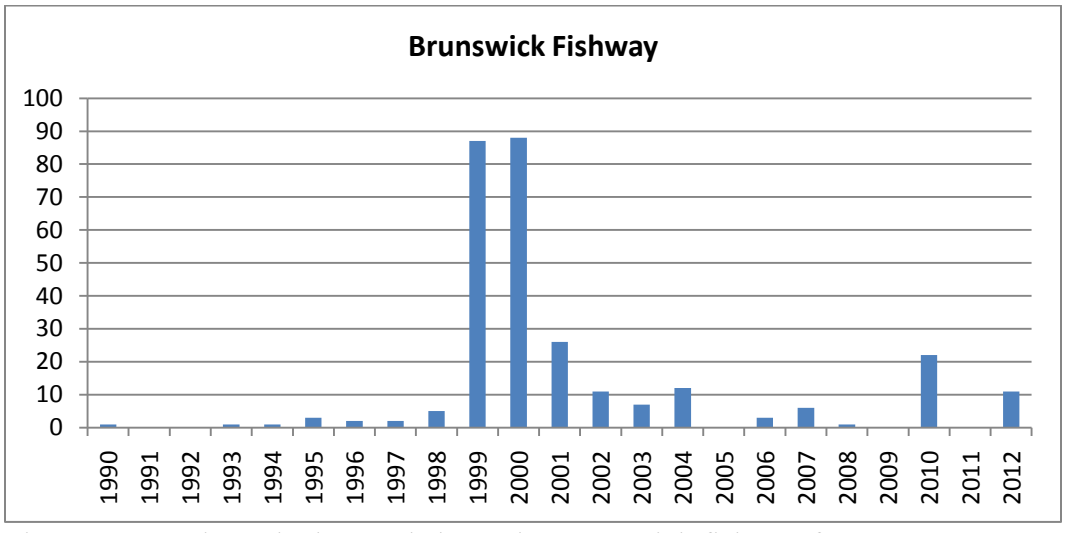

Figure 6. American shad passed above the Brunswick fishway from 1990 to 2012.

Video monitoring. In 2011 and again in 2013, John Lichter of Bowdoin-Bates-USM research group along with his summer research students, Bob Richter of Brookfield Renewable Power, Neil Ward of the Androscoggin River Alliance, and Gail Wippelhauser of the Maine DMR collaborated on an experiment to determine whether upstream passage of spawning American shad at Brunswick Fishway could be improved by increasing the attraction flow at the fishway entrance. Two current inducers were installed adjacent to the fishway entrance. The presence and behavior of American shad was monitored with two underwater cameras, one located in the river about 40 m feet downstream of the fishway entrance to confirm the presence of shad in the river, and a second one placed adjacent to the fishway entrance. Digital video recorders, computers, and software were installed in the fish ladder control room. Salmonsoft@ software was used to record video images when a fish crossed in front of each of the cameras.

In 2011, inducers were turned on and off over alternating two-hour periods. Approximately 16,558 American shad were counted at the lower camera, although previous telemetry studies have shown that an individual may swim past this part of the river multiple times per day. The fish were active primarily during the day for a period of 5-6 h, beginning 1-2 hours before high slack water and continuing for 3-4 hours into the ebb tide. A total of 91 American shad were seen at the entrance of the fishway. More fish were seen at the entrance in the afternoon than in the morning, and more fish were seen when the current inducers were turned on (54) than when the inducers were off (37). However, the current inducers were more effective in the morning than in the afternoon. In 2013, two current inducers were installed adjacent to the fishway entrance and were alternately turned off for 24 hours (attraction water of 100 cfs) then on for 24 hours (attraction water of 180 cfs) with the change occurring at noon every day. Approximately 500 of the nearly 25,000 shad viewed at the lower camera made it to the entrance of the fish ladder. To date, we have only completed roughly 2/3rds of the 2013 video data analysis. Equipment damage related to flooding prevented the study in 2012.

Because it is not clear how many of the 16,000-25,000+ shad viewed at the lower camera circled around the far side of the river after failing to find the fish ladder and were subsequently recounted in the lower camera, we are planning a study that will determine shad movement patterns in the tailrace of the dam for 2014. In any case, there appears to be some number of thousands of shad trying to navigate past the Brunswick Hydroelectric facility each year. Previous work with Michael Brown of the Maine DMR and John Lichter, Bowdoin College, showed that shad will spawn in the tidal waters of the lower Androscoggin if they cannot pass the dam.

Goals and Recommended Actions

- Conduct population estimates for adults spawning in the lower Androscoggin River
- Map young-of-year habitat based on existing beach seine surveys
- Continue fishway efficiency studies at Brunswick Fishway that document poor passage by adult American shad
- Monitor water chemistry (DO, turbidity, pH, temperature, conductivity) during spawning season
- Study impact of invasive species populations on shad populations

The timeline and associated costs of these recommended actions has not been determined.

Kennebec and Sebasticook Rivers

Amount of Habitat

The Kennebec watershed contains 407.6 river kilometers of potential American shad habitat. Of this, 300.4 river kilometers are currently accessible (though accessibility to habitat above dams with fish passage is limited), while the remaining 107.2 river kilometers are inaccessible due to obstructed fish passage (Table 1).

The watershed contains two major spawning areas, the mainstem Kennebec River below Lockwood Dam and the the Sebasticook River below Benton Falls Dam (Figure 7). While passage above these is considered possible because both dams have fishlifts, actual passage by American shad has been documented to be very low (Figure 8), and the majority of spawning is thought to occur below the first mainstem dams.

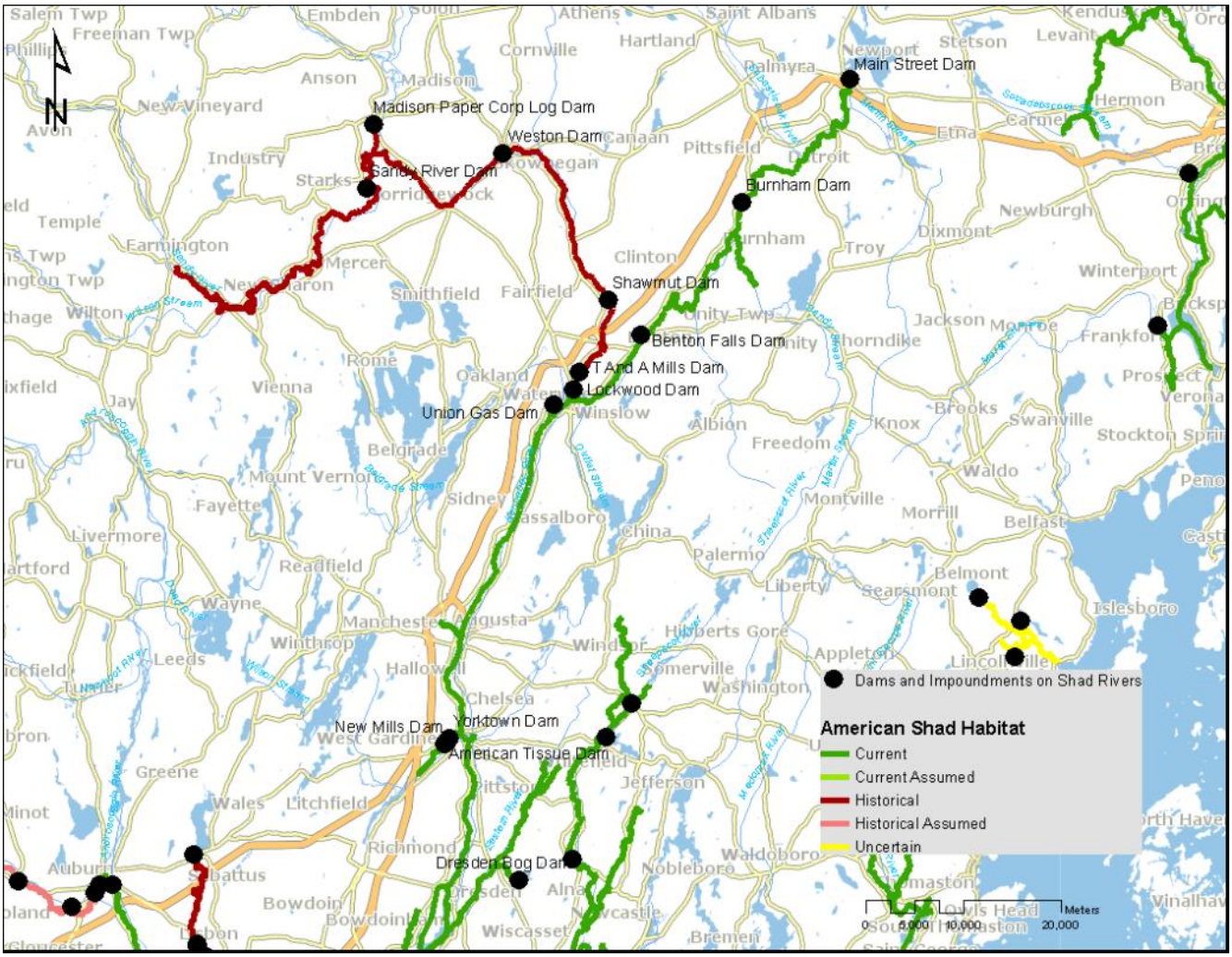

Figure 7. American shad habitat in the Kennebec and Sebasticook rivers. Historical habitat is above dams with no fish passage. The upper portion of the Sheepscot River also is shown at the bottom of the figure, in close proximity to the lower Kennebec River.

Available Data

- Adult American shad counts, Maine DMR
- Juvenile Abundance, Maine DMR
- Maine DEP water quality reports
- USFWS. 1983. American Shad Habitat in the Gulf of Maine. http://www.fws.gov/r5gomp/gom/habitatstudy/metadata/shadhab83.htm
- USFWS. 2013. GIS Data at the Gulf of Maine Coastal Program. http://www.fws.gov/r5gomp/gisindex.htm

Threat(s)

- Barriers to migration
- Past water quality (no longer considered to be a threat)
- Invasive species (possible, not studied)

Barriers to migration. The Kennebec River Restoration Program was initiated following the development of a Strategic Plan in 1985, an Operational Plan in 1986, and the signing of an Agreement in 1986 between the Maine DMR and the Kennebec Hydro Developers Group (KHDG). This Agreement provided a delay in fish passage requirements at seven hydropower facilities above Augusta in exchange for funds to initiate the restoration by means of trap-and-truck of river herring and American shad to selected upriver spawning and nursery habitat. In 1998, a new Agreement between state and federal fisheries agencies and the members of the KHDG was signed. The new Agreement provided for the removal of Edwards Dam, included new timetables or triggers for fish passage at the seven hydropower facilities above Augusta, and provided additional funds to continue the restoration by trap-and-truck. In 2006, the Kennebec River Restoration Program entered a new phase when upstream anadromous fish passage became operational at the Benton Falls, Burnham, and Lockwood hydropower projects (Figure 7).

Upstream passage at the Burnham and Benton Falls was required to be operational one year following the installation of permanent or temporary upstream fish passage at Fort Halifax and following installation of permanent upstream fish passage at four upriver non-hydro dams. These projects included the implementation of interim upstream passage measures at Fort Halifax dam and the construction of fishways at the Pleasant Pond dam in Stetson, the Plymouth Pond dam in Plymouth, the Sebasticook Lake outlet dam in Newport and the removal of the Guilford dam in Newport. Passage at the Benton Falls Dam was established in 2006 by way of a fishlift. The top of the lift contains a watered holding area leading to a large fish excluder, a gate with vertical bars spaces 2" apart to prevent larger fish from passing in an effort to minimize invasive species passage. All American shad passing Benton Falls must be manually passed upstream over this excluder grate. A fishlift also provides passage at the Burham Dam, however no upstream excluder panel prevents free passage of shad once they pass the fishlift.

The Lower Kennebec River Comprehensive Hydropower Settlement Accord requires that the Licensee install a trap, lift, and transfer facility at the project's powerhouses at Lockwood Dam. These facilities were operational in 2006. American shad that reach the top of the fishlift are passed upstream, however the next dam 1.9 river kilometers upstream has no fish passage capabilities.

The potential for these locations to pass American shad is thought to be low to moderate. The ability of shad to locate the fishlift entrance is likely hindered by attraction flows from large spillways. Further, at Benton Falls Dam there is evidence that shad remain in holding areas undetected, as evidenced by a large proportion of "passed" shad found only when the facilities are periodically de-watered, and only few shad passed during normal operations (Maine DMR ASMFC Compliance 2011 Report). However, this effect may be a result of flow differentials between the downstream portion of the dam and the headpond. Shad may remain in the portion between the fishlift and the headpond for longer periods of time because the flow is much lower than the tailraces, and use this time for resting.

Past water quality. Water pollution from upstream industries and municipalities in the early to mid-20th century had significant impacts on water quality in the Kennebec watershed and was thought to cause declines in many fish species populations. Water pollution abatement efforts that began in the early 1970s resulted in the dramatic improvement of water quality in the Kennebec and Sebasticook rivers. While water quality has drastically improved over the past forty years, high levels of PCBs and some toxic contaminants are still found in many resident fish species.

Invasive species. White catfish and carp (*Cyprinus carpio*) populations are known to be increasing in the Kennebec and Sebasticook rivers, in the portion where American shad spawning occurs and where juvenile shad are found. The effect of these invasive species on shad populations is not known, however white catfish are known to eat fish eggs of native species.

Agencies with Regulatory Authority

Maine DMR, USFWS, NOAA, Maine DEP, Brookfield Renewable Energy (formerly NextEra, formerly Florida Power and Light), KEI (USA) Power Management Inc., Benton Falls Associates (Essex Hydro Associates), Kennebec Hydro Developers Group

Other Organizations

Friends of Merrymeeting Bay, Kennebec Estuary Land Trust, Sportsman's Alliance of Maine

Current Action and Progress

Juvenile Abundance Surveys. See description in State-Wide Information above.

Monitoring and Passage. Fisheries personnel monitor American shad during their spawning migration at the Lockwood Dam on the Kennebec River and the Benton Falls Dam on the Sebasticook River. Shad are counted and passed upstream as they are encountered at the top of the fishway, after the shad have volitionally entered the fishlift. Biological sampling (length, weight, sex, and scale sample) is not performed on live American shad because the run levels continue to be extremely low, and any handling may cause mortality. Sampling is performed on American shad that have experienced fish passage mortality. Passage of American shad has remained low – only 5 were passed in 2012 at the Lockwood Dam, and only 39 total since the fishlift at Lockwood was operational. Passage at Benton Falls Dam may be increasing: in 2012 163 shad were passed (Figure 8).

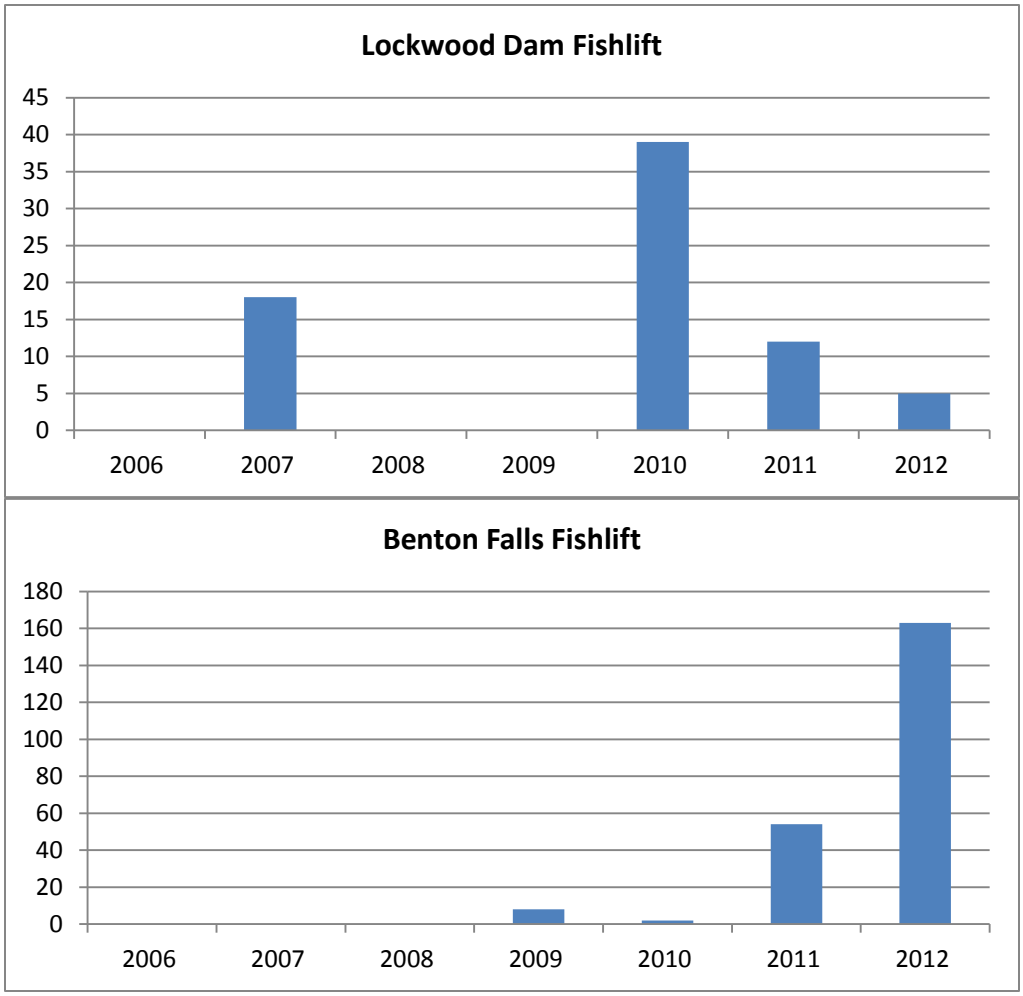

Figure 8. American shad passage at two counting locations in the Kennebec watershed. Fish passage was not operational before 2006.

Goals and Recommended Actions

- Ground-truth spawning habitat in the mainstem Kennebec and Sebasticook rivers
- Conduct population estimates for spawning adults
- Map young-of-year habitat based on existing beach seine surveys
- Develop fishway efficiency studies at Benton Falls and Lockwood fishlifts
- Conduct downstream passage studies at Benton Falls for both adult and juvenile American shad
- Monitor water chemistry (DO, turbidity, pH, temperature, conductivity) during spawning season
- Study impact of invasive species populations on shad populations

The timeline and associated costs of these recommended actions has not been determined.

Penobscot River

Amount of Habitat

The Penobscot watershed contains 786.3 river kilometers of potential American shad habitat. Of this, only 399.6 river kilometers are currently accessible (though accessibility to habitat above dams with fish passage is limited), while the remaining 386.7 river kilometers are inaccessible due to obstructed fish passage (Table 1).

Though few adult shad have been captured at the lower mainstem dams as part of fishway operations, recent summer trawl surveys conducted in the lower portion of the river have captured juvenile American shad (Lipsky and Saunders 2013). In 2004, 12 juvenile American shad were electrofished downstream of the Veazie Dam but none were captured during extensive upriver sampling (mainstem Penobscot from Veazie to the confluence of the East and West Branch in East Millinocket, the West Branch Penobscot to the outlet of Seboomook Lake, the East Branch Penobscot to Grindstone Falls, the Piscataquis River, the Stillwater River, Passadumkeag Stream, Pushaw Stream, and Millinocket Stream) (Yoder et al. 2004).

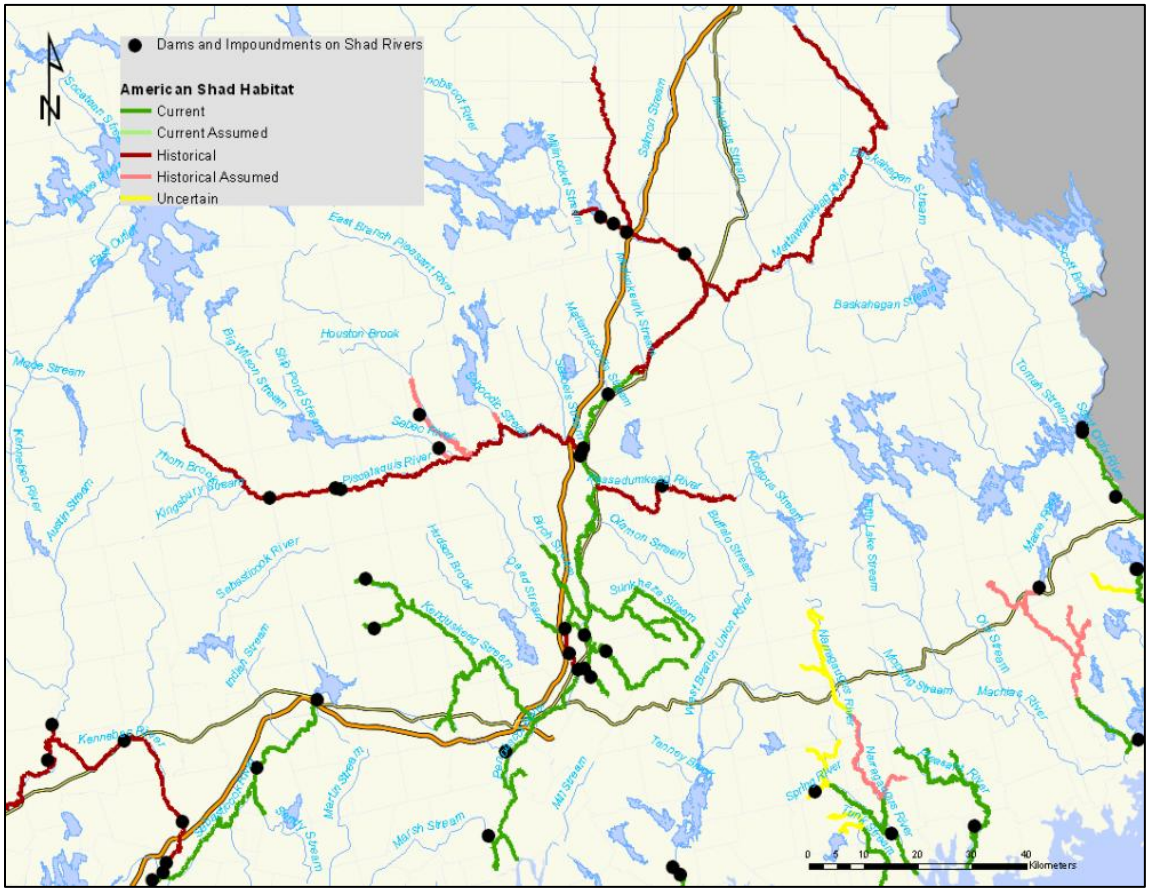

Figure 9. American shad habitat in Penobscot watershed. Historical habitat is above dams with no fish passage. The upper portion of the Kennebec River River also is shown at the bottom left the figure, and the Narraguagus, Pleasant, and East Machias rivers appear in the bottom right.

Available Data

- Adult American shad counts, Maine DMR
- Fish community survey data, NOAA
- Maine DEP water quality reports
- USFWS. 1983. American Shad Habitat in the Gulf of Maine. http://www.fws.gov/r5gomp/gom/habitatstudy/metadata/shadhab83.htm
- USFWS. 2013. GIS Data at the Gulf of Maine Coastal Program. http://www.fws.gov/r5gomp/gisindex.htm

Threat(s)

- Barriers to migration
- Possible water quality

Barriers to migration. Until recently, mainstem dams in the lower portion of the Penobscot River have limited fish passage by all species, and reduced the amount of spawning habitat for American shad by more than half of the potential area. In 2004, the Lower Penobscot River Settlement Accord was signed, a multi-party agreement which laid the framework for the Penobscot River Restoration Project (PRRP). Through this project, the Penobscot Trust purchased the Veazie, Great Works, and Howland Dams in 2010 with the goal of dam removal or fish passage at each location. Five major projects are part of this effort to improve migratory fish passage and habitat in the lower Penobscot River:

- Removal of Great Works Dam in 2012
- Upgrade of Old Town Fuel & Fiber water intake in 2012 to reduce fish interaction
- Removal of Veazie Dam in 2013
- Installation of a fishlift at Milford Dam in 2013; and
- Decommissioning and construction of a bypass at Howland Dam

Before these projects were completed, limited access was available to American shad by way of upstream passage at the Veazie Dam, and two Denil fishways at the Great Works Dam.

Water quality. In the early 20th century, severe water pollution from upstream industries and municipalities had had a significant impact on fish populations. Water pollution improvement efforts that began in the early 1970s resulted in the dramatic improvement of water quality, however many paper mills and other industry still operate on the river. While the PRRP has addressed some known issues with water intake, others may exist.

Agencies with Regulatory Authority

Maine DMR, USFWS, NOAA, Maine DEP, Black Bear Hydro Partners, LLC, Penobscot River Restoration Trust, PPL Corporation

Other Organizations

Penobscot Indian Nation, American Rivers, Atlantic Salmon Federation, Maine Audubon, Natural Resources Council of Maine, and Trout Unlimited

Current Action and Progress

Barrier removal and passage facilities. Recent work has opened habitat in the lower portion of the Penobscot River through removal of the Great Works and Veazie dams, and upcoming installation of a fishlift at Milford Dam and bypass at the Howland Dam. The result of these projects on American shad will likely not been seen for a few years.

Before the Veazie Dam was removed, few American shad were provided upstream passage at the fish trap installed at that dam – since 1978, fewer than twenty adult spawning shad were passed. It is likely that the majority of shad in the Penobscot River remained below the dam, and any spawning occurred in the mainstem.

Fish community surveys. NOAA Northeast Fishery Science Center (NEFSC) Maine Field Station has conducted fish community monitoring since 2010 in the Penobscot Estuary. The survey has relied on a combination of fixed (seine and fyke) and mobile (trawl) capture gear combined with mobile hydroacoustics to describe relative abundance and species composition in the estuary. Sampling has generally occurred from April through October at weekly to monthly intervals depending on the year, season and gear. Twelve seine sites are distributed from 10 to 40 kilometers downstream of head-tide, four fyke sites at 12 and 25 kilometers downstream of head-tide and trawls from 15 to 55 kilometers downstream of head-tide. A total of 67 species have been identified including 10 diadromous, 27 freshwater and 30 marine life histories. Most dominant in the surveys by number are the clupeids namely *Clupea harengus* with *Alosa* species most common in percent occurrence. The survey has been successful in establishing systematic methods of sampling and has provided a platform for several researchers interested in estuary species such as: *Salmo salar, Fundulus heteroclitus, Osmerus mordax, Microgadus tomcod*, *Alosa pseudoharengus, Alosa aestivalis*, and *Alosa sapidissima*.

One of the objectives of the Penobscot Estuary survey was to describe temporal and spatial distributions of diadromous species including American shad. It is believed the Penobscot has a remnant population of American shad through anecdotal reports from anglers and infrequent occurrence at the Veazie Dam fishway trap operated by the Maine DMR. Seine surveys conducted in collaboration with the Maine DMR in 2010 - 2012, confirmed presence of young-of-year (YOY) American shad in the estuary and 2011-2013 trawl surveys have confirmed presence of age- 1 juveniles. Lipsky and Saunders (2013) summarized YOY distribution in the Penobscot and determined that due to salinity intolerance, the YOY are likely the result of natural reproduction from the Penobscot rather than larval drift from other spawning locations.

Seine and fyke catch data have shown that most (40% of total) YOY shad are captured in September but are present from July through November. Captures were most common (45% of total) in the tidal freshwater reaches of the estuary, 8-15 kilometers below head of tide. However, captures did occur in higher salinity (10-20 ppt) areas over 45 kilometers from head of tide. Trawl data suggests some age- 1 American shad utilize the Penobscot estuary in their second summer for rearing. Trawls in 2011 to 2013 have captured 750 individuals between 9 and 27 cm total length. For the trawl, most captures occur at the high turbidity, salinity mixing zone 20 to 30 kilometers downstream of head tide.

Goals and Recommended Actions

- Ground-truth spawning habitat in the lower Penobscot River once the PRRP current objectives are complete
- Conduct population estimates for spawning adults
- Map young-of-year habitat based on existing beach seine surveys
- Develop fishway efficiency studies at Milford fishlift after sufficient time has passed for shad populations that may have spawned below the Great Works Dam have "found" their way upstream (part of current FERC license)
- Conduct downstream passage studies at Milford fishlift for both adult and juvenile American shad
- Monitor water chemistry (DO, turbidity, pH, temperature, conductivity) during spawning season
- Continued work to open habitat further upstream

Timeline

Current summer trawl surveys have documents American shad juveniles in the Penobscot River, however, with the large-scale changes occurring under the PRRP, dedicated work towards identifying spawning habitat and performing fish passage efficiency studies may be more productive after sufficient time has passed to allow fish populations to respond. Under the assumption that the PRRP work will be complete by 2016, it is suggested that the above recommendations be implemented in 2020, with the exception of water chemistry sampling which should be implemented at the Milford fishlift when it is operational. Adult shad counts and fish community surveys should continue annually.

Associated Costs

To accomplish the goals of the PRRP, it is estimated that ~$55 million is needed (Penobscot Restoration Trust 2013).

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