June 30, 2025

Cameron Dufour, Biologist - Field Services and Enforcement Team
Laura Paye, Hydropower & Dams Program Coordinator
Bureau of Land Resources
Maine Department of Environmental Protection
17 State House Station
Augusta, ME 04333-0017

Transmitted via email

Subject: **Report of Fish Kill and Forest Fire**

Dear Mr. DuFour and Ms. Paye,

Maine DEP Enforcement said that I should direct this correspondence to you.

Attachment A is a FERC filing made recently by Maine Council of Trout Unlimited (TU). Starting on page 3, it describes the June 17, 2025 trip event that occurred at McKay Station dewatering the West Branch of the Penobscot killing hundreds of fish and starting a forest fire. Details as reported by Brookfield Renewable (Brookfield) are included as Attachment B. Additional information should be forthcoming from Brookfield soon that more fully describes the event in order to meet FERC flow excursion reporting requirements.

TU did not report this immediately to MDEP due to the remote location, because the damage had already been done, and prior flows restored through the Ripogenus Dam crest gates. As stated in our FERC filing, it is well established by prior studies conducted incident to the current FERC relicensing effort that generator trip events kill hundreds of fish, predominantly landlocked salmon parr. As our report states, it would have been be dangerous to try to go to the areas identified by the studies as stranding areas when the time of flow restoral is unknown, but even so, the filing does include images of a dead yellow perch and a stranded crawfish. This is the tip of the iceberg.

Despite FERC efforts to find even a short-term solution to the mortality associated with trip events at McKay Station, they have been unsuccessful to date. We have attached a portion of their recent filing in which explains Brookfield's position as Attachment C. We find their filing less than credible, and state our reasons in Attachment A.

TU requests that MDEP look further into the incident to determine if a Water Quality Certification violation occurred and to take appropriate action if one did.

Given that the cross-arm failure also resulted in a forest fire, this might also be a subject for inquiry as to other violations as well. As our filing notes, this is not the first time a Brookfield cross-arm failure has resulted in a forest fire.

Very respectfully submitted,

Stephen G. Heinz
Maine TU Council FERC Coordinator

Attachments:

A – Maine TU Council letter dated June 30, 2025, Subject: Additional Information Requests (AIRs) Regarding Relicensing of the Ripogenus Project (P-2572) and the Penobscot Mills Project (P-2458)
B – Kevin Bernier (Brookfield) email dated June 18, 2025, Subject: West Branch flow excursions and forest fire
C – Pages from Brookfield letter dated May 29, 2025, Subject: Response to Additional Information Requests on the Final License Application

Electronic Copies to: Tim Obrey, MDIFW; Brian Cavanah, Robert Wood, MDEP; Andrea Claros – FERC Compliance

Attachment A

June 30, 2025

Ms. Debbie-Anne Reese, Esq.
Secretary Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Via online submission to: http://www/ferc.gov

Subject: **Additional Information Requests (AIRs) Regarding Relicensing of the Ripogenus Project (P-2572) and the Penobscot Mills Project (P-2458)**

Dear Secretary Reese,

Maine Council of Trout Unlimited ("TU") submits these comments regarding the May 29, 2025 response submitted by Brookfield Renewable U.S. (Brookfield) for Great Lakes Hydro America, LLC to your Issuance of February 28, 2025. For the reasons stated below, TU continues to have the serious concerns that we stated in the Non-government Organization's letter of March 21,2025 letter that additional AIRs and further additional studies will be required for the project to meet FERC information requirements and be Ready for Environmental Analysis (REA). This latest Brookfield filing heightens our concerns. Going back to the Pre-application Document (PAD), Brookfield said that most of required studies needed for relicensing had been accomplished when the projects were licensed some thirty years ago, and that the Project Mitigation and Enhancement (PM&E) measures in place were adequate. This is despite the fact that the project was then operated by Great Northern Paper (GNP) to power its paper mills in East Millinocket. Since then, GNP spun off its hydro operations into GLHA, sold GLHA to Brookfield after which GNP closed its paper mills. Much has changed since the last relicensing, and the NGOs jointly stated their concerns with Brookfields approach formally.[1] FERC's Study Plan Determination subsequently required 24 studies or studies with modifications,[2] yet the numbers of AIRs and incomplete studies contained in FERC's latest issuance is still substantial. Part of this is due to delays in studies brought on by failure of two generators at the Ripogenus Project caused by improper maintenance procedures by Brookfield following the July 7, 2023 generator trip event that caused a significant fish kill and was a matter of special concern to FERC's Division of Hydropower Administration and Compliance. Continued failure of Brookfield to provide informative responses to FERC AIRs will cause further delays. TU notes that delays to the issuance of a new license are in Brookfield's financial interest because some generation is bound to be lost from the Penobscot Mills project to water the over 5-mile dewatered section of the West Branch below Stone Dam, or Stone Dam dry way, that Maine Department of Environmental Protection (MDEP) is sure to require flow restoration in a Water Quality Certification (WQC) for the project.

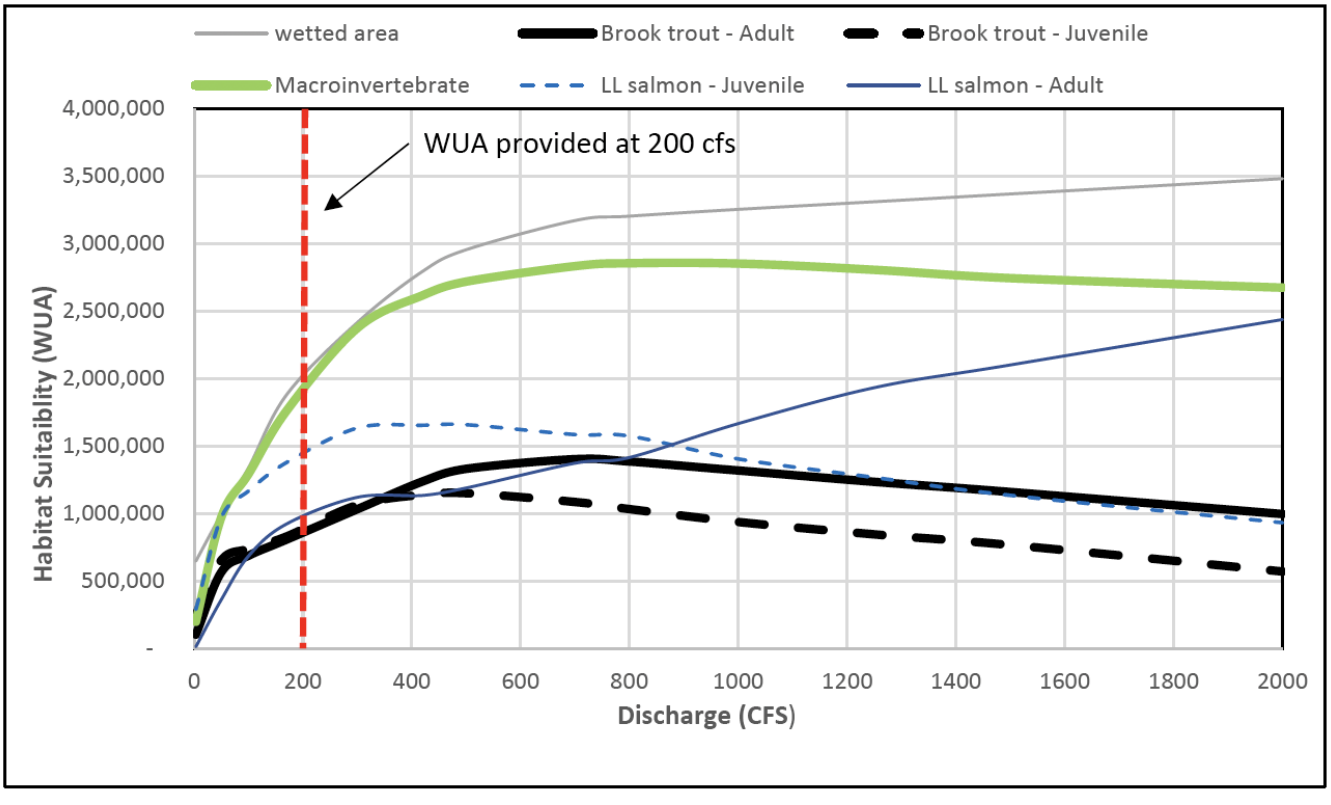
[1] NGO Preliminary Comments on the Proposed Study Plan (PSP) for the Ripogenus Project (P-2572) and the Penobscot Mills Project (P-2458) dated February 10, 2022.

[2] Study Plan Determination for the Ripogenus Hydroelectric Project and the Penobscot Mills Hydroelectric Project, Appendix A.

Administrative Note: Lack of coherent page numbers complicates referencing specifics in the document. Pdf page numbers have been used to provide clarity where needed.

Specific Comments:

Schedule A. Habitat Suitability Page A-16 (pdf page 27). The "corrected" graph below still shows best flows for macroinvertebrates and adult brook trout and landlocked salmon at ~ 700 cfs. This is a flow that Brookfield did not include in the Wadability/fishability study despite repeated TU requests. Some modeling has been done, page 12 (pdf page 23) but this is deceptive because Brookfield only looks at the reaches that they selected that are so low that it was possible to wade across the river. At higher flows, additional watered area is available for fishing.



Revised Figure 6.6-24

Please continue to note that 700 cfs is the optimal flow for adult brook trout and within the optimal range for macroinvertebrates. Adult landlocked salmon would benefit further from higher flows. The manner contained in TU's USR Comments remains valid, including our objections to the 30-foot casting distance used that FERC Staff has questioned:

> "Study assumed 30 ft fly casting distance. This is an unrealistically shortened distance and reduced the useable/castable area by 50%. Spin fishing would also be possible there with even longer casting distances. The reaches at the flows sampled provided a fishing opportunity more appropriate to a smaller tributary, not the main stem of the West

Branch of the Penobscot River where the bulk of recreational fishing is known to occur."[3]

In addition to the invalid nature of the casting distance assumption, the study did not account for the fact that the fishing zones were the deepest pools and runs in the section. Immediately upstream of the fishing zones were shallow riffles that were more wadable at all the flows tested. These shallow sections give anglers access to the far bank, easily doubling the castable area of the river available to anglers at the flows tested.

Brookfield's report is misleading and deceptive. Its conclusion that lower flows provide more, better fishing habitat defy logic as they are looking at only a small percentage of the 3440 cfs 50% median duration flows measured a short distance downstream at the West Branch Penobscot River gaging station near Medway, ME.[4] These flows are more appropriate to a nursery area, and Brookfield's Revised Figure 6.6-24 continues to demonstrate that.

Appendix A - Water Quality Study Report Addendum 2023 North Twin Impoundment Macroinvertebrate Sampling - Expected to meet MDEP criteria and did - page 12 (pdf page 55).

Appendix B - 2024 Macroinvertebrate Sampling of Six Sites in the West Branch Penobscot River Downstream of the Ripogenus and Penobscot Mills Projects (starts pdf page 189). "The LDM biocriteria results from the MDEP were not available as of this report." page 17 (pdf page 207). TU reserves comment until the publication of this finding.

Appendix C - Fish Stranding Mitigation Study Report (starts at pdf page 221). The Brookfield response is unresponsive to the AIR, presents nothing new of consequence, and is only designed to justify the status quo. It ignores both FERC Compliance efforts to at least find even temporary measures to lessen the severity of generator trip events, and TU's proposals to install a dam keeper, put 400 cfs into the gorge from a coldwater source as a buffer, and make the power lines that connect McKay Station to Millinocket redundant eliminating the current 'single point failure' situation that continues to exist.

Brookfield's lack of commitment to preventing fish kills on the West Branch of the Penobscot was further demonstrated on June 17, 2025 at 2:24 p.m. when another generator trip event occurred at McKay Station.[5] There was no severe weather in the area, the trip was caused by a cross-arm failure that in the absence of severe weather, one must assume was due to inadequate maintenance. The down wire that caused the generator trip also caused a forest fire.

A whitewater raft crew was in the process of launching just above McKay Station when this happened and was able to take videos of the event; these are attached as Attachments A

[3] Comments of Maine Council of Trout Unlimited on the Updated Study Report for the Ripogenus Project (P-2572) and the Penobscot Mills Project (P-2458) dated July1, 2924, page 7.
[4] USGS StreamStats accessed at https://streamstats.usgs.gov/ss/?gage=01028000&tab=info on June 27, 2025.
[5] Kevin Bernier (Brookfield) email June 18, 2025 2:14 PM, Subject: West Branch flow excursions and forest fire.

through F. [6] We have extracted still images from the videos showing extremely low flows, and provided them as Figure 1 and Figure 2.

Figure 1, photo by Greg Sarnacki

Figure 2, photo by Greg Sarnacki

[6] Videos taken July 17, 2025 by Greg Sarnacki. Provided as separate files with this filing.

This event was more drastic than the 400 cfs that was used as a flow during the stranding study conducted in 2022,[7] From the videos, there is only leakage flows coming from Ripogenus dam, and no flows from the powerhouse. Again, referencing the Brookfield email:

> "Article 402 of the Ripogenus license requires an outage flow of 400 cfs during generating unit outages at McKay Station, with scheduled minimum flows to be resumed as quickly and practically as possible. Although the minimum flow system at the Station functioned properly on two units currently in operation (#1 and #3) during yesterday's outage, the third unit (#2) is currently inoperable due to ongoing replacement of a thrust bearing oil cooler. As a result, approximately 350 cfs was passed through McKay Station and into the West Branch during the event, resulting in an approximate 101-minute minimum flow excursion until the gate could be opened at Ripogenus Dam."[8]

Based on the videos, the flows may even have been lower than the 350 cfs that Brookfield reported. One must assume that more than the hundreds of fish perished during the event with the largest number of them being landlocked Atlantic salmon parr. Sarah Sindo who manages the Big Eddy Campground downstream photographed one dead yellow perch observed during the event, and a stranded crayfish, Figure 3 and Figure 4.[9] It would have been dangerous for greater effort to be made to determine further mortality at the known stranding sight below Telos Bridge, Little A Falls and Big A Falls as restoral time was unknown when the event occurred and prevailing flows at the time of the failure were 2200 cfs.

Figure 3, photo by Sarah Sindo

Figure 4, photo by Sarah Sindo

[7] Brookfield Updated Study Report dated April 24, 2023, Appendix E: Fish Stranding Study Report; TU Stranding Study dated October 19, 2022, Subject: Maine TU Council Stranding Study Observations.

[8] Kevin Bernier (Brookfield) email June 18, 2025 2:14 PM, Subject: West Branch flow excursions and forest fire.

[9] Sarah Sindo photos taken June 17, 2025.

A positive did come out of the event. The necessity to release water directly from Ripogenus Dam again showed the majesty of Ripogenus Gorge when watered. Figure 5 is a view of the gorge taken from Ripogenus Dam.

Figure 5, photo by Scott Sells

As the NGOs stated jointly in their AIR Comments:

> "The 1982 Maine Rivers Study[10] evaluated rivers across Maine. They specifically mention that the SPECTACULAR Ripogenus Gorge was a significant geological location that is recognized as a potential National Natural Landmark ... This unique Maine resource has not been properly watered for decades, thus depriving the people of Maine of its full aesthetic value."[11]

[10] Maine Dept of Conservation and US Dept Interior- National Park Service. May 1982. Maine River Study: Final Report, page 248.

[11] NGO letter dated March 21, 2025, page 2.

"Alternative No. 1 – Ripogenus Dam Gate Automation
The automating of a gate at Ripogenus Dam to provide a mitigation flow in response to an unplanned station outage was eliminated due to the unacceptable public safety risk, since the reach below Ripogenus Dam is over ¾-mile-long, in a remote location, and used by recreational fisherman and other members of the public."

Appendix C Alternative 1.0 comments: While the generator spin system is one emergency measure to supply necessary river flows in an emergency, it cannot meet the flow levels that Brookfield could supply to maintain a consistent minimum flow when one of their generators is down for repair as during the June 17th event. A true minimum flow should not be contingent on or limited based on Brookfield's generators capacity or maintenance schedule needs. These sudden flow drops are population limiting events for most fish populations and will affect the future quality of fishing in the river. While Brookfield's plan does partially address an emergency. It is possible to do better. There could be an alternative operational rule that will protect the riverine resources at a consistent minimum flow by using automate gates at Ripogenus to quickly bring flows up again or by having buffering cool water releases already in place.

GHLA has argued safety concerns as the reason for not using automated gate at Ripogenus Dam, even though such gates could provide near immediate relief for flow emergencies. Like what happened on June 17th. Yet, automated gates are used at McKay station, a location that has similar access and similar confined channels for about 0.3 mile below the station. In addition, McKay has far higher usage by boaters and anglers than the area below Ripogenus Dam. Perhaps Brookfield wishes to avoid proposing automation of the Ripogenus Project to avoid calling attention to the fish kills that occurred at this site as well in 2023.

Appendix D - Model Run Results from Scenarios requested by Ripogenus Camp Owner Associations. Scenario 25 starting on pdf page 305. TU supports the camp owners' filings[12] and additionally note that the current lake level variations permitted under the current license adversely affect not only the camp owners but also the fish and wildlife in Ripogenus-Chesuncook-Caribou Lake, Maine's third largest.

A key provision of the camp owners' Ops Model run request was: "The monthly target elevations were proposed to simulate filling Ripogenus Lake after ice-out to elevation 940.1 (1.5 feet below the full pool elevation of 941.6) in the spring. After June 1st, Ripogenus is drawn down at a steady rate of 1 foot per month until October 15th (elev. 935.6). The lower limit on winter drawdown is elev. 925.1 (16.5 feet drawdown)" TU agrees that the 1.5 feet of flexibility provided by the 940.1 water level is a more than adequate buffer, and that the additional storage provided is critical to maintain lake and flow levels.

[12] Caribou and Chesuncook Lake Camp Associations letter dated June 24, 2025, Subject: Ripogenus Project (FERC P-2572-141) and Penobscot Mills Project (P-2458-273) Response to Additional Information Request on the Final License Application Schedule A, Item #5; and the clarification letter thereto dated June 26, 2024.

Brookfield has stated that, under the new license, it proposes to manage Ripogenus levels on the basis of the system-wide Rule Curve. TU supports the use of the existing system-wide rule curve.

As the Camp Owners explain, Brookfield did not conduct an error analysis. A key point of the Camp Owners is that: "For the 3 operations model simulation scenarios the overall average annual power generation for the total Ripogenus and Penobscot Mills Project decreased: -0.9%, -2.7% and -2.7%. Based on our error analysis these results are well within the model's margin of error of +/- 5%." The filing continues to demonstrate the actual spill is not as great as Brookfield leads you to think.

We ask that FERC conduct an independent error analysis to better understand the true import of the data so that the new license can include the values for fill, summer maintenance and maximum drawdown to best balance project environmental impacts and benefits.

Appendix E –IFW's data on Chesuncook up to pdf page 397 does mention that lake whitefish were last sampled in 1970 - over 50 years ago. Based on studies conducted to date, that lake whitefish have been extirpated from Ripogenus-Chesuncook-Caribou Lake, Maine's third largest, remains a concern. Brookfield as yet to supply a compilation or a collated list of current fish assemblage data organized by reach making comparison with data from the last license application very difficult.

Summary of Requests.

Based on the information presented above, the NGOs request that FERC:

- We support the Camp Owners' request to modify Scenario 26 as follows:
  -- Eliminate 3,000 cfs flow from North Twin
  -- Remove the dry years including 2021, 2001, 2002, 2016, 2004, 2020 and 2015 from the simulation calculations.

- Conduct an independent analysis of the Ops Model runs including an Operations Model error analysis. TU and the other NGOs are unable to do this using the proprietary CHEOPS and we are not resourced to conduct one ourselves.

- Request Brookfield to provide a Low Water Plan. 1700 cfs minimum flows will result in the inability of the operator to provide required flows in low-water years.

- Request Brookfield to redo the Wadability/Fishability study to include flows of up to 1000 cfs.

- Request Brookfield to redo the Fish Stranding Mitigation Study Report that includes measures to reduce the severity of the well-documented fish kills that occur upon generator trip events, including restoring a dam keeper at McKay station, providing 400 cfs buffering flows into the gorge from a cool water source, automate some of the gates at Ripogenus dam and install redundant power lines from McKay Station to Millinocket or other grid access point.

- Request Brookfield to redo the Fish Stranding Mitigation Study and at least comment on TU's proposals to install a dam keeper and run 400 cfs cold water buffering flows in the gorge.

- Request Brookfield to provide the data basis and calculations used to derive the 350 cfs estimate of the July 17, 2025 trip event flows.

Additionally, TU requests that Brookfield make an earnest effort to include analysis that informs the full range of operating parameters for the projects in its remaining reports:

- Recreation Management Plan

- Historic Properties Management Plan

- Loon Management Plan

- Wildlife Management Plan

- Shoreline Management Plan

- Upstream and Downstream Eel Passage Plan

- Fishway Operation and Maintenance Plan

- Operations Compliance Monitoring Plan (including Low Inflow Protocol)

TU reiterates the requests the NGO's jointly stated in their last joint filing that Brookfield:

1. Find a technical solution that avoids low flows occurring with generator trip events and provides the water from a coldwater source

2. Establish an appropriate flow regime below Stone Dam

3. Establish lake levels that support recreation, wildlife and fisheries both on the lakes and downstream

4. Respond to changes to recreational use of West Branch resources

5. Determine the feasibility of preferred flow and lake level scenarios through Ops Model runs that respond to stated parameters.

6. Determine economic tradeoffs for the full range of flow options for both Ripogenus/McKay Station and Stone Dam.

Very respectfully submitted,

Stephen G. Heinz
Maine TU Council FERC Coordinator

Attachments A through F: Videos taken July 17, 2025 by Greg Sarnacki at McKay Station (separate files)

Electronic Copies to: Tim Obrey, MDIFW; Brian Cavanah, Robert Wood, Laura Paye MDEP; Carl Wilcox – FERC Compliance

Attachment B

From: **Neal Hagstrom** troutnh@hotmail.com
Subject: Fw: West Branch flow excursions and forest fire
Date: June 18, 2025 at 2:55 PM
To: Stephen Heinz heinz@maine.rr.com, Kathy Houston khlally14@gmail.com, Bob Nasdor bob@americanwhitewater.org, Mark Zakutansky mzakutansky@outdoors.org, Matt Streeter mstreeter212@gmail.com, Gregory Friel mtnman11@myfairpoint.net

FYI- outage information from Tim Obrey.
Neal

From: Obrey, Tim <Tim.Obrey@maine.gov>
Sent: Wednesday, June 18, 2025 2:51 PM
To: Neal Hagstrom <troutnh@hotmail.com>
Subject: FW: West Branch flow excursions and forest fire

Fyi. Just received this.

From: Bernier, Kevin <Kevin.Bernier@brookfieldrenewable.com>
Sent: Wednesday, June 18, 2025 2:14 PM
To: Obrey, Tim <Tim.Obrey@maine.gov>; Perry, John <John.Perry@maine.gov>; Kane, Douglas <Douglas.Kane@maine.gov>; Way, Bryan C <Bryan.C.Way@maine.gov>; Theriault, Billie J <Billie.J.Theriault@maine.gov>; Godsoe, Benjamin <Benjamin.Godsoe@maine.gov>; Mohlar, Robert C <Robert.C.Mohlar@maine.gov>; Cross, Amanda S <amanda_cross@fws.gov>; Bryan Sojkowski <Bryan_Sojkowski@fws.gov>; Dunham, Kevin <Kevin.Dunham@maine.gov>; Gallant, Kevin <Kevin.Gallant@maine.gov>; Paye, Laura <Laura.Paye@maine.gov>; Caron, Mark <Mark.Caron@maine.gov>; Patrick Dockens (patrick_dockens@fws.gov) <patrick_dockens@fws.gov>; Briggs, Claire <Claire.Briggs@maine.gov>; Bishop, Joseph <bishop.joseph@epa.gov>; John Spain <john.spain@ferc.gov>; Noel J. Aglubat <noel.aglubat@ferc.gov>
Cc: Weaver, Nick <Nick.Weaver@brookfieldrenewable.com>; Osborne, Michael <Michael.Osborne@brookfieldrenewable.com>; Dill, Richard <Richard.Dill@brookfieldrenewable.com>; Bates, David S <David.Bates@brookfieldrenewable.com>; Scarzello, Michael <Michael.Scarzello@brookfieldrenewable.com>; Mapletoft, Thomas <Thomas.Mapletoft@brookfieldrenewable.com>; Dorman, Randy <Randy.Dorman@brookfieldrenewable.com>; Heidrich, David <David.Heidrich@brookfieldrenewable.com>; Wainwright, Paul <Paul.Wainwright@brookfieldrenewable.com>; Grevstad, Justin <Justin.Grevstad@brookfieldrenewable.com>; Burnett, Amy <Amy.Burnett@brookfieldrenewable.com>; York, Jason <Jason.York@brookfieldrenewable.com>; Mcdonough, Patrick <Patrick.McDonough@brookfieldrenewable.com>; Pocquette, Kayla <Kayla.Pocquette@brookfieldrenewable.com>; Stevens, Nate <Nathan.Stevens@brookfieldrenewable.com>; Brenton, Paul <Paul.Brenton@brookfieldrenewable.com>; Fradique, Andrea <Andrea.Fradique@brookfieldrenewable.com>; Goodhart, Cameron <Cameron.Goodhart@brookfieldrenewable.com>
Subject: West Branch flow excursions and forest fire

At 14:24 hrs yesterday afternoon, several of Great Lakes Hydro America, LLC's (GLHA) hydro stations on the West Branch of the Penobscot River (McKay, North Twin, and Millinocket) tripped offline due to a transmission line failure, which in turn caused a minimum flow excursion at the Ripogenus Project (FERC No. 2572) and a run-of-river and minimum flow excursion at the Millinocket Development (Penobscot Mills Project, FERC No. 2458). In response to the McKay Station trip, which is part of the Ripogenus Project, the System Operator dispatched a local operator to the Project. Following a public safety check and activation of the siren warning system, the operator opened a crest gate at the dam to re-establish river flows. Local operators were also dispatched to the North Twin and Millinocket Developments (both part of the Penobscot Mills Project) to re-establish river flows. After public safety checks were made downstream and siren warning systems activated, a Taintor gate was opened at the North Twin Development and the inflatable flashboard system was deflated at Stone Dam (part of the Millinocket Development) to restore river flows.

Article 403 of the Penobscot Mills license requires that the Millinocket, Dolby, and East Millinocket Developments be operated in a run-of-river mode while providing an instantaneous minimum flow of 2,000 cubic feet per second (cfs) to the West Branch of the Penobscot River at Millinocket. As the result of the Millinocket station trip, river flows at Millinocket dropped below the 2,000 cfs minimum until the inflatable flashboard system could be opened approximately 58 minutes after the trip.

Article 402 of the Ripogenus license requires an outage flow of 400 cfs during generating unit outages at McKay Station, with scheduled minimum flows to be resumed as quickly and practically as possible. Although the minimum flow system at the Station functioned properly on two units currently in operation (#1 and #3) during yesterday's outage, the third unit (#2) is currently inoperable due to ongoing replacement of a thrust bearing oil cooler. As a result, approximately 350 cfs was passed through McKay Station and into the West Branch during the event, resulting in an approximate 101-minute minimum flow excursion until the gate could be opened at Ripogenus Dam.

GLHA has determined that the station trips resulted from a cross-arm failure on the Ripogenus Project transmission line, which in turn resulted in a small forest fire. The fire was extinguished by Maine Forest Service and local fire department crews last evening.

GLHA is still investigating and collecting information on this event, which will be detailed in a report to FERC within 10 days. I will copy everybody on this report, but in the meantime, please let me know if you have any comments or questions.

Kevin Bernier
Senior Compliance Specialist

Brookfield Renewable U.S.
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Brookfield

Appendix C
Fish Stranding Mitigation Study Report

McKay Station Fish Stranding Mitigation Study Report

1.0 Introduction

Great Lakes Hydro America, LLC ("GLHA" or "Licensee") is the Licensee of the Ripogenus Project (FERC No. 2572) (Project) located on the West Branch of the Penobscot River (West Branch) in Penobscot and Piscataquis counties, Maine. In accordance with 18 Code of Federal Regulations (CFR) §5.15, the McKay Station Fish Stranding Mitigation Study was conducted in response to the Federal Energy Regulatory Commission's (FERC's) Second Study Plan Determination (SPD) dated September 19, 2023.

2.0 Basis for the Study

Based on study requests from stakeholders, FERC's May 13, 2022 SPD required GLHA to conduct a Fish Stranding Study in the West Branch downstream from McKay Station. The study was designed to evaluate the level of fish and macroinvertebrate stranding and mortality associated with an unplanned station trip (i.e., outage) at McKay Station, when flows would drop from generation releases (about 2,000 cubic feet per second [cfs]) to the outage flow of approximately 500 cfs[1]. The results of the Fish Stranding Study were provided in the Initial Study Report (ISR) filed with FERC on April 24, 2023, and indicated that stranding and mortality of fish and macroinvertebrates occurs in the West Branch downstream of McKay Station when river flows change abruptly due to an unplanned station trip.

Based on the results of the Fish Stranding Study and stakeholders requests, FERC's September 19, 2023 SPD required GLHA to conduct a McKay Station Ramping Rate Study[2] to explore protocols for changing flows at McKay Station that could reduce or eliminate stranding and mortality of fish in the West Branch. The results of the McKay Station Ramping Rate Study were provided in the Final License Application (FLA) filed with FERC on September 30, 2024, and indicated that stranding and mortality of fish and macroinvertebrates occurs in the West Branch downstream of

[1] As further discussed in this report, approximately 500 cfs represents the existing mitigation flow that is provided from McKay Station upon an unplanned station trip. This flow is in addition to any flows provided via Ripogenus Dam at the time of the unplanned outage.

[2] Though both the Fish Stranding Study and the McKay Station Ramping Rate Study are associated with evaluating stranding and mortality of aquatic organisms downstream of McKay Station, the studies differ in that the former addresses flow changes resulting from an unplanned station trip/shutdown and the latter addresses flow changes resulting from normal station operations.

McKay Station when river flows change during station operations, but to a lesser degree than the stranding/mortality that occurs during an unplanned station trip.

Based on the results of the Fish Stranding Study, FERC's September 19, 2023 SPD required GLHA to conduct a McKay Station Fish Stranding Mitigation Study to identify and assess measures to minimize the level of fish and macroinvertebrate stranding and mortality that occurs when McKay Station trips offline. FERC indicated that GLHA should consult with the U.S. Fish and Wildlife Service (USFWS), Maine Department of Inland Fisheries and Wildlife (MDIFW), and Maine Trout Unlimited (TU) to determine: 1) what effect the unplanned outages at McKay Station have on the fish and macroinvertebrate populations in the West Branch downstream from McKay Station; and 2) if appropriate, identify potential ways to address fish and macroinvertebrate stranding and mortality downstream from McKay Station. FERC indicated that examples of measures that could be considered to mitigate fish stranding downstream of McKay Station include: 1) a minimum flow that reduces the amount of stranding that is occurring; 2) a battery back-up system that supplies power to a unit or units at McKay Station when the main power source is unavailable, which would reduce the amount of time at the low flow; or 3) automating a gate a Ripogenus Dam so that when McKay Station trips offline, a gate opens to release the present minimum flow to the West Branch downstream of Ripogenus Dam.

In addition to the aforementioned studies required by FERC during the ongoing relicensing proceeding for the Ripogenus Project, via letter dated August 22, 2023,[3] FERC's Division of Hydropower Administration and Compliance also requested that GLHA identify and implement interim measures aimed at reducing the instances of fish and macroinvertebrate strandings downstream of McKay Station during downramping events, such as unit outages, until the current relicensing process is concluded and a long-term measure is identified, if determined necessary. Accordingly, via letter dated January 19, 2024,[4] GLHA filed with FERC an interim plan for the protection of aquatic resources during McKay Station outages.

This study report provides an overview of the results of the Fish Stranding Study, McKay Station Ramping Rate Study, GLHA's Interim Plan for the Protection of Aquatic Resources during McKay Station Outages, and an evaluation of potential measures to mitigate the effects of unplanned

[3] Accession Number: 20230822-3052
[4] Accession Number: 20240119-5146

McKay Station outages. The results of these studies and additional analyses conducted by GLHA were used to develop this McKay Station Fish Stranding Mitigation Study Report.

3.0 Study Goals and Objectives

The goals and objectives of this study are to: 1) determine what effect unplanned outages at McKay Station and/or normal operations of McKay Station have on fish and macroinvertebrate populations in the West Branch downstream of McKay Station; and 2) if appropriate, identify and assess measures to minimize the level of fish and macroinvertebrate stranding and mortality that occurs when flows in the West Branch downstream of McKay Station are modified due to normal operation of McKay Station and/or due to unplanned station outages.

4.0 Study Area

The study area includes the West Branch downstream of McKay Station to Nesowadnehunk Deadwater where the potential for fish stranding occurs based on operations or outages at McKay Station.

5.0 Study Methodology

The methodology for the McKay Station Fish Stranding Mitigation Study consisted of the following:

- Provide a general description of the Project and its operations, including a summary of the historical and current procedures for providing flows during a station outage;
- Provide a summary of the results of the Fish Stranding Study and McKay Station Ramping Rate Study;
- Provide a summary of historical and existing fish assemblage in the West Branch downstream of McKay Station and evaluate if operations of McKay Station affect the fish and macroinvertebrate populations in the West Branch;
- Provide a summary of historical evaluations for providing minimum flow during station outages;

- If operations of McKay Station are having a population-level effect on fish and macroinvertebrates in the West Branch downstream of McKay Station, identify proposed mitigation measures to limit or eliminate the effect.

6.0 Results

6.1 Project Description

The Ripogenus Project was originally constructed between the late-19th century and early-20th century to meet the hydromechanical and hydroelectric demands of the Millinocket and East Millinocket Paper Mills, which were constructed in 1900 and 1906, respectively, and fully shuttered in 2008 and 2013, respectively.

FERC issued an original license for the Ripogenus Project on December 20, 1968 (with an effective date of October 1, 1951), which expired on December 31, 1993. The Project operated under an annual license until a new license was issued to Great Northern Paper, Inc. on October 22, 1996. On May 19, 2000, the Commission issued an order transferring the license from Great Northern Paper, Inc. to GNE, LLC, and on August 26, 2002, FERC issued an order amending the license to reflect a change in the Licensee's name from GNE, LLC to Great Lakes Hydro America, LLC (the current Licensee).

McKay Station was constructed and began operation in the mid-1950s. McKay Station currently has three turbine units (Units 1, 2 and 3) with a hydraulic capacity ranging from approximately 400 cfs (with one unit operating) to 3,500 cfs with all three units in operation[5] (Table 1).

[5] Historically, the units were capable of operating at a hydraulic capacity ranging from approximately 400 cfs to 1,100 or 1,300 cfs. However, currently the units vibrate significantly at gate positions less than 70% to 80% of maximum hydraulic capacity, depending on the impoundment water surface elevation. Therefore, under typical operations, compared to an extended ramping of the units during startup or shutdown, the units are operated to rapidly move through the vibration zones to avoid damage to the units.

Table 1. Type and hydraulic capacity of turbines at the Ripogenus Project

Unit No.	Turbine Type	Minimum Hydraulic Capacity (cfs)	Maximum Hydraulic Capacity (cfs)
1	Vertical Francis	400	1,100
2	Vertical Francis	400	1,100
3	Vertical Francis	424	1,300
Total		**--**	**3,500**

Project Operations

The 1968 license for the Ripogenus Project included two articles related to the operation of the Project.

- Article 32 required that the Project operate in such a manner so as to provide an outflow during the flood season which, when combined with the runoff of the intervening area between the Ripogenus Project and the North Twin Development, will not cause an outflow that would exceed the spillway capacity of the North Twin Development.
- Article 33 required that the Project operate to provide a minimum flow of 200 cfs, as long as any storage remains in Ripogenus Lake, in the West Branch immediately below McKay Station and, following consultation with the MDIFW and the USFWS, take such steps as may be necessary to protect the fishery resources in the river channel between the dam and McKay Station.

Although operations data are not available for the period under the 1968 license, a description of typical Project operations was provided in the 1991 License Application filed with FERC in support of obtaining new licenses for the Projects in 1996. Under the 1968 licenses, McKay Station generated 40 Hz power to power the Millinocket and East Millinocket paper mills, with loads supplied by the grid being mostly large groundwood grinder motors where loads varied significantly during the grinding process. Due to the large size of these loads relative to the 40 Hz system, the system was prone to frequency upsets when the load changes occurred. Individual hydro governor controls on each hydro unit sensed the change in frequency when the load on a grinder motor changed and adjusted generator outputs in terms of flow and generation to compensate for the change and achieve a new balance. These frequency changes and governor responses made it impossible to maintain instantaneous flows at all 40 Hz hydro generators,

particularly at McKay Station, which was the first station to respond to a frequency upset (GNNC 1991). Hence, flows downstream of McKay Station historically varied during mill operations.

The Ripogenus Project operates as a store-and-release development using an annual seasonal drawdown to provide a reliable source of flows downstream of the Project. As presented throughout the relicensing proceeding, the Ripogenus Project is the primary water source that supports flows on the West Branch and main stem of the Penobscot River. Article 402 of the existing license requires minimum flows downstream of McKay Station into the West Branch as specified in Table 2. Flows below McKay Station are provided via the turbines; however, if necessary, GLHA will manually open a gate at Ripogenus Dam to augment flows.[6]

Table 2. Minimum flow requirements downstream of McKay Station for the Ripogenus Project

Date Range	Minimum Flow Requirement[1]
Fish Spawning or Incubation	
September 16 – October 14	1,000 cfs to facilitate drawdown of the North Twin impoundment (part of the Penobscot Mills Project).
October 15 – November 15	At least 1,422 cfs or inflow, but not less than 1,300 cfs[2] for salmon spawning.
November 16 – June 7	Greater than 1,422 cfs (or the spawning flow established above for the year)[2] for salmon incubation.
Whitewater	
May 1 – September 15 (8:30 AM – 5:00 PM)	Normal hydrologic year[3]: • 2,300 cfs on Saturdays and Sundays • 2,200 cfs on Mondays and Fridays • 2,000 cfs on Tuesdays through Thursdays Wet or dry hydrologic year[3]: • 2,200 cfs on Saturdays and Sundays • 2,000 cfs on Mondays and Fridays • 1,800 cfs on Tuesdays through Thursdays
September 16 – October 1 (8:30 AM– 5:00 PM)	Normal hydrologic year[3]: • 2,300 cfs on Saturdays and Sundays Wet or dry hydrologic year[3]: • 2,200 cfs on Saturdays and Sundays
June 8 – October 14 (5:00 PM – 8:30 AM)	1,000 cfs
Station Outages	
Times of generating unit outage	400 cfs with scheduled minimum flows identified above to be resumed as quickly as possible by releases from Ripogenus Dam if necessary, but in no event in more than three days following the initial outage.

[1] Minimum flow shall be the minimum flows for each hourly period measured on the basis of an hourly average.
[2] Flows to be established each year in consultation with the USFWS and MDIFW.
[3] The whitewater flow for each month from May through September is determined on the first day of each month based on an analysis of Total Available Water as described in the Water Use Plan in the application for new license filed with the Commission on December 17, 1991. The determination of "wet," "normal," or "dry" shall remain

[6] The planned release of any flows from Ripogenus Dam are provided with consideration of public safety within the reach below the dam.

constant during the month based on the first day of the month classification. The range of "normal" available water represents the expected available water during normal hydrologic conditions. It is defined as the range between x-s and x+s, where "x" is the mean value and "s" is the standard deviation. Based on a statistical analysis, total available water would be expected to be within this "normal" range two-thirds of the time and outside of this range ("wet" or "dry" years) one-third of the time.

Flows during McKay Station Outages

On May 3, 1991, following extensive consultation with resource agencies and the desire for a downstream mitigation flow following unplanned station outages, Great Northern Nekoosa Corporation (licensee for the Project at the time) filed with FERC a Plan for Providing Minimum Flow (1991 Plan) that detailed the proposed use of a braking system to provide a flow of approximately 400 cfs into the West Branch during unplanned outages at McKay Station. A copy of the 1991 Plan is provided in Attachment 1 of this study report. At the time of the relicensing, the implementation of the plan, in combination with the development and operation of the Holbrook Side Channel, was determined to provide the necessary mitigation to address the occurrence and frequency of unplanned outages at McKay Station.

As detailed in the 1991 Plan, the braking system was operated by automatically closing the wicket gates when a station trip occurred, which in turn slowed the turbines until the brakes (which were clamped to the turbine shaft discs) could bring the turbines to a complete stop. Once the turbines stopped, the wicket gates automatically reopened to 8 to 9 percent gate, which allowed approximately 400 cfs to pass while the brakes held the turbines in a stationary position. Testing of the system, as detailed in the 1991 Plan, demonstrated that it took approximately 20 minutes for this system to release the full 400 cfs to the West Branch below McKay Station following a station outage.

In May 2016, the braking system malfunctioned during an outage at McKay Station under high head conditions when the Ripogenus impoundment was nearly full. GLHA determined that the high water levels resulted in significant forces that could not be overcome (by the existing braking system) to brake and stop the units. As indicated in a letter to FERC dated February 16, 2018, GLHA identified an improved system for releasing minimum flows during outages at McKay Station which involved spinning (rather than braking) of the units to pass flow, which was tested and found to successfully provide an estimated flow of 479 cfs. The unit spinning system to provide the required flow during an unplanned station outage remains in effect today with flows

of at least 400 cfs provided to the West Branch from McKay Station within a few minutes after a station trip occurs.

6.2 Summary of Fish Stranding Study Results

Over the term of the Project's existing license, the frequency and duration of unplanned McKay Station outages have been greatly reduced. As discussed further in this report, this reduction in unplanned McKay Station outages is the result of upgrades within the powerhouse and transmission system, as well as improved response measures. Currently, unplanned station outages occur infrequently (i.e., an average of 0.7 outages per year), with five documented occurrences from 2018 through 2024 (2 in 2018, 2 in 2021, and 1 in 2023), which, on average, lasted approximately 3.5 hours. To date, there have been no unplanned outages in 2025. During unplanned station outages, GLHA implements a procedure that provides the required 400 cfs outage flow (i.e., via the automated flow from McKay Station in combination with leakage and/or seasonal minimum flows released from Ripogenus Dam) to the West Branch within minutes. The outage minimum flow is provided until the outage is resolved, units are restored to service, or a gate can be safely opened at Ripogenus Dam. For the October 2022 Fish Stranding Study, a typical unplanned station outage was simulated by reducing the flow from McKay Station from approximately 2,200 cfs to 510 cfs, maintaining 510 cfs for 4 hours, and then restoring flow from McKay Station to 2,200 cfs. During the simulated outage, changes in water surface elevation occurred in approximately 15 to 30 minutes in the upper reaches of the study area. River water surface levels stabilized after approximately 1 hour at Telos Bridge and after 3.5 hours at the Nesowadnehunk Deadwater. In the West Branch, the total change in water surface elevation varied from 1.4 feet at the upstream end of the Nesowadnehunk Deadwater to 3.4 feet at Telos Bridge, a high gradient reach that is relatively narrow in some areas. The changes in water surface elevation at Big Eddy and Little A were both approximately 2 feet. Of note, no changes in water surface elevation occurred within the Holbrook Side Channel, an existing mitigation measure implemented to provide landlocked salmon nursery and spawning habitat. Aquatic habitat along the shorelines was exposed during low flow conditions; however, much of the river channel remained wetted.

Stranded fish were observed throughout seven distinct reaches of the West Branch between McKay Station and the Nesowadnehunk Deadwater. Approximately 450 stranded fish were observed during the study, representing 9 species: landlocked salmon, brook trout, slimy sculpin, blacknose dace, common shiner, white sucker, fallfish, yellow perch, and banded killifish. Most stranded fish

were young-of-year landlocked salmon (55%) followed by blacknose dace (31%) and banded killifish (5%). Of the stranded fish observed, approximately half were classified as mortalities. Most stranded fish were small-bodied species and lifestages such as juvenile landlocked salmon, dace, and sculpin. No observations of large adult landlocked salmon or adult brook trout occurred. Of the seven reaches, the Little A Falls had the highest abundance of stranded fish, followed by Big Eddy, and then the West Branch near the Holbrook Side Channel. There was no stranding of fish or macroinvertebrates observed within the Holbrook Side Channel or the Big A Falls reach. Stranded macroinvertebrates observed included crayfish, stonefly larvae, caddisfly larvae, dragonfly larvae, and leeches. Most invertebrates were alive and able to find shelter in wetted areas during the 4-hour-long simulated station outage. A limited number of macroinvertebrate mortalities were observed.

6.3 Summary of McKay Station Ramping Rate Study Results

The McKay Station Ramping Rate Study was conducted by making planned changes in unit operations at McKay Station and observing the study reaches in the West Branch downstream of the station to document changes in water depth and instances of fish or macroinvertebrate stranding.

- During Scenario 1 (July 17, 2024), GLHA operated 3 units at or close to maximum hydraulic capacity (~3,500 cfs) starting at 8:00 AM. At approximately 2:00 PM, GLHA simultaneously shut down 2 units and operated the remaining unit near full hydraulic capacity (~1,000 cfs).

- During Scenario 2 (July 24, 2024), GLHA operated 3 units at or close to maximum hydraulic capacity (~3,500 cfs) starting at 8:00 AM. At approximately 2:00 PM, GLHA shut down 1 unit and continued operating 2 units for 1 hour (until 3:00 PM), then shut down another unit, and operated 1 unit near full hydraulic capacity (~1,000 cfs).

Both operational scenarios resulted in rapid changes to river flow downstream of McKay Station and some stranding of fish and macroinvertebrates along shorelines and exposed habitats. During Scenario 1, water depth in the West Branch was reduced 2.3 feet near the Holbrook Side Channel, 2.4 feet downstream of Big Eddy, and 2.0 feet at Little A. During Scenario 2, total change in water depth in the West Branch was very similar to Scenario 1, but Scenario 2 resulted in a slower overall rate of change in water surface elevation and water depth, particularly at the Big Eddy and Little

A study reaches. The average rate of change in water depth was 0.04 foot/min (0.5 inches/min) during Scenario 1 (3 units to 1 unit) and 0.02 foot/min (0.25 inches/min) during Scenario 2 (3 units to 2 units to 1 unit). Under both scenarios, at 1 unit flow (~1,000 cfs), some aquatic habitat along the shorelines was exposed; however, most of the river channel remained wetted with ample water for fish and invertebrates.

A total of 81 stranded fish during Scenario 1 and 71 stranded fish during Scenario 2 were observed in the three study reaches. There were 23 observed fish mortalities during Scenario 1 and 33 observed fish mortalities during Scenario 2. Stranded fish species included: landlocked salmon young-of-year, slimy sculpin, blacknose dace, white sucker, fallfish, yellow perch, American eel, brown bullhead, and unidentified minnow species. Most stranded fish were small-bodied species and life stages such as juvenile landlocked salmon, small adult dace, and slimy sculpin. Of the total number of fish observed, 37 percent were classified as mortalities. No adult landlocked salmon or adult brook trout were observed in the three study reaches.

Approximately 287 stranded macroinvertebrates were observed during Scenario 1 and 189 during Scenario 2. Stranded macroinvertebrates included crayfish, stonefly larvae, caddisfly larvae, mayfly larvae, damselfly larvae, and leeches. Most invertebrates (97%) were alive and able to find shelter in wetted areas following reductions in river flow and water surface elevation. Very few invertebrate mortalities were documented. Fewer invertebrate strandings were observed during Scenario 2, likely because of the slower rate in which the water level decreased. No freshwater mussels were observed during the study.

The study demonstrated that some stranding of fish and macroinvertebrates occurs when operations are modified from 3 units to 1 unit at McKay Station. However, in comparing the two scenarios, pausing at 2 unit operation for 1 hour limited the overall effects of these operational changes. In total, fewer stranded organisms were observed during Scenario 2 (3 units to 2 units to 1 unit), suggesting the rate of change in water depth allowed more organisms to move out of shallow shoreline habitats and into the free flowing main stem of the river. The study reaches were positioned within 2.6 river miles downstream of McKay Station. The rate of change in water depth and, therefore, fish and invertebrate stranding, would be expected to decrease further downstream in the West Branch.

Review of operational data from 2014 through 2023 demonstrate that rapid changes in unit operation (i.e., modifying operations from 3 units to 1 unit) at McKay Station occur very

infrequently. There have been four occurrences when McKay Station operations were modified from 3,000 cfs or greater to 1,000-1,300 cfs in the past 10 years (i.e., an average of 0.4 occurrences per year) and a total of 350 occurrences when station flow was reduced by greater than 25 percent as compared to the preceding hourly flow. Although the 2024 study demonstrated that stranding occurs when station flow is reduced from 3,500 cfs to 1,000 cfs, the infrequency of these operational changes diminishes the overall effect they have on fish and aquatic communities in the West Branch, which is supported by data and testimonials that the West Branch downstream of McKay Station continues to be one of the premier landlocked salmon fisheries in the State of Maine.

6.4 Summary of Aquatic Resources in the West Branch downstream of McKay Station

The West Branch downstream of McKay Station provides for and supports habitat that is managed by MDIFW as a high-quality, coldwater salmonid fishery. The reach includes an 1,800-foot-long section of steep-sided gorge immediately downstream of McKay Station that transitions into riffle, run, pool, and tributary habitats that provide habitat for spawning, nursery, and adult lifestages for landlocked salmon, brook trout, and other game and non-game fish species. Almost all landlocked salmon in this reach are wild, completing their entire life cycle in the river. This life history is unusual because landlocked salmon generally spawn in tributaries and rear in larger lakes. The West Branch downstream of McKay Station, however, provides adult habitat in large deadwater areas and pools, and it provides ample spawning, rearing, and nursery habitat in flowing reaches.

Based on studies completed during the previous relicensing and data collected by the Midwest Biodiversity Institute (MBI) in 2004, the fish assemblage downstream of McKay Station was known to include at least 23 cold and cool water species, including many salmonid species (e.g., landlocked salmon, brook trout, lake trout, whitefish), suckers, perches, minnows, sculpin, American eel, rainbow smelt, chub, stickleback, and chain pickerel.

GLHA performed fish assemblage sampling downstream of McKay Station in the summer and fall of 2022 and in the spring of 2024 using raft electrofishing and hoop net surveys. Fish assemblage data were analyzed using the Maine Rivers Index of Biotic Integrity (IBI or Maine IBI) (Yoder et al. 2008) to provide an overall measure of the condition of the fish assemblage in the West Branch. Based on IBI scores, the 2022 and 2024 Fish Assemblage Study demonstrated that the existing fish community in the West Branch downstream of McKay is of very good or exceptional quality

with no non-native species exerting invasive effects, a predominance of coldwater attributes, and a high proportion of fluvial specialist and dependent species. Maine IBI scores ranged from 65.0 to 90.8. Indexed to the Biological Condition Gradient (BCG) classes established by the New England Large Rivers fish assemblage assessment, this places the West Branch mostly within the range of BCG Level III (60-80; very good), except the Maine IBI scores of 81.3 and 90.8 which are Level II (exceptional). The data from previous fish assemblage sampling in 2004 and 2009 completed by MBI essentially scored the same as in 2022 with one site (WBR 37) with a score of 91.2 about 10 points higher than any site in 2022. Compared to IBI scores for other Maine and New England Rivers, this reach of the West Branch ranks third in terms of its quality only behind the Allagash and Aroostook rivers in Maine and New England (Yoder et al. 2008, Yoder et al. 2015). The Fulton's condition factor for landlocked salmon varied between 0.65 and 1.40 for adults, with a mean of 0.92, and between 0.66 and 1.48 for juveniles with a mean of 0.95 in 2022. Similar results were obtained in May 2024 ranging from 0.57-1.34 with a mean of 0.89 for adults and a range of 0.60-1.33 and a mean of 1.01 for juveniles. Values of 1.0 are representative of normal growth and condition, while values greater than 1.0 are representative of increased growth and condition and values less than 1.0 are representative of decreased growth and condition.

Via letter dated November 17, 2023, the MDIFW provided information related to the landlocked salmon and brook trout fishery in the West Branch downstream of McKay Station. MDIFW data indicates that catch rates for salmon in the West Branch are very good compared to other similar rivers in the region. Fish catch and size evaluations show that recruitment in the West Branch is robust. MDIFW indicated that these data imply that the low-flow events, which have occurred once or a few times in most years, has an impact, but the impact is not catastrophic for the salmon population in the West Branch. Overall, MDIFW indicated that the low-flow events during station outages do not compromise the salmonid or invertebrate populations in the West Branch; however, each event does cause mortalities, which should be mitigated.

6.4.1 Holbrook Side Channel

As part of the minimum flow improvements and mitigation provided at the Ripogenus Project during the prior relicensing, the licensee constructed the Holbrook Side Channel in 1998, which provides landlocked salmon nursery and spawning habitat. This habitat improvement project is approximately 0.8 mile downstream of McKay Station and created approximately 14.5 acres of instream habitat for landlocked salmon, brook trout, and other fish species. The Holbrook Side

Channel, which is approximately 1,500 feet long, discharges back into the West Branch near Telos Bridge. The design includes two 30-inch-diameter pipes and an associated flow control valve in one of the pipes to divert 35 to 65 cfs (depending on flow conditions in the West Branch) into the side channel through a rock berm. In-river channel bed modifications were made at the outlet of the Holbrook Side Channel where it discharges back to the mainstem of the West Branch and within the large pool in the middle of the side channel. These modifications to the channel bed were made to create a defined and reliable stream outlet from the main river and to provide unobstructed access to the side channel on the downstream end for spawning landlocked salmon.

As a condition of the existing license, the Licensee monitored the success of the Holbrook Side Channel habitat enhancement project for 5 years from 1998 to 2002. Monitoring included annual spawning redd counts and electrofishing surveys. Results of the monitoring demonstrated that landlocked salmon were using the Holbrook Side Channel for spawning and rearing and that the number of redds and juvenile salmon increased substantially after the habitat project was completed. Based on the success of the mitigation project, and in consultation with the agencies, it was agreed to cease monitoring after 2002, but to continue maintaining the Holbrook Side Channel habitat as mitigation for the periodic reduction in flows from McKay Station. GLHA continues to maintain and operate the Holbrook Side Channel to support spawning and rearing habitat for landlocked salmon. More recently, as part of the Fish Stranding Study conducted by GLHA in 2022, it was observed that the Holbrook Side Channel remained fully operational and flowing even when flows in the West Branch downstream of McKay Station were reduced to 510 cfs to simulate an unplanned station outage. As indicated in the FLA filed with FERC on September 30, 2024, GLHA proposes to continue to operate and maintain the Holbrook Side Channel as habitat for landlocked salmon and brook trout. Given that the Holbrook Side Channel is a designed, constructed, and operated mitigation measure, and GLHA is proposing to continue to manage and operate this mitigation measure over the term of the Project's new license, it is GLHA's understanding that the Holbrook Side Channel should continue to be classified as mitigation, in part to address the varying and periodic low flows associated with McKay Station.

6.5 Summary of Measures Evaluated to Provide Minimum Flows during Station Outage to Protect Aquatic Resources

6.5.1 1991 Minimum Flow Evaluation

As indicated in a May 3, 1991 letter filed with FERC (Attachment 1) (and summarized in a January

19, 2024 letter filed with FERC), in 1991, Great Northern Paper evaluated three alternatives for providing the minimum flow at McKay Station during a station outage: 1) automating a gate at Ripogenus Dam so that flows could be released into the Upper Gorge without delay caused by the need to dispatch an operator to manually open a gate; 2) passing a minimum flow at McKay Station by installing a bypass pipe and valve either at the end of the power tunnel or off the penstock for Unit 1; and 3) passing a minimum flow through one or more turbines by using the existing butterfly valves and wicket gates and applying the turbine brakes to prevent rotation.

Alternative No. 1 – Ripogenus Dam Gate Automation

The automating of a gate at Ripogenus Dam to provide a mitigation flow in response to an unplanned station outage was eliminated due to the unacceptable public safety risk, since the reach below Ripogenus Dam is ¾-mile-long, in a remote location, and used by recreational fisherman and other members of the public. In response to FERC's September 19, 2023 SPD, GLHA confirmed that the automation of a gate at Ripogenus Dam is an unviable option due to the public safety risks associated with automated releases of water into the Upper Gorge and the presence of recreational users (e.g., fishermen) in the Upper Gorge. In particular, sudden flow releases into the gorge without warning may not allow enough time for recreational fishermen within the Upper Gorge to escape. Additionally, given the remote location of the Upper Gorge, emergency services are likely not able to arrive in time for a rescue effort resulting from an automated release of water to the Upper Gorge. Due to this public safety risk, GLHA is not proposing or considering the automation of any gates at Ripogenus Dam as a mitigation measure associated with unplanned McKay Station outages.

Alternative No. 2 Bypass Pipe

The construction and operation of a bypass pipe within or upstream (i.e., a tap off of the Project's penstock) of the powerhouse to provide a mitigation flow in response to an unplanned station outage was eliminated in 1991 due to the numerous mechanical and civil limitations and significant construction and operations challenges. In response to the September 19, 2023 SPD, GLHA reviewed the results of the 1991 study relative to McKay Station's current configuration and operations, as well as potential technology improvements and anticipated cost. Based on this review, GLHA has concluded that the results of the 1991 evaluation relative to a bypass pipe (within or upstream of the Project's powerhouse) continue to be valid today. In particular, given that the current mitigation measures provide flows to the West Branch from McKay Station that exceed the required 400-cfs minimum outage flow within minutes of an unplanned outage

(estimated to be 479 cfs during testing in 2018 and 510 cfs during the 2022 station trip simulation), and considering the leakage and seasonal minimum bypassed flows that are released from Ripogenus Dam during normal operations, GLHA concludes that providing a 500 cfs outage flow utilizing a bypass pipe alternative (as considered in the 1991 evaluation) continues to be unwarranted.

Although higher outage flows would be more protective of fish and macroinvertebrate populations in the West Branch downstream from McKay Station (e.g., 1,700 cfs to maintain GLHA's proposed normal operating minimum flow), such flows would significantly increase the technical challenges of installing an automated penstock tap and/or retrofitting the Project's powerhouse to enable higher flow releases. Challenges of constructing a system to automatically release approximately 1,700 cfs at or near the powerhouse include the construction of a bypass pipe that would need to be installed at the dead-end of the tunnel, continue underground (e.g., beneath the parking lot adjacent to the powerhouse), and discharge downstream of the McKay Station at a low enough elevation as to not result in a public safety concern to boaters who access the river in this location. Relative to the 1991 evaluation that raised concerns regarding the water velocities and structural control measures required to automatically release 500 cfs, an increase of the automated release to 1,700 cfs greatly increases the challenges associated with the sizing of the discharge pipe and valve(s), discharge velocities and the means of dissipating the flow at the discharge point, and concerns related to back pressure within the pipe.

If the bypass were to be installed as a tap off of the Project's existing penstock, additional challenges include the requirement of a large valve and pipe access vault to be constructed underground on the upstream (west) side of the Project's powerhouse. The vault would need to be greater than 8,000 cubic feet in size and would require removal of bedrock adjacent to the powerhouse and existing reinforced concrete associated with Penstock No. 1. Consistent with the 1991 evaluation, it is assumed that blasting (which would be inadvisable in this area) would be required to construct the bypass system.

The cost of constructing a bypass system that increases automated outage flows from the current ~500 cfs to 1,700 cfs is much greater than the 1991 estimates. As a AACE International Class V (-50% to +100%) cost estimate, GLHA estimates that the cost of constructing such a bypass system would be in the range of $3,000,000 to $6,000,000.

Alternative No. 3 – Turbine Wicket Gate/Braking System

The 1991 evaluation determined that the implementation of a turbine wicket gate/braking system is a feasible option for providing minimum flows from McKay Station during unplanned station outages. As a result of this evaluation and associated stakeholder consultation and FERC approval, this alternative was tested and implemented in 1991 to automatically release 400 cfs. As described above, the system was subsequently improved to a more reliable unit spinning system in 2018 that currently provides automated bypass flows of about 500 cfs to the West Branch at McKay Station during station outages.

6.5.2 2024 Minimum Flow Evaluation

As referenced above, in addition to the studies and consultation being performed in support of the ongoing relicensing, via FERC's August 22, 2023 letter (provided in Attachment 2 of this study report), GLHA performed consultation with the USFWS, MDIFW, Maine Department of Environmental Protection (MDEP), and the Land Use Planning Commission (LUPC) regarding measures aimed at reducing downstream stranding events associated with Project operations, including unit outages. The letter also requested that GLHA further evaluate measures to provide minimum flows during a station outage. As described above, GLHA has reevaluated the measures identified in the 1991 Plan relative to the Project's existing configuration and operations, as well as an increase in the automated outage flow. Based on this evaluation, GLHA concluded that the best alternative for minimizing affects to downstream aquatic resources during an unplanned station outage is to continue to implement the previously approved unit spinning system in combination with GLHA's ongoing system reliability and transmission line maintenance upgrade activities to reduce the frequency and duration of unplanned outages at McKay Station. As noted above, these activities have resulted in reducing the number of unplanned outages to an average of 0.7 outages per year.

In order to reduce the number of unplanned outages, GLHA's ongoing system reliability and transmission line maintenance activities consist of the following.

- **System Reliability** – GLHA is in the process of implementing a relay coordination study to evaluate reconfiguration of the system relays in order to improve transmission and generation protection. Implementation of the study results will increase the stability and reliability of the system, thereby minimizing outages at McKay Station due to system trips

at other interconnected facilities, which typically result from lightning strikes and local utility outages.

- **Transmission Line Maintenance –** GLHA is in the process of implementing a long-term plan for the repair and upgrade of the Ripogenus Project transmission line to minimize outages of McKay Station caused by transmission line failures. In general, the plan replaces support structures (poles and crossarms) based on periodic inspections aimed at identifying wood rot and structure damage (primarily from woodpeckers). GLHA believes implementation of this plan has been effective, as there have been no station outages caused by transmission line failures since May 2016.

6.5.3 2025 Minimum Flow Evaluation

As described in Section 6.5.1, in response to FERC's September 19, 2023 SPD, GLHA performed a reevaluation of the alternatives associated with the 1991 Plan. GLHA believes that the 1991 consultation process and the resulting plan included a comprehensive series of alternatives. Section 6.5.1 provides the results of GLHA's reevaluation of the 1991 alternatives.

In addition to the 1991 alternatives, GLHA evaluated the potential for the installation of a load bank at the Project. A load bank system would accept the electrical load during a failure event and would allow the plant to pass flows at a reduced capacity. While a load bank system may be technically feasible, there would be significant complications related to cost, attempting to provide the station's normal operating flow of 1,700 cfs, physical space and clearances to install the equipment, unit stability at load, unit availability, and safe heat dissipation. Based on an initial review of this alternative, it is unlikely that such a system would be able to provide flows greater than the existing unit spinning system for the duration of typical outages. Due to these combined factors, in combination with an unknown cost for installation and operation, GLHA does not believe that a load bank system is a suitable alternative.

7.0 Summary and Recommendations

Ripogenus Dam was built in the early 1900s and McKay Station was constructed and operational in the mid-1950s. FERC issued an Original License for the Project in 1968 and a New License in 1996. In 1991, based on agency consultation and an evaluation of various alternatives, the Project's Licensee implemented a minimum flow procedure during unplanned station outages. As approved

by FERC, the measure provided approximately 400 cfs from McKay Station until such time that normal powerhouse operations could be resumed. In 2018, GLHA identified an improved system for releasing minimum flows during outages at McKay Station which involved spinning (rather than braking) of the units to pass flow; this system was tested and found to be effective in providing the required 400 cfs minimum flow (and measured at about 500 cfs) during station outages. Under GLHA's current operations, this outage flow, in combination with year-round leakage and seasonal bypass flows from Ripogenus Dam, is automatically provided downstream of McKay Station following unplanned station outages.

Over the term of the Project's existing license, the frequency and duration of unplanned McKay Station outages have been greatly reduced. As discussed in this report, the reduction in unplanned McKay Station outages is the result of upgrades within the powerhouse and transmission system, as well as improved response measures. Currently, unplanned station outages occur infrequently (i.e., an average of 0.7 outages per year), with five documented occurrences from 2018 through 2024 (2 in 2018, 2 in 2021, and 1 in 2023), which, on average, lasted approximately 3.5 hours. To date, there have been no unplanned outages in 2025. Unplanned station outages are typically caused by factors unrelated to the Project operations such as lightning strikes.

Fisheries data have been historically collected by the Licensee and MDIFW downstream of McKay Station. A comparison of the historical and current fisheries data collected in the West Branch downstream of McKay Station indicates that the fish assemblage is of very good or exceptional quality. Compared to other Maine and New England Rivers, this reach of the West Branch ranks third in terms of its quality only behind the Allagash and Aroostook rivers in Maine and New England. Similarly, the MDIFW indicated that their long-term angler survey data shows that catch rates for salmon in the West Branch are very good compared to other similar rivers in the region (including the East Outlet of the Kennebec River and the Moose River). Fish catch and size evaluations show that recruitment in the West Branch is robust. MDIFW indicated that these data imply that the low-flow events, which have occurred infrequently, have an impact, but the impact is not catastrophic for and does not compromise the salmon population in the West Branch.

Based on a reevaluation of the measures associated with the 1991 plan, as well as consideration of installing a load bank, GLHA has determined that the current alternative of providing the minimum outage flow using the unit spinning system is the best alternative for providing flows downstream

of McKay Station during a station trip. As discussed above, modifying a gate at Ripogenus Dam to provide an automated release is not a viable option due to public safety concerns related to recreational activities within the Upper Gorge. In addition, the various challenges associated with constructing a bypass pipe to provide a higher outage flow (e.g., 1,700 cfs) or installing a load bank in response to an unplanned station outage makes such alternatives also non-viable options.

Based on the results of the studies completed to date, GLHA proposes the following measures for continued operation of the Ripogenus Project:

- Continue to implement the ongoing system reliability measures and transmission line maintenance activities to reduce the frequency and duration of unplanned station outages at McKay Station.

- Continue to implement the current outage minimum flow procedure, which provides approximately 500 cfs of flow from McKay Station into the West Branch within minutes of an unplanned outage of McKay Station. This automated outage flow is in addition to any leakage and/or seasonal bypass flow being released from Ripogenus Dam at the time of the unplanned station outage.

- Continue to operate and maintain the Holbrook Side Channel, which provides approximately 14.5 acres of instream habitat for landlocked salmon, brook trout, and other fish species about 0.8 mile downstream of McKay Station. The Holbrook Side Channel is an existing mitigation measure resulting from the previous relicensing and is intended to provide stable fisheries and aquatic habitat downstream of McKay Station. During the Fish Stranding Study, it was observed by GLHA and MDIFW that flows in the Holbrook Side Channel were not affected by the reduction in river flows caused by a simulated station outage.

- Provide a year-round minimum flow of 1,700 cfs to the West Branch downstream of McKay Station, which will minimize changes in flows and fish and macroinvertebrate strandings/mortalities during normal operations of McKay Station, particularly during the whitewater boating season, as compared to current license requirements.

8.0 Correspondence and Consultation

As discussed above, in response to FERC's August 22, 2023 letter, GLHA consulted with USFWS, MDIFW, MDEP, and LUPC related to measures to provide flows following unplanned station outages. GLHA's January 19, 2024 filing, which is provided in Attachment 2 of this study report, provides details regarding this consultation.

Consistent with FERC's September 19, 2023 SPD, GLHA is providing a copy of this report to USFWS, MDIFW and TU for review and comment. GLHA requests that any comments related to this report be filed directly with FERC within 30 days of the filing and distribution of this report, with a copy of the comments provided to GLHA. Pending comments, GLHA will update the report and file an updated version with FERC.

9.0 Literature Cited

Great Northern Nekoosa Corporation (GNNC). 1991a. Ripogenus Project (FERC No. 2572) Application for New License for Major Existing Dam. Great Northern Nekoosa Corporation, FERC No. 2572. December 1991.

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