



April 2022

Review for Cascade Hydroelectric Project Certification by the Low Impact Hydropower Institute's (LIHI)

Prepared by Gary M. Franc April 11, 2022

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I. INTRODUCTION

The Cascade Hydroelectric Project (CHP or Project) is located at river mile (RM) 135.6 on the Androscoggin River in the City of Berlin and the Town of Gorham, New Hampshire. It is situated immediately below the Cross Power Dam¹ (RM 136.1 on the Androscoggin River), LIHI #174 and upstream of the Upper Gorham Dam² (RM 132.6 on the Androscoggin River), LIHI #175.

The New Hampshire Department of Environmental Services, Water Supply & Pollution Control, now renamed the New Hampshire Department of Environmental Services (NHDES) issued a Section 401 Water Quality Certification (WQC) for the Project on July 6, 1989³.

The Federal Energy Regulatory Commission (FERC) issued a 30 year major license for the CHP as FERC Project 2327 to James River New Hampshire Electric, Inc. (JRNWE), effective August 1, 1994, expiring on August 1, 2024⁴. On April 14, 1997, JRNWE sold the Project to Crown Vantage New Hampshire Electric (CVNWE)⁵. On September 1, 2000, CVNWE changed its name to American Tissue New Hampshire Electric, Inc. (ATNWE)⁶. On June 3, 2002⁷, ATNHE and GNE, LLC (GNE) jointly submitted an application to transfer license ownership to GNE after a bankruptcy sale of ATNHE to GNE. On August 12, 2002⁸, GNE filed notice of changing its name to Great Lakes Hydro America LLC (GLHA). On August 30, 2002, the FERC approved the transfer of the Project license⁹. The Project is currently owned by GLHA which is a subsidiary of Brookfield Renewable Energy Group (BREG).¹⁰ On September 18, 2019, GLHA filed a notice of intent with FERC to relicense the Project¹¹.

The Project, which began operation in 1914, has an authorized total installed capacity of 7.92 megawatts (MW). The LIHI application states the Project produced an average annual generation (AAG) of 39,191 megawatt-hours (MWh) for calendar years 2014 through 2018, which corresponds to an annual plant factor of 56.5%.

GLHA submitted an application for LIHI certification on November 22, 2021. On December 16, 2021, LIHI notified GLHA that the intake review for the Project was complete. The intake review found that the application required only minor additional information, corrections and supporting documentation to perform the full certification review. On February 7, 2022 LIHI posted the certification application for public comment and the supplemental information was received on March 1, 2022. The 60-day public comment period ended on April 8, 2022.

¹ FERC Project No. 2326, LIHI #174

² FERC Project No. 2288, LIHI #175

³ See page 89 of the LIHI application.

⁴ License - <u>https://elibrary.ferc.gov/eLibrary/filedownload?fileid=0156AC4B-66E2-5005-8110-C31FAFC91712</u>

⁵ https://elibrary.ferc.gov/eLibrary/filedownload?fileid=0010D529-66E2-5005-8110-C31FAFC91712

⁶ https://elibrary.ferc.gov/eLibrary/filedownload?fileid=000FAFE6-66E2-5005-8110-C31FAFC91712

⁷ License transfer - <u>https://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=1011183:1</u>

⁸ Licensee name change - <u>https://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=10716935</u>

⁹ https://elibrary.ferc.gov/eLibrary/filedownload?fileid=001A1CB2-66E2-5005-8110-C31FAFC91712

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¹¹ Notice to relicense - <u>https://elibrary.ferc.gov/eLibrary/filedownload?fileid=0203C886-66E2-5005-8110-C31FAFC91712</u>



II. PROJECT GEOGRAPHIC LOCATION

The Androscoggin River is located in the states of New Hampshire and Maine, in northern New England. It is 178 miles long, draining 3,450 square miles (SQMI) with 720 SQMI within New Hampshire. The river joins the Kennebec River at Merrymeeting Bay in Maine before it empties into the Gulf of Maine and the Atlantic Ocean. (See Figure 1).



Figure 1-Androscoggin River Basin



The Androscoggin River drops more than 1,500 feet in its journey from the Rangeley Lakes in Maine, with an average descent of 8 feet per mile, through northeastern New Hampshire, reentering Maine near Bethel and flowing through the state to Merrymeeting Bay. The Androscoggin River watershed can be broken down into two major sections, the upper and lower Androscoggin River watersheds.

The Little Androscoggin River is its largest tributary, flowing from Bryant Pond through Oxford County including Norway and South Paris, Maine, finally joining the main stem at Auburn, Maine. Other tributaries are the Nezinscot River at Turner, Maine, the Webb River at Dixfield Village, Maine and the Ellis and the Swift Rivers joining at Rumford, Maine. At Rumford Falls (LIHI #38), the river drops 177 feet in one mile at Pennacook Falls. The river continues south through Livermore, Livermore Falls (including the Riley, Jay, Otis and Livermore developments, LIHI #48), Auburn, Lewiston, Lisbon and Durham, Maine.

The Androscoggin River basin contains numerous dams that generate hydroelectric power. In the list below, other developments owned by BREG or its affiliates are italicized in blue font. The Project is italicized in red font. The Projects from upstream to downstream include:

- 1. Errol Project at RM 170.1 owned by Brookfield White Pine Hydro and licensed as FERC Project No. 3133;
- 2. Pontook Project at RM 152.4 owned by Pontook Operating LP and licensed as FERC Project No. 2861;
- 3. Sawmill Project at RM 139.2 owned by GLHA and licensed as FERC Project No. 2422;
- 4. Riverside Project at RM 138.8 owned by GLHA and licensed as FERC Project No. 2423;
- 5. J. Brodie Smith Project at RM 138.2 owned by Central Rivers Power (CRP) and licensed as FERC Project No. 2287;
- 6. Cross Power Project at RM 136.9 owned by GLHA and licensed as FERC Project No. 2326;
- 7. Cascade Project at RM 136.3 owned by GLHA and licensed as FERC Project No. 2327;
- 8. Upper Gorham Project at RM 133.2 owned by GLHA and licensed as FERC Project No. 2311;
- 9. Gorham Project at RM 130.4 owned by CRP and licensed as FERC Project No. 2519, LIHI #153;
- 10. Shelburne Project at RM 127.6 owned by GLHA and licensed as FERC Project No. 2300;
- 11. Rumford Falls Upper & Middle Dam at RM 90.9 and 90.7 owned by Rumford Falls Power Company (RFPC) and licensed as FERC Project No. 2333 (LIHI #38);
- 12. Riley Project at RM 69.3 and Jay Project (RM 66.6) owned by Eagle Creek Renewable Energy LLC (ECRE) and licensed as FERC Project No. 2375 (part of LIHI #48);
- 13. Otis Project (RM 63.8) owned by ECRE and licensed as FERC Project No. 8277 (part of LIHI #48);
- 14. Livermore Falls (RM 61.2) owned by ECRE and licensed as FERC Project No. 2375;
- 15. Gulf Island Project at RM 35.0 owned by Brookfield White Pine Hydro and licensed as FERC Project No. 2283, including Deer Rips and Androscoggin No. 3 (LIHI #163);
- 16. Lewiston Falls Project at RM 30.8 owned by Brookfield White Pine Hydro and licensed as FERC Project No. 2302;
- 17. Worumbo Project at RM 15.7 owned by Brown Bear II Hydro, Inc. (BBIIH) licensed as FERC Project No. 3428 (LIHI #10).
- 18. Pejepscot Project at RM 12.5 owned by Topsham Hydro Partners LP (THP) and licensed as FERC Project No. 4784.
- **19.** Brunswick Project at RM 8.0 owned by Brookfield White Pine Hydro and licensed as FERC Project No. 2284.

In 1983 the first Project on the river, Brunswick installed upstream and downstream passage followed by the Pejepscot Hydropower Project in 1987 and the Worumbo Project in 1988. This provided an opportunity for anadromous species to migrate upstream as far as Lewiston Falls.



Inflow to the NH projects is regulated and operated in accordance with a 1983 Androscoggin River Headwater Benefits Agreement (ARHBA)¹². FERC approved the ARHBA¹³ on June 30, 1992. The ARHBA states the Errol dam will release a volume of at least 1,550 cubic feet per second per day (CFSD) provided that:

- 1. Volume releases from Aziscohos Lake into the Magalloway River are sufficient to provide at least one-third of the annual volume release at the Errol dam. The Magalloway River joins the Androscoggin River just upstream of the Errol Dam;
- 2. In the judgement of the Engineering Committee¹⁴ sufficient volume is in the upstream storage ponds to furnish and maintain the 1,550 CFSD at Berlin; and;
- 3. Any party to the agreement requests in writing that the 1,550 CFSD be released and discharged.

There are two US Geological Survey (USGS) gages located near the Project:

- 1. USGS gage 01053600 (GAGE1) on the Androscoggin River upstream of the Project at Cambridge NH. This gage has a contributing drainage area of 1,177 SQMI and started recording streamflow on October 1, 2008;
- 2. USGS gage 01054000 (GAGE2) on the Androscoggin River immediately downstream of the Project near Gorham, NH. This gage has a contributing drainage area of 1,361 SQMI. The Period-of-Record (POR) flows extend from October 1, 1913 to present day, with a block of days from October 1922 through September 1928 where flows were not recorded.

Since GAGE2 is just downstream, Project inflows can be estimated by multiplying GAGE2 recorded flows by a drainage area ratio (DAR) of (1,359/1,361) or 0.9985. Table 1 shows the monthly and annual inflows at the Project based on two separate periods, the POR¹⁵ and calendar years 1989 through 2018, as provided in the LIHI application. As shown, over time, available inflow has increased.

Table 1 - Estimated Inflows using POR and Calendar 1989 -2018 Flow Records													
Flow Range	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ОСТ	NOV	DEC	ANNUAL
POR	2,269	2,291	2,610	4,075	4,256	2,817	2,103	1,928	1,928	2,095	2,197	2,247	2,567
1989 - 2018	2,558	2,675	3,016	4,590	4,020	2,907	2,267	2,015	1,892	2,378	2,628	2,528	2,788
Diff	290	384	405	515	(236)	90	163	87	(36)	284	431	281	221
% Diff	12.8%	16.8%	15.5%	12.6%	-5.5%	3.2%	7.8%	4.5%	-1.8%	13.5%	19.6%	12.5%	8.6%

Based on analyses of estimated Project inflows, the minimum daily flow of 729 cubic feet per second (CFS) occurred on October 14, 2021. The maximum daily flow of 19,971 CFS occurred on June 18, 1917. The Project's POR average annual inflow is 2,567 CFS, about 1.89 CFS per SQMI.

A daily flow of 1,562 CFS is exceeded about 90% of the time annually. A daily flow of 2,041 CFS is exceeded about 50% of the time annually. A daily flow of 3,943 CFS is exceeded about 10% of the time annually. The 1% exceedance annual daily flow is 10,179 CFS. Based on a frequency analysis, the 10-year daily flow is about 16,362 CFS and the 100-year daily flow is 20,885 CFS. The 7Q10¹⁶ flow is estimated as 1,209 CFS.

¹² LIHI Application, Section 7 – page 62

¹³ https://elibrary.ferc.gov/eLibrary/filedownload?fileid=00C3D8A6-66E2-5005-8110-C31FAFC91712

¹⁴ Engineering Committee consists of five members, each representing a hydro owner on the Androscoggin River.

¹⁵ At the time of my analysis, present day was December 15, 2021, making POR from October 1, 1913 through December 15, 2021.

¹⁶ 7Q10 flow is the daily seven day rolling average flow that is exceeded 90% of the time annually. There is only a 10% chance that a seven day rolling average flow less than this value will occur in a given year.

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III. PROJECT SITE CHARACTERISTICS

The Project is located at river mile (RM) 135.6 on the Androscoggin River in the City of Berlin and the Town of Gorham, New Hampshire (See Figure 2), situated immediately below the Cross Dam¹⁷ (RM 136.1 on the Androscoggin River) and upstream of the Upper Gorham Dam¹⁸ (RM 132.6 on the Androscoggin River). Both of these developments are currently LIHI certified.

The FERC issued a 30 year major license as FERC Project No. 2327 effective August 1, 1994, expiring on August 1, 2024¹⁹. The Project is currently owned by GLHA which is a subsidiary of BREG.

The dam (Latitude 44.448852 N, Longitude -71.187116 W) and a grinder room were originally constructed in 1903 by the Berlin Mills Company as a hydro-mechanical site for paper making activities.

The grinder room was converted to a hydroelectric generating powerhouse between 1913 and 1918, as the hydro-mechanical units were replaced one by one with hydroelectric turbine/generators.



Figure 2 - Project Overview

The first hydroelectric energy was produced in 1914. Three hydroelectric units used the same flow as the six hydro-mechanical units, so three penstocks were phased out of service.

The dam is in the same configuration as in 1903. The 583-foot-long, 53-foot-high concrete gravity dam consists of:

- A 15-foot-wide concrete abutment with a top elevation of 908.6 feet mean sea Level (FTMSL). The abutment extends for about 20 feet upstream and about 30 feet downstream perpendicular to the end of the spillway;
- An ogee spillway section with a crest length of 313 feet and a crest elevation of 898.4 FTMSL. Three-foot flashboards establish a normal impoundment elevation of 901.4 FTMSL (See Figure 3).

 $^{^{\}rm 17}$ FERC Project No. 2326, LIHI #174

¹⁸ FERC Project No. 2288, LIHI #175

¹⁹ License - https://elibrary.ferc.gov/eLibrary/filedownload?fileid=0156AC4B-66E2-5005-8110-C31FAFC91712



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Figure 3 - Spillway & Bypassed Reach

- A forebay gate structure controls river flows into the forebay. The structure is about 168 feet long by 15 feet wide. The gate structure consists of 15 three-foot-wide concrete piers and a concrete deck with a top elevation of 908.5 FTMSL. The forebay gates are wooden, each about 9 feet wide and 11 feet high (See Figure 4);
- An abutment, adjacent to the forebay gate structure, which consists of two parallel 3-foot-wide concrete retaining walls with earth fill. The retaining walls extend approximately 88 feet, including 77 feet located inland of the river bank;
- A forebay, downstream of the forebay gate structure, approximately 300 feet long, with an average width of 240 feet. The normal water surface elevation within the forebay is 901.2 FTMSL and the maximum forebay depth is 24 feet. The forebay wall is a concrete gravity structure that extends approximately 326 feet downstream. The wall has a maximum height of 41 feet, with a 4-foot, 11-inch-wide crest at an elevation of 901.5 FTMSL. The forebay wall also has:
 - A deep gate located about 90 feet downstream;
 - A 4-foot-wide by 2.5-foot-deep sluiceway located about 193 feet downstream;
 - A concrete platform located on top of the forebay wall. This platform is about 19 feet by 24 feet and supports an electrical tower with transmission lines.
 - A steel framed brick and block powerhouse structure approximately 135 feet long, 43 feet wide and 67 feet high, with a concrete substructure and 16-foot by 41-foot addition. Three penstocks lead from the head gates to three Francis turbines. Units 1 and 2 each have a maximum hydraulic capacity of 950 CFS and minimum operating turbine flow of 535 CFS. Unit 3 has a maximum hydraulic capacity of 1,050 CFS and a minimum operating turbine flow of 535 CFS. The total hydraulic capacity of the powerhouse of 2,950 CFS, which based on the flow duration analysis, is exceeded annually about 19% of the time. During August and September this period of excess flow drops to about 3% of the time. All flows in excess of 2,950 CFS spill into the bypassed reach.





IV. ZONES OF EFFECT (ZOEs)

The Project is comprised of three ZOEs:

- ZOE 1, the impoundment, extends from the Project's dam and forebay upstream 3,000 feet to the base of the upstream Cross dam (FERC No. 2326) (See red shading in Figure 5);
- ZOE2, the bypass reach, extends directly below the spillway section of the dam to the convergence with the tailrace. The bypass reach is separated from the powerhouse forebay by a 350-foot-long section of retaining wall (See yellow shading in Figure 6), and;
- ZOE 3, the powerhouse tailrace and downstream reach, extends 50 feet directly to the confluence with the bypass reach and continues approximately 2 miles downstream to the regulated reach of the river upstream of the Upper Gorham Project (FERC No. 2288) (See orange shading in Figure 6. Note, only the upper portion of ZOE 3 is shown).



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Figure 5 - ZOE 1



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Figure 6 - ZOE 2 & 3

The alternative standards selected to satisfy the LIHI certification criteria in each of these ZOEs are identified in Table 1. As part of my review process, I checked and agreed with their selection, with the exception of the changes I have noted in **RED**.

CRITERION and STANDARD SELECTED									
	Α	В	С	D	Ε	F	G	Н	
Zone Number and Zone Name	Ecological Flows	Water Quality	Upstream Fish Passage	Downstream Fish Passage	Shoreline and Watershed Protection	Threatened and Endangered Species	Cultural and Historic Resources	Recreational Resources	
1. Impoundment	1	2 , <mark>3</mark>	1	1	2	2	1	1	
2. Bypassed Reach	2	2 , <mark>3</mark>	1	1	2	2	1	1	
3. Tailrace Reach	2	2 , <mark>3</mark>	1	1	2	2	1	1	

Table 1: Zones of Effect

V. REGULATORY AND COMPLIANCE STATUS

A WQC was issued by the NHDES on July 6, 1989²⁰. The FERC issued a 30-year major license (FERC No. 2327) for the Project to JRNWE, effective August 1, 1994, expiring on August 1, 2024²¹. On April 14, 1997, JRNWE sold the Project to CVNWE²². On September 1, 2000, CVNWE changed its name to ATNWE²³. On June 3, 2002²⁴, ATNHE and GNE jointly submitted an application to transfer license ownership to GNE after a bankruptcy sale of ATNHE to GNE. On August 12, 2002²⁵, GNE filed notice of changing its name to GLHA. On August 30, 2002, the FERC approved the transfer of the Project license²⁶. GLHA is a subsidiary of BREG.

On September 18, 2019, GLHA filed a Pre-Application Document (PAD) and a notice of intent to relicense the Project using FERC's Integrated Licensing Process (ILP)²⁷. On March 3, 2022 GLHA filed a draft license application²⁸.

A. Licensing Requirements

The existing FERC license includes a number of requirements intended to restore, protect, and enhance natural resources and improve public access and recreation. The FERC license contains eight license articles pertaining to the Project:

• Article 401 - Requires operating the Project in run-of-river (ROR) mode for the protection of fish and wildlife resources and water quality;

²⁰ See page 89 of the LIHI application.

²¹ License - <u>https://elibrary.ferc.gov/eLibrary/filedownload?fileid=0156AC4B-66E2-5005-8110-C31FAFC91712</u>

²² https://elibrary.ferc.gov/eLibrary/filedownload?fileid=0010D529-66E2-5005-8110-C31FAFC91712

²³ https://elibrary.ferc.gov/eLibrary/filedownload?fileid=000FAFE6-66E2-5005-8110-C31FAFC91712

²⁴ License transfer - <u>https://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=1011183:1</u>

²⁵ Licensee name change - <u>https://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=10716935</u>

²⁶ https://elibrary.ferc.gov/eLibrary/filedownload?fileid=001A1CB2-66E2-5005-8110-C31FAFC91712

²⁷ Notice to relicense - https://elibrary.ferc.gov/eLibrary/filedownload?fileid=0203C886-66E2-5005-8110-C31FAFC91712

²⁸ https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20230303-5000&optimized=false

- Article 402 Requires a minimum flow of 6 CFS or inflow, whichever is less, for the protection and enhancement of fish and wildlife resources and water quality in the bypassed reach of the Androscoggin River;
- Article 403 Requires a plan to monitor ROR operation and minimum flow, as stipulated by Articles 401 and 402, respectively, and to describe how flows will be maintained below the Project when the impoundment is refilled after any maintenance and/or repairs. On May 23, 2003²⁹, FERC approved an amended Minimum Flow and Operating Monitoring Plan (MFOMP) replacing the original plan approved on September 24, 1997³⁰;
- Article 404 Gives FERC authority to require GLHA to construct, operate, and maintain, or provide for the construction, operation, and maintenance of fishways as may be prescribed by the US Department of the Interior (USDOI);
- Article 405 Requires a plan to monitor dissolved oxygen (DO) levels and temperature in the Androscoggin River upstream and downstream of the Project. On December 3, 1996, FERC modified and approved a water quality monitoring plan for the Project³¹;
- Article 406 Requires implementing the provisions of a FERC-approved Programmatic Agreement (PA) for cultural resources;
- Article 407 Requires developing and filing a shoreland management plan (SMP);
- Article 408 Gives GLHA authority to grant permission for certain types of use and occupancy of the project lands and waters and to convey certain interests in project lands and waters for certain types of use and occupancy, without prior FERC approval.

B. Compliance Issues

A review of the FERC docket for the period since GHLA acquired a new thirty-year license for the Project on August 1, 1994 indicated only two deviations of license article 401 and 402 occurred. GLHA reported these deviations to resource agencies and FERC as required. On March 16, 2020, FERC informed GLHA that the ROR deviation that occurred on December 13, 2019 due to ice conditions would not be considered a violation of Article 401³². On May 29, 2018, FERC informed GLHA the ROR deviation occurring on March 13, 2018 due to a power failure would not be considered a violation of license³³.

VI. LIHI PUBLIC COMMENTS

GLHA submitted an application package for LIHI certification on October 8, 2021. On December 15, 2021, LIHI notified GLHA that the intake review for the Project was complete. The intake review found that a revised application was not needed but additional information was required. LIHI posted the application for public comment on February 7, 2022. The 60-day public comment period ended on April 8, 2022.

A. Comment Letters

On February 7, 2022, LIHI filed notice on their email list that the public comment period for the application has been opened. The notice states, *"LIHI is seeking comment on this application. Comments that are directly tied to specific LIHI criteria (flows, water quality, fish passage, etc.) will be most helpful, but all comments will be considered. Comments may be submitted to the Institute by e-mail at <u>comments@lowimpacthydro.org</u> with*

²⁹ https://elibrary.ferc.gov/eLibrary/filedownload?fileid=003357BD-66E2-5005-8110-C31FAFC91712

³⁰ https://elibrary.ferc.gov/eLibrary/filedownload?fileid=0015243C-66E2-5005-8110-C31FAFC91712

³¹ https://elibrary.ferc.gov/eLibrary/filedownload?fileid=0014E0A4-66E2-5005-8110-C31FAFC91712

³² https://elibrary.ferc.gov/eLibrary/filedownload?fileid=02071FD9-66E2-5005-8110-C31FAFC91712

³³ <u>https://elibrary.ferc.gov/eLibrary/filedownload?fileid=01F64C47-66E2-5005-8110-C31FAFC91712</u>

"Cascade Project Comments" in the subject line, or by mail addressed to the Low Impact Hydropower Institute, 1167 Massachusetts Avenue, Office 407, Arlington, MA 02476. Comments must be received at the Institute on or before 5 pm Eastern time on April 8, 2022 to be considered. All comments will be posted to the web site and the applicant will have an opportunity to respond. Any response will also be posted. The project description and complete application can be found HERE³⁴."

No comments were received.

B. Agency Correspondence

On February 7, 2022, LIHI³⁵ emailed contacts³⁶ listed in the Project application as knowledgeable about the Project stating, *"You may have already received this notice if you are on the Low Impact Hydropower Institute (www.lowimpacthydro.org)* email list. However, you were also identified as an agency contact on the LIHI recertification application recently submitted by Great Lakes Hydro America, LLC a subsidiary of Brookfield Renewable Energy Group for the Cascade Hydroelectric Project located on the Androscoggin River in NH. The application reviewer, Gary Franc (copied here), may be in contact with you if he has questions about these projects or wishes to clarify any aspects of the LIHI applications. You may also provide comments directly to LIHI as indicated below. More information about the projects and their application can be found in the link below. If you would like to receive additional notices about these projects or other hydroelectric projects in your region applying for LIHI certification, please sign up for our mailing list³⁷.

No responses were received. Throughout my review, I found no reasons to contact any agencies or individuals.

VII. DETAILED CRITERIA REVIEW

This section contains my review of the Project with regard to the LIHI Certification criteria. As part of my review, I conducted a FERC e-library search to verify claims in the recertification application. My review concentrated on the period since GHLA acquired a new thirty-year license for the Project on August 1, 1994.

A. Ecological Flows

The goal of this criterion is to support habitat and other conditions that are suitable for healthy fish and wildlife resources in riverine reaches that are affected by the facility's operation. The Applicant states the Project satisfies the LIHI flows criterion in ZOE 1 by meeting alternative standard A-1, and in ZOE 2 and ZOE 3 by meeting alternative standard A-2.

Inflow to the Project is regulated by five large storage reservoirs at the headwaters of the Androscoggin River system: Lake Umbagog, Rangeley Lake, Mooselookmeguntic Lake, Richardson Lakes (Upper and Lower), and Aziscohos Lake (See Figure 1).

^{34 &}lt;u>https://lowimpacthydro.org/cascade-project-complete-application-received/</u>

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The Errol Hydroelectric Project impounds Lake Umbagog and serves as the release point for the upper storage reservoir system. It is operated in accordance with the terms of a 1909 agreement between Union Water Power Company (UWPC) and downstream paper and power companies (1909 Agreement).

The 1909 Agreement requires the Errol Project, in combination with the other upstream reservoirs, to target providing at least 1,550 CFS for downstream uses while storage is available. The 1909 Agreement was incorporated into the 1983 ARHBA. The ARHBA ensures that the 1909 Agreement is met and requires hydroelectric generators who benefit from the flow regulation to reimburse the water storage reservoir owner's annual operations and maintenance costs.

The Cascade Project is operated in a ROR mode with minimal impoundment fluctuations. The low headwater level limit is 6 inches below the normal full pond elevation of 901.4 FTMSL. GLHA monitors operations including impoundment elevations and flows through both the powerhouse and as discharged through dam structures continuously to maintain compliance with minimum flow and ROR operation. Any deviations are reported to FERC.

The bypass reach is a 400-foot-long bedrock channel fed by water passing over a 313-foot-long spillway. There is an agency-recommended minimum flow of 6 CFS specific to the bypass reach. In addition, the reach receives water during times of high flow in excess of the capacity of the powerhouse, 3% of the time in August and September and 19% of the time annually, or when the powerhouse units are down.

An instream flow study in the Cascade bypassed reach in consultation with the resource agencies was conducted as part of the licensing proceeding in the late 1980s. Researchers employed transect-based methods to compare physical habitat in the reach at 6 CFS (leakage flow) and at a release of 100 CFS over the dam. See Table 2 for results of study.

Two transects were established in the reach; one in a riffle and one in a large pool. Researchers noted limited changes in wetted stream width or depth at the two flow scenarios. Water velocities increased in the main channel.

Based on the limited changes in aquatic habitat noted during the study, a minimum flow of 6 CFS in the bypassed reach was recommended. GLHA provides the minimum flow through a portion of the flashboards as weir flow.

Table 2 – Bypassed Reach Instream Flow Study								
Variable	Flow 1	Flow 2	Percent Increase					
Flow (CFS)	6	100	1,567					
Wetted Width in Feet (Transect 1)	69	69	0					
Wetted Width in Feet (Transect 2)	104	108	3.85					
Maximum Depth in Feet (Transect 1)	2.4	2.9	20.83					
Maximum Depth in Feet (Transect 2)	8.0	8.2	2.5					
Water Velocity in Feet/Second (Transect 1)	0 to 0.6	1.1 to 3.5	NA to 483					
Water Velocity in Feet/Second (Transect 2)	Negligible	0 to 0.4	-					

According to FERC's November 1993 Final Environmental Impact Statement for the Upper Androscoggin River³⁸, the minimum flow was established by evaluating the Project fishery resources and habitat in the bypassed reach via a fish survey and a minimum flow study. The conclusions were:

- Some wild rainbow trout and an occasional hatchery origin landlocked salmon (all less than 12 inches) were found in the bypassed reach, primarily the result of immigration from upstream areas;
- Stocking of large (8-15 inch) rainbow trout upstream did not seem to be contributing significantly to the fish population in the reach;
- Rainbow trout spawning habitat was virtually non-existent and brown trout spawning habitat was very limited at all modeled flows due to the lack of suitable spawning gravel; and
- Juvenile brown trout habitat was the least abundant life stage habitat.

Given the overall lack of salmonid habitat in the immediate Project area and the backwater effect of the existing tailrace into the bypass reach, the New Hampshire Fish and Game Department (NHFG) concurred with the US Fish and Wildlife Service (USFWS) recommendation of a 6 CFS minimum flow.

The Androscoggin River, downstream of the Cascade Project, consists of 2 miles of deep rapids/riffle and deep run habitat with a 0.5 percent gradient. The reach enters the upper extent of the Upper Gorham Project impoundment. This reach receives Cascade's tailrace flows during times of generation. In addition, bypassed reach flow backwaters to the tailrace during times of unit shut down.

GLHA monitors operations including impoundment elevations and minimum and turbine flows to maintain compliance with ROR and minimum flow requirements. Any deviations are reported to the resource agencies and to FERC.

My review indicates that GLHA has historically operated the Project in accordance with its current license requirements pertaining to reservoir levels and minimum flows and satisfies the Ecological Flows criterion as defined in the current license; however, GLHA conducted bypass reach habitat studies in 2020 for relicensing. It is my recommendation that if granted LIHI certification, GLHA will be required to provide updates on the relicensing process as part of its annual compliance statements and LIHI will reevaluate compliance with this criterion when appropriate.

B. Water Quality

The goal of this criterion is to ensure water quality is protected in water bodies directly affected by facility operations, including downstream reaches, bypassed reaches, and impoundments above dams and diversions. The Applicant states the Project satisfies the LIHI water quality criterion in all ZOEs by meeting alternative standard B-2. As part of my review, due to the Project's WQC being almost 33 years old and given the Project is currently undergoing relicensing, I changed the alternative standard in all ZOEs to B-3. Therefore, review of the water quality criterion is based on results of water quality studies being conducted as part of the relicensing process.

The river in the Project Area is designated as Class B, defined as waters considered acceptable for fishing, swimming and other recreational purposes, and, after adequate treatment, for use as water supplies. Regulations for Class B waters include:

• No disposal of sewage or waste unless it has received adequate treatment to prevent the lowering of the physical, chemical, biological, or bacteriological characteristics;

³⁸ <u>https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=165045</u>

- No disposal of sewage or waste that is harmful to aquatic life, and;
- All surface waters shall be free from substances that:
 - Settle to form harmful benthic deposits;
 - Float as foam, debris, scum or other visible substances;
 - Produce odor, color, taste or turbidity that is not naturally occurring and would render the surface water unsuitable for its designated uses;
 - \circ $\;$ Result in the dominance of nuisance species; or
 - Interfere with recreational activities.

Water quality criteria for Class B waters include:

- Dissolved Oxygen At least 75% saturation, based on a daily average with an instantaneous minimum of 5 milligrams per liter (MG/L);
- Color No concentrations that would impair any existing or designated use, unless naturally occurring;
- Turbidity Shall not exceed naturally occurring conditions by more than 10 Nephelometric Turbidity units (NTU); a measurement of suspended solids.
- Nutrients Shall contain no phosphorus or nitrogen in such concentrations that would impair any existing or designated uses, unless naturally occurring;
- pH, a measure of acidity and alkalinity of a solution, within a range of 6.5 to 8.0 standard units (s.u.) unless naturally occurring;
- Temperature Any stream temperature increase associated with the discharge of treated sewage, waste or cooling water, water diversions, or releases shall not be such as to appreciably interfere with the uses assigned to this class; and
- Conductivity³⁹ 835 microSiemens (µSiem) or less. A Siemen is a measure of amps per volts.

Water quality monitoring conducted in 2020 as part of the current relicensing effort within the Project impoundment demonstrated the water temperature, DO concentration, and DO percent saturation vertical profiles in the water column was uniform and well mixed.

Measurements found in the impoundment included:

- Dissolved Oxygen (DO) concentration was above the standard throughout the study and ranged from 7.9 MG/L to 10.8 MG/L. The DO percent saturation ranged between 92.8 percent and 109.0 percent. The daily average DO percent saturation exceeded the 75 percent standard and ranged from 96.6 percent to 105.1 percent;
- The water temperature ranged from 13.3°C to 25.3°C;
- pH varied within a narrow band between 6.5 and 7.0 and was within the standard limits for Class B waters;
- Chlorophyll-a was below the detection limit in one sample. In the remaining samples, chlorophylla ranged from 1.1 micro-gram per liter (μ g/L) to 8.0 μ g/L with an average of 2.7 μ g/L and median of 2.0 μ g/L. The median concentration was below the thresholds for the protection of recreational uses and aquatic life in oligotrophic waters.
- Total phosphorus was below the detection limit in one sample. In the remaining samples, total phosphorus ranged from 5.2 μ g/L to 47 μ g/L with an average of 21 μ g/L and median of 9.8 μ g/L. The median total phosphorus concentration was below the threshold for the protection of aquatic life in mesotrophic waters.

³⁹ Conductivity or specific conductance of an electrolyte solution is a measure of its ability to conduct electricity.

- Nitrite+nitrate N⁴⁰ was below the detection limit in two samples and ranged from 0.06 milligram per liter (mg/L) to 0.15 mg/L in the remaining samples with an average of 0.09 mg/L;
- Total Kjeldahl Nitrogen (TKN), the total concentration of nitrogen and ammonia, was below the detection limit in two samples. In the other samples, TKN ranged from 0.22 mg/L to 0.39 mg/L with an average of 0.32 mg/L;
- The Secchi disk readings ranged from 2.9 meters (M) to 4.7 M. The Secchi disk was visible to the bottom of the impoundment in the readings taken on August 6 through the end of the study demonstrating good water clarity.

Within the bypassed reach, tailrace and downstream, DO concentration, DO percent saturation, and pH met the Class B water quality standards throughout the study. Measurements in these reaches included:

- DO ranged from 7.8 mg/L to 10.6 mg/L. The DO percent saturation ranged from 92.7 percent to 106.7 percent. The daily average DO percent saturation ranged from 95.2 percent to 106.1 percent;
- The water temperature ranged from 13.3°C to 25.3°C;
- pH varied between 6.6 to 7.0.

The average, minimum, and maximum DO, water temperature, and pH levels were similar within the impoundment and downstream confluence indicating consistent water quality within the bypass reach.

The Project is operated under a MFOMP approved and authorized by FERC with agency approval⁴¹. The Project meets all current water quality standards for Class B waters pursuant to the existing WQC that was issued by the NHDES on July 6, 1989⁴².

It is my recommendation that the Project satisfies the LIHI water quality criterion, however, if granted LIHI certification, GLHA will be required to provide updates on the relicensing process as part of its annual compliance statements and LIHI will reevaluate compliance with this criterion when appropriate.

C. Upstream Fish Passage

The goal of this criterion is to ensure safe, timely and effective upstream passage of migratory fish so that migratory species can successfully complete their life cycles and maintain healthy populations in areas affected by the Project's facilities. The Applicant states the Project satisfies the LIHI upstream fish passage criterion in all ZOEs by meeting alternative standard C-1.

In the opinion of the National Marine Fisheries Service (NMFS)⁴³, there is no upstream fish passage in this reach of the Androscoggin River occupied by the Project since diadromous species such as alewife, blueback herring, striped bass, sea lamprey, and American shad are not present given that the downstream Lewiston Falls is impassable to these species, and the further upstream Rumford Falls is impassable to Atlantic salmon.

American eel, a catadromous fish species, are present in the lower Androscoggin River (i.e., downstream of Lewiston Falls) in relatively low numbers as compared to other watersheds in Maine⁴⁴. No American eels

⁴⁰ The drinking water standard for nitrite-N is 1.0 mg/L. However, nitrite is very uncommon in groundwater, so it is generally assumed that almost all of the nitrate plus nitrite is in the nitrate form.

⁴¹ https://elibrary.ferc.gov/eLibrary/filedownload?fileid=0015243C-66E2-5005-8110-C31FAFC91712

⁴² See page 89 of the LIHI application.

⁴³ See page 73. <u>http://cybrary.fomb.org/ESA/20090000_NOOA_Bio_val_Atlantic_salmon_habitat_GOM_Distinct_Population_Segment.pdf</u>

⁴⁴ See page 79. <u>http://cybrary.friendsofmerrymeetingbay.org/FishWildlife/MAINE.RIVERS.REPORT_FINAL.09.01.2006.pdf</u>

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were collected in the upper Androscoggin River during fish sampling studies historically conducted in the Project areas.

Although no upstream fish passage is currently present, the current license article 404 gives FERC authority to require GLHA to construct, operate, and maintain, or provide for the construction, operation, and maintenance of upstream fishways as may be prescribed by the USDOI.

My review indicates no issues pertaining to upstream fish passage have arisen since license issuance. It is my recommendation that the Project satisfies the upstream fish passage criterion, however, if granted LIHI certification, GLHA will be required to provide updates on the relicensing process as part of its annual statement to LIHI and LIHI will reevaluate compliance with this criterion when appropriate.

D. Downstream Fish Passage

The goal of this criterion is to ensure safe, timely and effective downstream passage of migratory fish and for riverine fish such that the facility minimizes loss of fish from reservoirs and upstream river reaches affected by facility operations. Migratory species can successfully complete their life cycles and maintain healthy populations in areas affected by the facility. The Applicant states the Project satisfies the LIHI downstream fish passage criterion in all ZOEs by meeting alternative standard D-1.

The upper Androscoggin River throughout Maine and New Hampshire supports a well-known, popular coldwater trout and landlocked salmon fishery. Angling for salmonids is bolstered by trout stocking and wild reproduction in the upper watershed and in tributaries. Cold water inflow from tributaries and regulated water releases from upper storage reservoirs enhance coldwater fisheries habitat in the main stem of the Androscoggin River.

The Androscoggin River in the vicinity of the Project supports approximately 30 species of resident fish. Fish sampling studies conducted in 1988 and 2003 indicated that the overall catch was dominated by common fish species from the northeastern United States, including fallfish, smallmouth bass, white sucker, longnose dace, common shiner and spottail shiner. Other species, such as rainbow trout, bullhead, and yellow perch were less common. Smallmouth bass and white sucker were most common in riverine segments. Smallmouth bass and fallfish were most common in the impounded segments.

NHFG does not have a formal, published fisheries management plan for the upper Androscoggin River. However, the NHFG stocks the river annually with brook trout, rainbow trout, and brown trout to support a put and take fishery approximately 15 miles upstream from the Project.

Although no downstream fish passage is currently present, license article 404 gives FERC authority to require GLHA to construct, operate, and maintain, or provide for the construction, operation, and maintenance of downstream fishways as may be prescribed by the USDOI.

My review of the FERC docket indicates no issues pertaining to downstream fish passage have arisen since license issuance. The Project satisfies the downstream passage and protection criterion as defined in the current license; however, it is my recommendation that if granted LIHI certification, GLHA will be required to provide updates on the relicensing process as part of its annual compliance statements and LIHI will reevaluate compliance with this criterion when appropriate.

E. Shoreline and Watershed Protection

The shoreline and watershed protection criterion is designed to ensure that sufficient action has been taken to protect, mitigate or enhance environmental conditions of soils, vegetation, and ecosystem functions on shoreline and watershed lands associated with the facility. The Applicant states the shoreline and watershed protection criterion in all ZOEs is satisfied by meeting alternative standard E-2.

Article 407 requires a Shoreline Management Plan (SMP) for Project aesthetics and access to lands around the impoundment. The SMP was filed on August 1, 1995 and supplemented by letter on May 12, 2000. FERC modified and approved the SMP on July 5, 2000⁴⁵. The SMP adopted the provisions in the NH Comprehensive Shoreland Protection Act, now named the Shoreland Water Quality Protection Act (SWQPA) ⁴⁶. The SWQPA lists uses of the shoreland within a 250-foot-buffer that are permitted, prohibited, or restricted and establishes planting and vegetation removal standards within any existing woodland buffers.

The Project's ROR operation and license requirements for minimal impoundment fluctuation help in providing protection for the Project's shoreline areas within all Projects ZOEs.

My review of the FERC docket indicates no issues pertaining to shoreline and watershed protection have arisen since license issuance. The Project satisfies the LIHI shoreline and watershed protection criterion; however, it is my recommendation that if granted LIHI certification, GLHA will be required to provide updates on the relicensing process as part of its annual compliance statements and LIHI will reevaluate compliance with this criterion when appropriate.

F. Threatened and Endangered Species Protection

The threatened and endangered species protection criterion is designed to ensure that the facility does not negatively impact state or federally-listed threatened or endangered species. The Applicant states the LIHI threatened and endangered species criterion is satisfied in all ZOEs by meeting alternative standard F-2.

The USFWS identified two mammals listed on the federally threatened species list that may occur in the Project Area or may be affected by the Project⁴⁷. The July 1, 2019 USFWS species lists were obtained using the Information for Planning and Consultation (IPaC) project planning tool. There are no federally documented endangered or threatened aquatic species in this reach of the Androscoggin River.

The Canada Lynx and the Northern Long Eared Bat are identified as having the potential to be present or occupy habitats in the vicinity of the Project. However, the Project has no effect on the species since generally no tree-clearing activities or corridor maintenance activities are required. Minor mowing and brush removal on the canals and dam abutments may occur but no significant tracts of forested lands occur within the project boundaries.

The NHFG identifies four state endangered bat species, the eastern small-footed bat, the little brown bat, the tri-colored bat and the northern long-eared bat, as having the potential to occur in or near the Project

⁴⁵ https://elibrary.ferc.gov/eLibrary/filedownload?fileid=0015EB2F-66E2-5005-8110-C31FAFC91712

⁴⁶ <u>https://nhlakesproperty.com/for-buyers/shoreland-protection/</u>

⁴⁷See section 7.0 of LIHI application, page 156 for IPaC report; later updated as part of the draft license application, Volume II, Exhibit E appendix E <u>https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20230303-5000&optimized=false</u>.

boundary.⁴⁸ Additionally, the New Hampshire Natural Heritage Bureau (NHB) towns list can be used to identify endangered and threatened and rare species near the Project (Towns of Berlin and Gorham).⁴⁹

The NHFG documented bald eagles in the Project Area.⁵⁰ Based on the NHB, there are five bald eagle nests documented on the upper Androscoggin River within proximity to the Project. While eagles are no longer listed under the Endangered Species Act, eagles continue to be protected under the federal Bald Eagle and Golden Eagle Protection Act (Eagle Act) as well as other federal laws and are legally protected in New Hampshire as a species of special concern.

Based on the IPaC review and NHB reviews, no state-listed fish or mussel species were identified occurring in the vicinity of the Project. No state-listed botanical species are documented in the Project area and lands within the Project boundary based on surveys conducted in 2020 for relicensing⁵¹.

In summary, the Project is operated in a ROR mode. Limited impoundment fluctuations are not expected to produce long-term impacts to shoreline habitats that may potentially support rare plant species. Routine Project operations are not anticipated to affect threatened or endangered bats. There may be periodic vegetation clearing for dam safety, access, and other purposes but these instances would be conducted in accordance with the Section 4(d) rule using the USFWS consultation process. As such, no negative effects are anticipated by this periodic activity.

My review indicates no issues pertaining to threatened and endangered species protection have arisen since license issuance. The Project satisfies the LIHI threatened and endangered species protection criterion; however, it is my recommendation that if granted LIHI certification, GLHA will be required to provide updates on the relicensing process as part of its annual compliance statements and LIHI will re-evaluate compliance with this criterion when appropriate.

G. Cultural and Historical Resource Protection

The cultural and historic resource protection criterion is designed to ensure that the facility does not unnecessarily impact cultural and historic resources associated with the facility's lands and waters, including resources important to local indigenous populations. The Applicant states the LIHI cultural and historic resources criterion in all ZOEs is satisfied by meeting alternative standard G-1.

There are no known archeological sites within the Project boundary. No features within the Project Area are listed on the National Register of Historic Places, and the State of New Hampshire's division of Historical Resources has not listed any of the sites in the State Register of Historic Places.

GLHA is required to submit an annual report for managing historic properties, as set forth in the 1993 Programmatic Agreement (PA) for Managing Historic Properties and the August 1996 PA Amendment.⁵² The PA pertains to all of GLHA's developments on the Androscoggin River and specifically applies to the Project's dam and powerhouse. The PA requires GLHA to submit an annual report regarding any

⁴⁸ https://www.wildlife.state.nh.us/nongame/documents/endangered-threatened-wildlife-nh.pdf and

https://www.wildlife.state.nh.us/nongame/endangered-list.html

⁴⁹ https://www.nh.gov/nhdfl/documents/town-lists.pdf See page 34 for Town of Berlin and page 110 for Town of Gorham.

⁵⁰ <u>https://www.wildlife.state.nh.us/wildlife/profiles/bald-eagle.html</u> and See section 7.0 of LIHI application, page 152.

⁵¹ See section 7.0 of LIHI application, page 156 for IPaC report; later updated as part of the draft license application, Volume II, Exhibit E https://elibrary.ferc.gov/eLibrary.filelist?accession_number=20230303-5000&optimized=false.

 ⁵² https://elibrary.ferc.gov/eLibrary/filedownload?fileid=000B3435-66E2-5005-8110-C31FAFC91712

alterations, or future planned alterations to structures. On January 4, 2021, GLHA filed the latest report⁵³. Specific to the Project, during 2020, the following repairs occurred:

- Forebay wall repairs;
- Spillway concrete repairs;
- Replacement of forebay gates 1 and 3;
- Rack house repairs, and;
- Unit 3 generator lead repairs.

Planned activities for 2021 include replacement for Unit 1's head gate and overhaul of its turbine.

My review indicates no issues pertaining to cultural and historic resource protection have arisen since license issuance. The Project satisfies the LIHI cultural and historic resource protection criterion; however, it is my recommendation that if granted LIHI certification, GLHA will be required to provide updates on the relicensing process as part of its annual compliance statements and LIHI will re-evaluate compliance with this criterion when appropriate.

H. Recreational Resources

The goal of this criterion is to ensure that recreation activities on lands and waters controlled by the facility are accommodated and that the facility provides recreational access to its associated land and waters without fee or charge. The Applicant states that the recreation criterion in all ZOEs is satisfied by meeting alternative standard H-1, Not Applicable/De Minimis Effect.

Several recreation facilities are located near the Project, primarily two municipal parks, Alpine Cascades and Glenside, neither of which provide access to project lands or waters. Due to the Project's small footprint, there is no recreational or public access to the Project impoundment although there is informal access in the tailrace of the Cross Power Project, just upstream. Otherwise, there is no safe access to the impoundment, bypass reach or tailrace. The Project boundary follows the water line with little surrounding land, and the land surrounding the 350-foot-long bypass reach are forested and steep with no safe access.

Downstream access to the Androscoggin River is available from a gravel hand carry boat site approximately 2 river miles upstream of the Upper Gorham Project in the reach of the regulated river downstream of the Project's dam. This access point is not within the Project boundary, is not a Project recreation facility and is not owned or maintained by GHLA.

My review indicates no issues pertaining to LIHI recreational resources have arisen since license issuance. The Project satisfies the LIHI recreational resources criterion; however, a recreational use study will be conducted at all GLHA Projects in the vicinity in 2022 for relicensing. Therefore, it is my recommendation that if granted LIHI certification, GLHA will be required to provide updates on the relicensing process as part of its annual compliance statements and LIHI will re-evaluate compliance with this criterion when appropriate.

⁵³ https://elibrary.ferc.gov/eLibrary/filedownload?fileid=020B3575-66E2-5005-8110-C31FAFC91712

VIII. RECOMMENDATION

My review comprised a thorough assessment of the certification application and its supporting documentation, a search of the FERC docket and other publicly available information.

The relicensing process and Project impacts may be better understood, and Project operations could change when all required studies are complete and new agency recommendations are made. Therefore, it is my recommendation that the Project be certified for a ten (10) year term with the following condition:

• Condition 1: The facility Owner shall provide updates to LIHI on the ongoing status of Project relicensing, including studies, FERC filings, resource agency consultation, prescriptions and recommendations, and agency comments on study results. LIHI reserves the right to modify the Certificate or conditions based on the outcome of the relicensing.

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Gary M. Franc

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